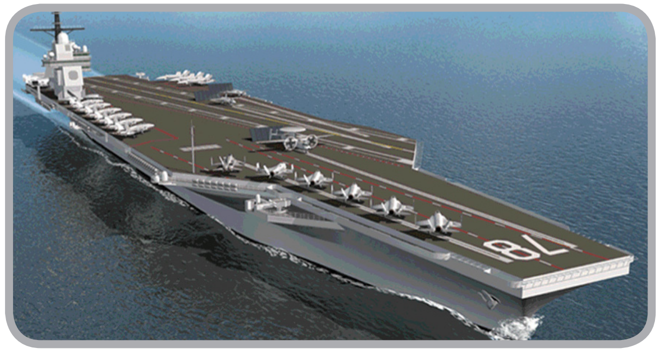
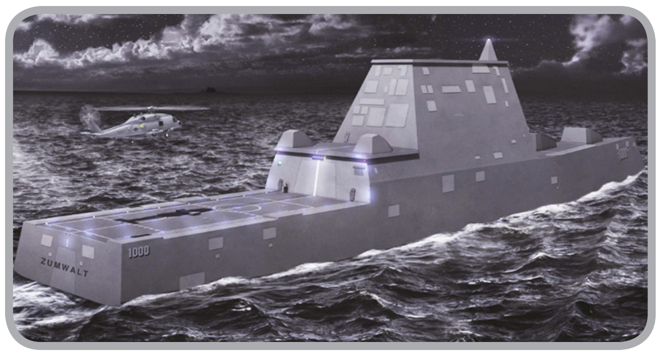
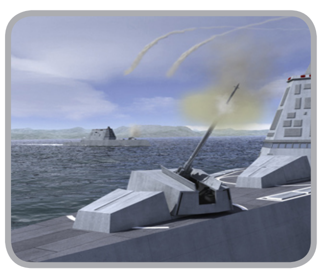
NAVY MANTECH
Manufacturing Technology Program



2008 Project Book





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2008 Navy ManTech Project Book Layout:

To highlight the Navy ManTech Investment Strategy with its concentration on a few key platforms, the 2008 Navy ManTech Project Book is organized by PEO / platform. Projects that impact each of the PEOs / platforms represented will be found in that section.

The layout for each project page features one project-specific image at the top of the page. The two graphics at the bottom of the page are representative of the PEO / platform it is categorized under. The specific weapon system addressed by the project may not be featured in these representative graphics; check within the project write-up and in the helpful sidebar for more information.

Table of Contents:

Navy ManTech Overview

Managed within the Office of Naval Research (ONR), the Navy ManTech Program provides for the development of enabling manufacturing technology and the transition of this technology for the production and sustainment of Navy weapon systems to support the Fleet. Navy ManTech is currently focused on shipbuilding affordability. Reducing the acquisition cost of current and future platforms is a critical goal of the Navy, and ManTech aids in achieving this goal by developing and transitioning key manufacturing technology.

Transition of technology is key to Navy ManTech success. Advances in manufacturing technology are useful to the Navy only if they result in implementation in the production of weapon systems. Transition of manufacturing processes to private and government industrial entities that manufacture and repair systems and components for the Fleet is the goal of every ManTech project.

The Navy ManTech Program works with defense contractors, the Naval Research Enterprise, Navy acquisition Program Offices, and academia to develop improved processes and equipment. Project success is measured by implementation of these technologies on the factory floor and rapid transition to the Fleet to support Navy warfighters. It is structured to provide maximum dissemination of the results of ManTech projects and to promote early 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 Navy ManTech Program.

There are many customers of the Navy ManTech Program. They range from the acquisition Program Managers (PMs) and industry responsible for transitioning major Navy weapon systems from development into production, to the logistics managers at the naval depots and shipyards responsible for repair, overhaul, and remanufacture of major weapon systems. Additional beneficiaries of the Navy ManTech Program include the other Services and academia.

The Navy ManTech Program is part of the Department of Defense (DoD) ManTech Program, managed by the Office of the Deputy Under Secretary for Defense, Advanced Systems & Concepts, which has oversight of the ManTech programs of the Services and the Defense Logistics Agency (DLA). These organizations, together with the Missile Defense Agency (MDA), coordinate their programs through the auspices of the Joint Defense Manufacturing Technology Panel (JDMTP) consisting of the ManTech directors of the Services, DLA, and MDA with advisory representation from the Office of the Secretary of Defense (OSD), the Department of Commerce's National Institute of Standards and Technology (NIST), the Department of Energy, and industry. The JDMTP is organized to identify and integrate requirements, conduct joint program planning, and develop joint strategies.

Navy ManTech Objectives

The overall objective of the Navy ManTech Program is to significantly improve the affordability and improve mission capability of Department of the Navy (DoN) systems by engaging in manufacturing initiatives that address the entire weapon system life-cycle and that enable the timely transition of technology to industry and to the Fleet.

More specifically, DoD 4200.15 states that investments should:

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 work force, and promote high levels of worker education and training.
8. Meet other national defense needs...

Navy ManTech: Supporting the Affordability of the Fleet by —

- ***Focusing resources on key, high priority acquisition platforms***
- ***Targeting cost reduction as the primary benefit***
- ***Developing critical manufacturing and repair / sustainment solutions***
- ***Engaging relevant industry partners up front and throughout the process***
- ***Targeting ManTech transition and platform implementation as the key measures of success***

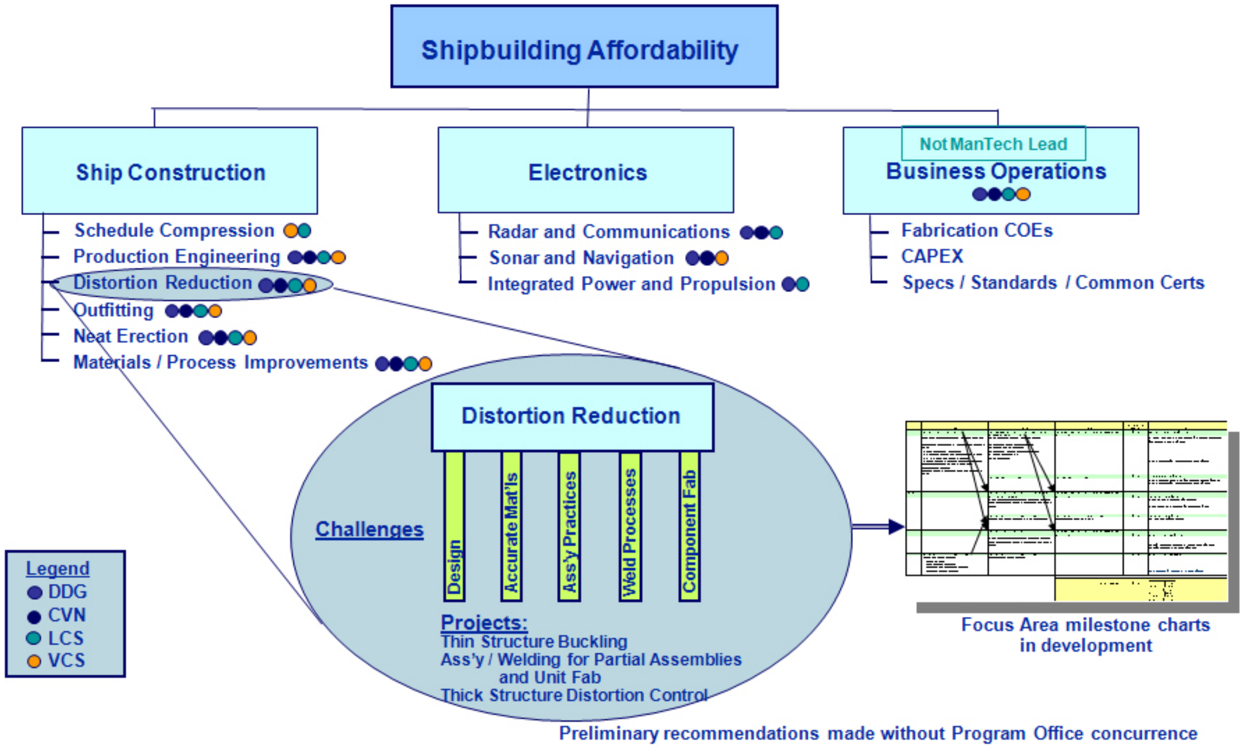
Navy ManTech Investment Strategy

The Navy ManTech Program implemented the Naval Integrated Systems Investment Strategy in FY04 to concentrate ManTech investments on key Navy acquisition programs to maximize technology transition and implementation. This sharply focused investment strategy was structured to ensure that the bulk of ManTech's investments aggressively addressed the highest priority manufacturing needs of the emerging major Navy weapon systems. Rather than supporting every program with funding that fell short of the level where ManTech could be productive, ManTech began to concentrate on a select few systems with a series of focused investments.

The initial emphasis of the strategy was on manufacturing technology necessary to meet performance requirements of the targeted platforms. Manufacturing projects were initiated through FY06 in support of three platforms: the future guided missile destroyer - DD(X) (now the DDG 1000), the future aircraft carrier - CVN 21, and the Littoral Combat Ship - LCS. The DD(X) focused initiative was the test initiative for the new investment strategy. It began in FY00, before the formal adoption of the investment strategy.

During the second quarter of FY06, the emphasis of the strategy was changed to a focus on affordability. Reducing the acquisition cost of advanced platforms is critical to the future of an effective Navy. In support of the acquisition program cost reduction goals, affordability is a focus area of the 2007 Navy S&T Strategic Plan. In support of this plan and at the direction of the Chief of Naval Research (CNR), Navy ManTech is now focused on manufacturing technologies that assist the Navy in the affordable acquisition of four major platforms: DDG 1000, CVN 21, LCS, and VIRGINIA Class Submarine (VCS).

ONR and the Navy ManTech COEs conducted strategic planning and roadmapping activities to identify high payoff shipbuilding investment areas. During this strategic planning activity, three primary thrusts, Ship Construction, Electronics, and Business Operations, were identified as well as specific focus areas under each thrust. For each ManTech focus area, challenges and potential projects were developed early-on, and initial roadmaps for investment were established. As the process proceeds, the roadmaps are being modified and specific projects to support the focus areas are being funded.



Navy ManTech projects are developed in conjunction with industry and the acquisition PM. 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. The Program Executive Offices (PEOs), PMs, and relevant industry partners are encouraged to participate in an initial concept exploration phase – an assessment of the manufacturing processing needs of the weapon system. Most importantly, this includes the determination of whether the ManTech projects have a high likelihood of successful completion in time to meet the “window of opportunity” for insertion into the weapon system. Balanced with ManTech’s available resources, highest priority manufacturing opportunities are selected.

Agreements are also 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.

To clarify communication between the entities, Navy ManTech has established definitions for transition and implementation and has instituted the development of a Transition Plan for each project that is signed by Navy ManTech, the COE Director, Industrial Facility Management, the Program Office and, if appropriate, the Technical Warrant Holder.

For Navy ManTech purposes:

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

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

ManTech, alone, cannot ensure implementation, but a well-defined Transition Plan will assist the Program Office and Industrial Facility Management in supporting the transition and in resourcing and achieving implementation.

In addition to increased involvement from the PM customer, ManTech engages key industry partners earlier in the development cycle and continues to keep industry involved throughout. Focused initiative integrated project teams (IPTs) keep communication lines open among the PM, Navy ManTech, the COEs, and industry to ensure that projects complete in time to meet the ‘window of opportunity’ for implementation. Projects whose implementation opportunities have been lost are terminated. Thus the Navy ManTech Program ensures that resources are focused on those projects with high implementation probability.

While the large majority of yearly ManTech Program resources are invested in accordance with the focused initiative investment strategy, Navy ManTech does support smaller efforts in Repair Technology (REPTECH), Energetics, and Best Manufacturing Practices (BMPs).

REPTECH: While the major emphasis of the Navy ManTech Program 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.

Energetics: Energetics ManTech efforts that assist in the transition from R&D to production are an integral part of the Navy ManTech Program. Projects develop and transition process technologies for the synthesis of new or improved energetic materials, improved manufacture of propellants and explosives and improved handling and loading of energetic materials into systems and components. Concentration is on developing solutions to ensure the availability of safe, affordable, and quality energetics products in support of Program Executive Offices such as Integrated Warfare Systems (PEO IWS / IWS3C) and Conventional Strike Weapons (PEO (W) / PMA 201).

Best Manufacturing Practices: Established in 1985, Navy ManTech’s Best Manufacturing Practices (BMP) Program fosters the identification, validation, and sharing of the best practices used in government, industry, and academia. In 1993, the Navy ManTech Program established the BMP Center of Excellence (BMPCOE), a partnership of Navy ManTech, the Department of Commerce (DOC), and the University of Maryland at College Park (UMCP). Additional details on this COE are included in the section beginning on Page 7.

Navy ManTech Execution

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

The program currently has nine COEs engaged in ManTech activities. Descriptions of the COEs and their core competencies are presented below.

Best Manufacturing Practices Center of Excellence

The BMPCOE was established in 1993 and is a national resource providing Best Practices, Systems Engineering, and Web Technologies that enable defense and commercial customers to operate at a higher level of efficiency and effectiveness. The BMPCOE helps businesses identify, research, and promote exceptional manufacturing practices.

BMPCOE's core competencies are:

- **Surveys:** BMPs are identified through a unique, on-site process based on organizations' voluntary sharing of information.
- **Systems Engineering:** The Program Manager's Workstation is an electronic suite of tools designed to provide timely acquisition and engineering information so users can make informed decisions.
- **Web Technologies:** The proven fifth-generation Collaborative Work Environment adapts to organizational processes and culture and can be tailored to users' needs and functions.

Through its nine regional Satellite Centers, BMPCOE serves the entire U.S. industrial base. Satellite Centers were established as an extension of BMPCOE to provide representation and awareness of BMPCOE's mission, tools, and resources. Responsibilities of the Centers include participating at conferences and exploring opportunities for potential surveys and team members.

BMPCOE Web site: www.bmpcoe.org

Center for Naval Shipbuilding Technology

The mission of the Center for Naval Shipbuilding Technology (CNST) is to identify, develop, and deploy in U.S. shipyards, advanced manufacturing technologies that will reduce the cost and time to build and repair Navy ships. The Center works closely with the Navy's acquisition community and the shipbuilding industry to identify manufacturing technology issues that negatively impact shipyard efficiency, both with respect to cost and cycle-time. CNST solicits, selects, and funds projects to address these critical and costly issues. The projects are focused on improving major ship construction and repair processes, such as optimizing production processes, predicting and reducing weld distortion, developing more efficient structural fabrication product lines, increasing the use of robotic welding methods and eliminating inefficiencies in training, material usage, and supply chain procedures.

Looking forward, CNST is pursuing projects focused on improving the affordability of current U.S. Navy acquisition programs, specifically VIRGINIA Class submarines, Ford-Class aircraft carriers, Zumwalt-Class destroyers, and the Littoral Combat ship. New projects being considered include investigating the use of adhesives for mounting lightweight outfitting items, developing smart manufacturing methods for composite structures, implementing a mobile hybrid laser welding system, installing state-of-the-art hull fairness and accuracy control tools, improving shipyard-wide parts marshalling and improving outfitting practices.

CNST is operated and managed by ATI in Charleston, SC.

CNST Web site: http://www.cnst.us

Composites Manufacturing Technology Center

The Composites Manufacturing Technology Center (CMTC), established in 2000, is located in Anderson, SC, and is operated by the Applied Research and Development Institute of the South Carolina Research Authority (SCRA). The CMTC is consortium-based with a balanced membership providing expertise to address all Navy composites manufacturing technology needs. The Composites Consortium (TCC) membership includes prime contractors, composites industry suppliers, and universities. TCC 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 assembled from consortium members. 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 manned and unmanned aircraft, surface ships, submarines, missiles, and land vehicles.

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

The Electro-Optics Center

The Penn State University Electro-Optics Center (EOC) was established in 1999 as the Navy's Center of Excellence for Electro-Optics. The center is located in Freeport, PA, utilizing two facilities with a total of 63,000 square feet of laboratory and office space. The Vision of the EOC is to be the national resource for the advancement of electro-optics and related technology for the primary benefit of national security.

The Mission of the EOC is to:

- Provide the best and latest electro-optic (E-O) technologies for the United States warfighter and national security interests
- Partner with government, industry, universities, and nonprofit organizations
- Conduct basic and applied research and technology demonstrations that add to the greater capabilities of the technology field through resident expertise and collaborations
- Seek out and facilitate technology transfer leading to the commercialization of E-O and related technologies

- Expand the current and prospective workforce through education and outreach
- Provide effective project and program management and knowledge of the government acquisition process.

The EOC is supported by the Electro-Optics Alliance, a growing consortium of 400+ industrial, government, non-profit, and academic organizations that share their E-O expertise and capabilities through project teams focused on Navy and DoD requirements. The purpose of the Alliance 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 Alliance 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. U.S. organizations with capabilities in E-O science and technology are encouraged to join the Alliance by visiting the EOC Web site and completing a membership application.

EOC Web site: http://www.electro-optics.org

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 in the U.S. in order to maximize available research capabilities at the lowest possible cost. The EMPF serves as a corporate residence of expertise in electronics manufacturing. The EMPF's principal goals are to: improve responsiveness to the needs of DoD electronics systems; ensure that deliverables make a significant impact in the electronics manufacturing industry; facilitate the development and transition of technology to the factory floor; and expand the customer base to a national level.

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

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

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC), established in 1994, is Navy operated and located at the Naval Sea Systems Command's Naval Surface Warfare Center (NSWC), Indian Head Division, Indian Head, MD.

A renowned leader in energetics, the Indian Head Division serves as the focal point for this group and provides a full spectrum of capabilities including energetics research, development, modeling and simulation, engineering, manufacturing technology, production, test and evaluation, and fleet / operations support.

Energetic materials (reactive chemicals), formulations (propellants, explosives, pyrotechnics), and subsystem components (fuzes, detonators, boosters, igniters, safe & arm devices) are critical to the performance and reliability of weapon systems as well as 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 finally transition successful results.

EMTC Web site: http://www.ih.navy.mil/Directorates/cao/emtc/index.asp

Institute for Manufacturing and Sustainment Technologies

The Institute for Manufacturing and Sustainment Technologies (iMAST), established in 1995, coordinates Navy ManTech efforts at The Pennsylvania State University's Applied Research Laboratory (ARL), one of four 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: mechanical drive transmission, materials processing, laser processing, advanced composites, manufacturing systems, repair and sustainment, and complex systems monitoring. iMAST supports the Navy and Marine Corps systems commands, as well as PEOs and Navy laboratories.

REPTECH applies new and emerging technologies to improve capabilities of Navy depots, shipyards, Marine Corps Logistics Bases, and lower level maintenance activities throughout the Fleet. REPTECH cooperates and communicates with Navy COEs, the joint depot community, DoD industrial activities, industry, PEOs, and university laboratories.

iMAST Web site: http://www.arl.psu.edu/capabilities/mm_imast.html

Navy Joining Center

The Navy Joining Center (NJC) was established in 1993. The Center is operated by Edison Welding Institute (EWI) and is located in Columbus, OH.

Material joining is a primary means of fabricating and maintaining the fleet, aircraft, weapons, and the advanced electronics that are the core of modern Navy forces. Implementing the best materials joining technologies is critical to improving the performance of Navy weapon systems and increasing the productivity of manufacturing practices needed to reduce the acquisition costs of these systems. The NJC provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC team represents a collaborative effort among industry, academia, and government and is experienced in identifying joining problems, developing and deploying solutions, and transferring technology.

The NJC disseminates project results and other joining information through demonstrations, workshops, conferences, publications, and a Joining Technology Information network. Typical projects provide joining solutions for metallic, non-metallic, ceramic, and composite materials that support Navy ManTech strategic plans.

NJC Web site: http://www.ewi.org/njc

Navy Metalworking Center

The Navy Metalworking Center (NMC) is the national resource for the development and transition of advanced metalworking and manufacturing technologies, materials and related processes. Established in 1988 to address Navy and DoD metalworking needs, NMC works in partnership with government, industry, weapon systems prime contractors, and Program Offices to develop and apply innovative technologies.

NMC drives new technologies from research and development to naval weapon systems application with two objectives: 1) to implement new technologies that will improve weapon system performance; and 2) to develop new production means for weapon systems prime contractors and suppliers that lower the production cost of naval weapon systems.

For 19 years, NMC has supported the U.S. Navy with affordable new metalworking technologies and capabilities that have responded to increasingly stringent requirements for greater agility, survivability, and lethality. NMC is operated by Concurrent Technologies Corporation, an independent, nonprofit organization located in Johnstown, PA.

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

Navy ManTech Technology Transfer

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

Program Web Site

The **Navy ManTech Program Web site** can be accessed at http://www.onr.navy.mil/sci_tech/3t/mantech/. The Web site is a central source for accessing general information about the program, program activities and participation, developments and events, and key points of contact. The site also offers links to the online annual Navy ManTech Project Book, program success stories, as well as other publications and reports.

Defense Manufacturing Conference

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

Project Book

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

End-of-Project Demonstration

End-of-project demonstrations for ManTech projects are held by the performing organization. The format usually consists of a formal briefing followed by an actual demonstration of the new equipment, process, or technology. An end-of-project demonstration schedule and a point of contact for information on specific demonstrations are available through the News and Events section of the Navy ManTech Web site.

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. Several of the COEs operate Learning Centers or Teaching Factories to aid their technology transfer activities.

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

Highlight – Addressing VIRGINIA Class Submarine Affordability

Overview

Navy ManTech is vigorously investing in projects that can lead to cost reductions in the VCS Program. Extensive interaction and cooperation between the Navy ManTech Program Office, the COEs, General Dynamics Electric Boat (EB), Northrop Grumman Newport News (NGNN), PEO (Subs), and the PMS450 VCS Program Office have resulted in a focused ManTech initiative that is successfully transitioning and implementing technology.

The common goal of the Navy and industry is to reduce the cost of VIRGINIA Class submarines from $2.4B to $2.0B (FY05 $) by the time construction begins on the 2012 ship. The key elements are: (1) design changes, (2) construction improvements, and (3) economies achieved by increasing the procurement rate to two ships per year. One major facet of this reduction effort is to reduce the span of time of beginning construction to launching the submarine from 84 months to 60 months. These combined efforts are expected to reduce construction cost and enable the acquisition of two submarines per year starting in 2012 or earlier.

Navy ManTech is investing in a number of areas to improve VCS affordability: In fiscal years 2006 and 2007, the Navy ManTech Program invested $11.1M in VCS projects with plans to invest an additional $16M in FY 2008. The following are examples of major cost reduction initiatives under way:

- Advanced Welding and Joining Processes
    - Eliminate defects in welds on large diameter pipes using the most cost-effective methods
    - Adapt commercially available techniques to simplify the preparation, installation and inspection, process for pipe joining and fitting
    - Develop software tools to predict weld distortion during pressure hull construction and provide the basis for welding procedures to minimize the distortion
- Outfitting Process Improvements
    - Analyze major processes including time constraints, scheduling methods, and flow of work, information, and material
    - Recommend improvements and prioritize for least cost and maximum efficiency
- Design for Production Process Improvements
    - Provide the design community with information on best practices, cost, and associated design standards and rules that facilitate better design decisions for reducing downstream manufacturing, assembly, and testing costs
- VCS Material Management
    - Implement an optimum material flow system to address material flow problems and reduce the costs associated with warehousing, transportation, and rework. Material flow problems result in high cycle times, excess inventory, low material availability rates, and re-manufacture / re-procurement of rejected, damaged, or lost parts.
- VCS Schedule Compression
    - Reduce cycle time and cost of key VCS systems provided by outside suppliers through the application of known best manufacturing practices:
        - Assist suppliers of high-risk systems in process improvements

- Use alternative contracting or supply / build approaches to more efficiently deliver material to the shipyard when needed.

- Improved Materials and Processes
  - Analyze materials and processes to ensure optimum choices. Examples of successful improvements include:
    - Development of a semi-automated work cell to lower cost during cladding of components
    - Identification and qualification of alternative damping materials that can be applied more cost-effectively
    - Identification of process improvements to reduce foreign particle inclusions in steel castings of hull inserts.

Product Centric Facility Design

One ManTech initiative that has already resulted in cost savings to the VCS Program is the Product Centric Facility Design Project, funded through the Center for Naval Shipbuilding Technology (CNST) with the goal of designing a new structural fabrication facility and processes for major structural assemblies. Structural fabrication constitutes approximately 20-30% of the recurring labor hours for each VCS delivered to the Navy. The objectives of this project included development of a conceptual design and layout incorporating manufacturing concepts based on similar product families; re-engineering the existing manufacturing processes to reduce costs and span-time; and integrating new production technologies and manufacturing strategies into the existing facility. An example of new production technologies being considered involved increased use of robotic welding through more efficient access to computer-aided design (CAD) data.

Process Improvements

The ManTech Product Centric Facility Design Project funded the following improvement efforts:

- Conceptual design for a next-generation Steel Fabrication Facility (SFF) and computer simulation and modeling program of the layout and processes

- Conceptual design of a MIDS deck manufacturing cell (part of SFF) that implements the part-family, product-structure approach

- An innovative, semi-automated manufacturing cell for structural shapes, which was designed with a new manufacturing technique that automates the digital data shielding process

- Development and implementation of a “one-stop” software tool to quickly analyze and extract electronic data that exists in the VIRGINIA design database system. Examples of the type of data that can be easily extracted include joint indices, hanger locations, and system fitting and valve locations.

Implementation on the Factory Floor

ManTech Product Centric efforts at EB are being transitioned with funding from PMS450 either through the shipyard Design for Affordability initiative or through the Block II CAPEX programs. EB is implementing manufacturing cells for two of the major part families (structural shapes and digital data shielding) and one of the major product lines (decks). The structural shapes manufacturing cell will not only reduce the cost of manufacturing structural shapes, but it also supports most of the identified part families. It is expected to eliminate up to 30% of part manufacturing cost. The processes used for manufacturing structural shapes will be applied to other product families to generate additional savings for the program. The digital data shielding work cell has been successfully used in two applications. The software system for digital design data manipulation is supporting a wide range of manufacturing processes and structural components. The MIDS deck manufacturing cell will save over 25% of the manufacturing costs. It is expected to also cut the span-time by 40%.

Cost Savings

ManTech Product Centric efforts are expected to result in the following benefits to the VCS Program when implementation is completed:

- The "One-Stop" Software System for digital design data manipulation was totally funded by the ManTech Product Centric Project and is in use today. This capability is vital to analyzing parts to determine product families and part counts within designated families. It is a key enabler to automate the process to obtain part and design data information directly from the design database. "One-Stop" has reduced the time it takes to identify and provide manufacturing key design model information by more than 50%.

- The digital data shielding process that initially was developed using ManTech funding is now being industrialized by EB with transition funding from PMS450. During the ManTech project, a proof of concept was fully developed resulting in partial implementation on VCS hulls 779 and 780 and saving $520K. Full implementation will be achieved on the SSN 781 construction, which will provide a Class savings of $12M for the remaining 22 ships of the 30-ship program.

- The Steel Fabrication Facility is now part of the Shipyard Facility Improvement Plan. The transition plan is in development and it identifies manufacturing processes and facility requirements to support project implementation at the Quonset Point Manufacturing Facility. Initial engineering estimates of potential Class cost savings from the new facility, when fully implemented as part of the CAPEX Program, are between $100M – $175M.

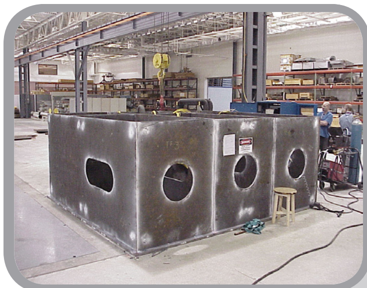
Summary

The Navy ManTech Program is a key contributor to the VCS Cost Reduction Program. ManTech investment is helping industry to identify, develop, and integrate advanced manufacturing technologies to address cost drivers in naval ship construction. Close coordination between PMS450 and ONR is helping to improve the success of transitioning this advanced manufacturing technology into production. This investment is already paying dividends; projects identified to date are expected to save more than $200M to the remaining VIRGINIA Class construction.

The christening ceremony for the Navy's newest Virginia-class submarine USS North Carolina (SSN 777). North Carolina is the fourth Virginia-class submarine built and the first major U.S. Navy combatant vessel class designed with the post-Cold War security environment in mind. North Carolina is scheduled to be commissioned in December 2007. Photo courtesy of Northrop Grumman (RELEASED)

CVN Projects

Manufacturing Process Development Provides Fabrication Parameters for CVN



Period of Performance:

February 2004 to
August 2007

Platform:

CVN

Affordability Focus Area:

Distortion Reduction

Center of Excellence:

NMC

Point of Contact:

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Stakeholder:

NAVSEA PMS 378

S1058 – Manufacturing Process Development for Elimination of Weld Distortion of CVN 21 Heavy Plate Erection Units

Objective

The objective of this project was to develop, calibrate, upgrade and validate fabrication parameters that will be used to produce CVN 78 production innerbottom assemblies that meet flatness requirements. This objective was achieved through the analysis, fabrication and subsequent measurement of two HSLA steel prototype assemblies. An additional approach to achieve this objective was to assess the applicability of weld distortion modeling for predicting distortion in large structures of interest to the shipbuilding industry. These objectives were met by the project.

Payoff

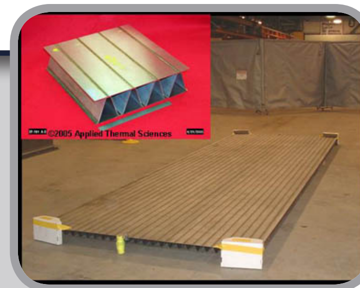
This project reduced the weld joint volume by 22% in the thick plate weld joint, which resulted in approximately 5,000 man-hours and $50,000 in filler metal saved per hull. Additional qualitative benefits included simplified construction practices by eliminating pre-cambering, reduced cost and schedule impact associated with rework of production assemblies and availability of the prototype assemblies for additional testing and evaluation. This technology may be applicable to other Navy surface ships that contain HSLA-65 and -100 welded structures, resulting in additional benefits to the Navy. The results of the predictive weld distortion software assessment were provided to Northrop Grumman Newport News (NGNN) to assist with the further evaluation of the software.

Implementation

By working closely with NGNN and PMS 378, the technology developed under this project was directly implemented in the production of CVN 78 with the fabrication of the first production units in January 2007. The prototype assembly produced in this project was a deliverable to the Navy and was used for additional testing.

LASCOR Technology Offers Significant Weight Reduction to CVN Applications

S1059 – Laser Welded Lightweight Panel Structure Fabrication and Application to CVN 21



Period of Performance:

March 2004 to February 2007

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

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Stakeholder:

NAVSEA PMS 378

Objective

Current design goals for the CVN 21 class of aircraft carrier call for weight and ship center of gravity reductions. One possible method of weight reduction is to use stiff, lightweight, metallic-sandwich panels called Laser-welded corrugated-core (LASCOR) panels. However, the design requirements and fabrication experience for using LASCOR panels are not sufficiently developed to use in critical applications. In the past, having a domestic commercial supplier, limited smaller panel sizes, lack of an engineering manual and increased cost were barriers to widespread LASCOR implementation. In this project, a domestic commercial supplier has demonstrated the ability to fabricate a 78-inch x 240-inch panel with competitive costs. Efforts have focused on determining acceptable applications to focus implementation efforts; selecting the optimum material for strength, corrosion resistance and cost; demonstrating the manufacturing process with roll-formed core sections; and performing preliminary panel, stud and joint testing. Manufacturing methods are being developed to accommodate ship construction realities. The primary objective of this project is to establish shipyard use of LASCOR technology, addressing issues such as material evaluation, structural testing, joint attachment, stud application, manufacturing issues, reparability, application development, and demonstration. The viability of LASCOR technology will be demonstrated incrementally. Future work will focus on application validation testing and support. Large structural panels will be tested for global compression and lateral pressure performance. Areas such as attachments/features, joints, static loading, shock, structural testing, ballistics, and corrosion may be investigated based on the specific application design requirements.

Payoff

Provided project proves to be a viable alternative to support weight-reduction efforts for CVN 78, an overall weight savings of 100 long tons could be identified. An estimated 15 to 35 percent weight reduction can be attained for two leading candidate application opportunities. Weight reduction will result in a lower center of gravity. Other potential benefits of LASCOR include reduced life-cycle maintenance costs and increased ship compartment useable volume. The number of welded stiffeners can be significantly reduced and flatness can be improved. Additionally, LASCOR is being designed so that modular fabrication with conventional welding methods can be used to simplify installation. The lean alloy duplex stainless steels materials being considered for LASCOR panels have excellent corrosion resistance at a reasonable cost.

Implementation

The project consisted of a multifaceted Integrated Project Team (IPT) with the Navy Metalworking Center working closely with PMS 378; NSWCCD; Naval Sea Systems Command; the Navy Joining Center; Applied Thermal Sciences; the Institute for Manufacturing and Sustainment Technologies; and Northrop Grumman Newport News. The technology developed under this project may lead to implementation efforts for applications such as doors, berms, decks, island, and bulkheads. Efforts are being made to transition LASCOR designs to actual shipyard applications.

New Electrode Achieves Reduced Manganese Emissions

S1060 – Development of Cost-Effective, Low-Manganese, Flux-Core Welding Electrode for Joining High-Strength Steels

Objective

The Navy Metalworking Center (NMC) worked to develop a modified MIL-101-T-“X” low-fuming, flux-cored welding electrode for use with 75% Ar-25% CO2 shielding gas. The modified electrode was intended to reduce welder exposure to manganese fumes without increasing porosity or diffusible hydrogen content, while still meeting Naval Sea Systems Command requirements and shipyard usability characteristics. This was a proactive response to reduced Mn emission limits during welding proposed by the American Conference of Government Industrial Hygienists (ACGIH).

Payoff

The goals of the project were not met.

Implementation

The project achieved reduced Mn emissions; however, the lots did not meet mechanical property requirements.

Period of Performance:

February 2004 to December 2006

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

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Stakeholder:

NAVSEA PMS 378

Consistent Availability of SMAW Electrode Furthers Ballistic Performance

S1061 – Availability of SMAW Electrode (MIL-10718-M) Required for Ballistic Performance Requirements

Objective

The objectives of this project were to optimize 1/8-inch and develop 3/32-inch-diameter MIL-10718-M shielded metal arc welding (SMAW) electrodes manufacturing processes and test methods to ensure that conformance test requirements and shipyard usability requirements could be met. An additional objective was to qualify two suppliers for each diameter of electrode. These objectives were met by the project.

Payoff

The primary benefit of this project is consistent availability of two diameters of MIL-10718-M electrodes needed for cost-effective naval vessel production. These electrodes provide welds that are capable of consistently meeting the required ballistic performance in welded HSLA-100 and HY-100 steels, as measured by the weld metal strength, ductility, and notch toughness properties. In addition, the ability to procure electrodes from two manufacturers allows for greater flexibility during procurement, provides competition in pricing and ensures consistent availability to the U.S. military and military contractors.

Implementation

Implementation of the 1/8-inch MIL-10718-M electrode is complete, with the electrodes in use at Northrop Grumman Newport News (NGNN) and General Dynamics Electric Boat (GDEB) for new construction and repair of the Gerald R. Ford (CVN 78) Class aircraft carriers and VIRGINIA (SSN 774) Class submarines. Implementation is also anticipated on DDG 1000 and LHA-R. Successful implementation of the 3/32-inch electrode will be achieved when it is approved by NAVSEA 05P24 and transferred to domestic shipyards, which is anticipated in Fall 2007.

Period of Performance:

February 2004 to June 2007

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

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Stakeholder:

NAVSEA PMS 378

Durable Non-Skid Coatings Provide Significant Benefits to Flight Deck Maintenance

Period of Performance:

October 2003 to
October 2006

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

iMAST

Point of Contact:

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tdb14@psu.edu

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$500,000

S1064 – Long Life Non-Skid Coatings

Objective

Non-skid flight deck coatings must withstand extreme service conditions, including impact, abrasion, exposure to organic fuels and lubricants, and frequent scrubbing or other cleaning processes. The majority (>80%) of flight deck non-skid coatings are replaced following each deployment. The objective of this project is to develop a durable Type V (Extended Durability Rollable) nonskid deck coating capable of lasting through two deployments. At a minimum, the non-skid coating should enable positive flight deck surface control of the aircraft at all times in all sea-states, retain coefficient of friction greater than 0.95 throughout the life-cycle, support life-cycle cost avoidance and provide weight reduction or remain weight-neutral compared to current materials. It should also be easily refurbished if and when necessary and cure within 24 hours of application. The results of this project were directly applicable to CVN 68 class carriers, CVN 21, LHA / LHD and all other platforms that utilize nonskid coatings.

Payoff

The development of an extended service life non-skid coating will substantially reduce maintenance and repair costs. If the service life of the non-skid coating on areas outside of the landing area can be extended through one extra deployment, the cost avoidance in manpower and material would be more than $1M per carrier per deployment. The total annual cost avoidance to the Navy would be ~$5M per year. Other performance enhancements resulting in the development of a more durable non-skid coating are improved personnel and equipment safety, reduced sailor fatigue, improved readiness, and the potential for improved aircraft launch and recovery rates.

Implementation

Full implementation requires qualification to the recently revised MIL-Spec, MIL-PRF-24667B (SH) and the concurrence of NAVSEA 05M1. Spray application equipment is being developed by Naval Surface Warfare Center, Carderock Division, in partnership with Pratt & Whitney Automation (PWA), Inc. Development of the Type V (Extended Durability, Roller-Applied Deck Coating) formulation is complete. This formulation has both high impact durability and high wear resistance. Wear tests conducted in December 2006 show that the coating will lose < 0.5 % of coating mass in the 500-cycle wear test described in Mil-PRF-24667B. This value is very small compared to the typical 5% – 10% weight loss experienced by conventional epoxy-based systems under similar conditions. The first TAMMS / Euclid production run of the long-life nonskid was completed in early-mid June 2007. Coating application trials were performed at PWA in Huntsville AL using the Pratt & Whitney Convergent Spray Technology application system. The application trials show that the nonskid coating developed by ARL Penn State and the TAMMS division of Euclid Chemicals can be applied in the traditional manner (trowel & roller) or by spray application followed by back-rolling to achieve the traditional profile. Pending successful laboratory testing of the Type V Extended Durability nonskid coating, NAVSEA 05M will schedule a shipboard demonstration. TAMMS is independently pursuing a trial installation on the automobile deck of a commercial ferry in the Seattle area.

Spatial Scheduling Reduces Planning and Production Costs

S1065 – Modeling and Simulation for Carrier Construction Planning and Sequencing

Objective

The objective of this project is to use advanced simulation and modeling tools to improve carrier construction planning and sequencing. This will allow Northrop Grumman Newport News (NGNN), the sole builder of U.S. Navy aircraft carriers, to evaluate alternative construction and assembly sequencing strategies in an effort to reduce production costs and risks associated with on-time delivery to the Navy. Results from this project will also provide NGNN with better visibility and decision-making opportunities early in the product life-cycle. A discrete event simulation (DES) model was used to evaluate several construction strategies in a production engineering analysis. CAD product models were used to develop assembly simulation models for high-value carrier assemblies. Spatial scheduling tools were developed for space-limited facilities throughout the shipyard. Finally, the project provides an improved decision support capability by using the Applied Research Lab (ARL) at Penn State's recent Cave Automated Virtual Environment (CAVE) upgrades for the CVN 21 Propulsion Plant program.

Payoff

The results from this project lead to cost avoidance in the planning, production, and capital acquisition phases. Lead-time reduction due to the use of modeling tools and increased planning visibility is anticipated as well as a reduction in planning man-hours. Cost avoidance was also found through fixture reduction, additional assemblies in the Covered Modular Outfitting Facility (CMOF), and additional units. Total potential cost avoidance is estimated to be $3.9M / yr.

Implementation

Simulation results for various construction alternatives have been delivered to NGNN planners in a final report. Assembly simulation pilot results and a Delmia software migration plan were delivered to NGNN in June 2005. The Final Assembly Platen (FAP) Spatial Scheduling Tool (with included Buffer Zone platen view) was deployed at NGNN in June 2006 and is currently in use for spatial planning of CVN 78. A similar tool has been developed for the Structural Fabrication and Assembly planners and is currently being evaluated for full implementation. The full body motion tracking suit further developed in this project will be used in future CAVE reviews to optimize design and construction planning where access and line of sight challenges are identified.

Period of Performance:

June 2004 to December 2006

Platform:

CVN

Affordability Focus Area:

Production Planning

Center of Excellence:

iMAST

Point of Contact:

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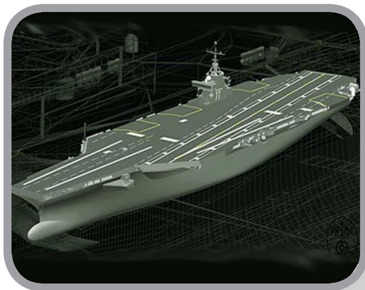
Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$1,135,000



Higher Strength Steel Provides Improved Protection Performance

S1066 – High Strength and Toughness Naval Steels for Ballistic Protection

Period of Performance:

June 2004 to February 2007

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
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Stakeholder:

NAVSEA PMS 378

Objective

HSLA-100 high strength and toughness steel has been used extensively in CVN 21 applications. The need for reduced topside weight in CVN 21 design has resulted in a need for higher strength steel with improved or equivalent protection performance that could be used in thinner sections. The Navy Metalworking Center (NMC) and the project team is evaluating and demonstrating the performance of such steel. Efforts have shown that the most feasible means of achieving that goal is to modify the processing of HSLA-100 steel, with specified minimum yield strength of 100 ksi, to achieve 115 ksi minimum yield strength (HSLA-115). The steel supplier has indicated that such an approach would be commercially feasible. The objectives of this project are to produce and evaluate production-size plates of HSLA-115 steels; optimize heat treatment; and analyze material, mechanical, protection, formability, and weldment properties. This project supports the efforts necessary to attain the desired benefits of high-strength and toughness steels and to achieve substantial weight reduction in the CVN 21 design. The technology developed under this project is expected to lead toward efforts supporting formal Material Selection Information (MSI) requirements.

Payoff

Provided that the improved HSLA-115 material retains or exceeds material performance levels relative to the currently used HSLA-100 material, then the thickness of the steel plating can be reduced to achieve the desired weight reduction. This thickness reduction should result in a 175 long ton weight reduction and a lower center of gravity. This project documented successful production plate manufacturing, acceptable explosion and under-matched welding performance at reduced thickness as well as acceptable impact toughness values throughout the yield strength range of 115 ksi to 130 ksi.

Implementation

The project consisted of a multifaceted Integrated Project Team (IPT) with NMC working closely with PEO (Carriers); the Naval Surface Warfare Center, Carderock Division (NSWCCD); Mittal Steel USA; Naval Sea Systems Command; the Navy Joining Center (NJC) and Northrop Grumman Newport News (NGNN). NJC, working with NSWCCD, NMC, and NGNN, was a task lead for the welding effort. The technology developed under this project is expected to lead toward efforts supporting the Material Selection Information (MSI) documentation and requirements. The benefits of this project have progressed into the HSLA-115 Evaluation and Implementation Phase II (S2171) project that is aligned with the CVN 78 implementation schedule. The implementation plan is targeted to satisfy the design and construction schedule requirements for the production of CVN 78.

Lightweight Composites Meet Critical Weight Parameters

S1069 – CVN 21 Composites Applications for Weight Reduction

Objective

As lead design yard for CVN 78, Northrop Grumman Newport News (NGNN) must satisfy several challenging design objectives for the next generation aircraft carrier including the reduction of KG (distance from keel to center of gravity). To do this, weight must be removed in the areas which are above the ship KG. In Phase I of this effort, lightweight multifunctional materials and material systems were identified that met the fire and fragmentation protection requirements associated with a typical aircraft carrier topside structure. Utilizing the multifunctional materials approach, a notional concept (baseline) for a lightweight structure that met CVN 78 requirements was developed and evaluated. At the end of Phase I, NAVSEA directed that the structural panel design conform to CVN 78 Platform Ship Specification Section 150, Island Structure. In Phase IIA and IIB, studies were conducted to select suitable island areas for the application of the lightweight composite structure. In addition, the baseline and alternative panel designs were evaluated in a trade study to determine which panel design best fulfilled the requisite design criteria and outfitting needs. Based on the studies, a panel design was down-selected for manufacturing and performance optimization in Phase IIC.

Payoff

Successful execution of Phase II resulted in an integrated system design that meets CVN 78 critical ship requirements which was validated through testing and analysis. Performance testing and cost analyses indicated that the affordable panel design would meet performance requirements and reduce the weight of the island by 23 tons. This provided information to so that NGNN could design lightweight composite structures capable of contributing significantly to weight KPP that meet the load requirements for any topside aircraft carrier application.

Implementation

Key personnel at NGNN, PMS 378, and NAVSEA 05P have been integrally involved throughout the course of the project to ensure that performance requirements and cost / weight goals were met. Risk reduction plans were incorporated into the project's statement of work and a requirements document that outlines the tasks required to fully qualify the composite ship structural material system was developed.

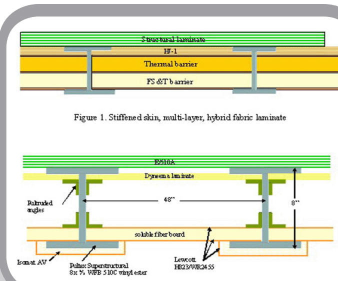

Figure 1. Stiffened skin, multi-layer, hybrid fabric laminate

Period of Performance:

October 2006 to May 2007

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CMTC

Point of Contact:

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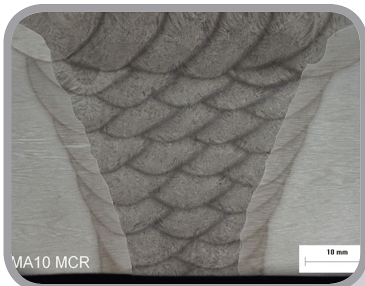
Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$928,000

Welding Development Enables Enlarged Flight Deck and Overall Cost Avoidance



Period of Performance:

May 2004 to December 2007

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

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Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$1,291,000

S2022 – Welding Development for High Strength Steel

Objective

Increasing the strength of steel has the potential to replace the currently used High-Strength Low-Alloy (HSLA-100) steel for selected applications and reduce the weight of CVN 78. However, further development is needed on the steel itself and on the fabrication technologies that Northrop Grumman Newport News (NGNN) will use for ship construction. Welding is one of these needed fabrication technologies. The Navy Metalworking Center (NMC) is leading the overall steel development project. As a subtask to that activity, the Navy Joining Center (NJC) led the weld development activity. Steel development efforts have shown that the most feasible means of achieving the weight reduction and performance goals is to modify the processing of HSLA-100 steel to produce steel with minimum yield strength of 115 ksi (HSLA-115). The objectives of the NJC project were to develop welding procedures to increase productivity for fabrication of HSLA-115 steel while meeting the undermatching weld metal performance requirements. Development focused on optimized welding electrodes and procedures to produce welds with requisite yield strength, ductility, and toughness at minimum cost.

Payoff

Weld development for the HSLA-115 high-strength steel will enable reductions in thickness of the flight and gallery decks. This corresponds to approximately 175 long tons of weight reduction and a lower center of gravity. The reduced weight for an enlarged flight deck will result in a 15% increase in sortie rates for this carrier class. A secondary benefit from the project will be total ownership cost avoidance due to the development of efficient and productive welding procedures which will minimize the fabrication costs for this new steel and will reduce the learning curve for shipyard implementation. Further details of payoff metrics are not available at this time for release outside the project team. The technology developed during this project also has applications on other Navy ships.

Implementation

The implementation plan is structured to satisfy the design and construction schedule requirements for the production of CVN 78. The Integrated Project Team includes PEO (Carriers) and NGNN to facilitate successful implementation of the technology developed during this project to the Navy and to the shipyard. The project supports the Material Selection Information (MSI) documentation and requirements.

New Watertight Door Design Provides 27% Weight Savings over Standard Watertight Door

S2031 – Advanced Surface Ship Watertight Enclosures

Objective

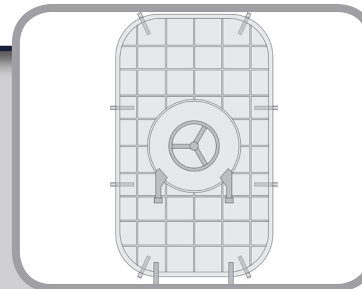
Navy standard watertight doors (NSWDs), designed in the early 1950s, are expensive to install and maintain and are too heavy for today's needs. Installation costs are about $8,400 per door, and watertight doors are usually at or near the top of the Navy's Top Management Attention (TMA) list for hull, mechanical, and electrical (HM&E) systems requiring frequent maintenance due to poor functioning, corrosion, and loss of water-tightness. To maximize substitution opportunities on CVN 78, this project focuses on the 26 inch x 66 inch, 10 lbs per square inch interior door, weighing 292 pounds, with eight latching dogs and a 6-inch diameter window. The objective is to specify a new interior watertight door for the CVN 78, featuring improvements over the NSWD and incorporating advances in materials, design, and manufacturing processes including, but not limited to: stainless steels, cellular sandwich panels, a novel compliant seal and latching mechanism, distortion-reducing plug-in-hole installation, and highly accurate, high-speed, automated laser cutting and welding processes. Tasks were added in FY07 with the objective of extending the technology developed for CVN 78 to the Littoral Combat Ship (LCS) and decreasing cost.

Payoff

The new door design passes finite element analysis at 15 lbs per sq. inch pressure, a 1.5 overload (as required). The new door weight is 213 lbs, which represents a 27% reduction, as compared to the NSWD. Reducing the weight of the doors allows increased alternate weight allocation opportunities for armor, ordinance, cargo, and other warfighting-related functions, while maintaining stability. Reduced installation and maintenance costs due to low distortion plug-in-hole installation, and the use of a more corrosion-resistant material (304 stainless steel) than the low carbon steel (A-36) used in the NSWD, combined with reasonable manufacturing costs, will result in a reduction of total ownership costs, providing more resources for the warfighter.

Implementation

The new door will be fabricated at Penn State's Applied Research Laboratory (ARL) and by external manufacturers to provide doors for a testing program to include hydrostatic, shock and cyclic testing. Northrop Grumman Newport News (NGNN) will document installation costs and investigate ways of reducing those costs. Manufacturing specifications for an optimized design of an interior watertight door for CVN 78 will be delivered to PMS 378 at the end of the project. On this project, ARL Penn State's Institute for Manufacturing and Sustainment Technologies (iMAST) is teamed with the Naval Surface Warfare Center, Carderock Division for Navy in-service experience and their expertise in functional and performance requirements of watertight doors, and with NGNN for their expertise in door installation and shipbuilder requirements.



Period of Performance:

June 2004 to September 2008

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

iMAST

Point of Contact:

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Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$2,312,000

Metallurgical Evaluations Reduce Thickness of High Strength Steel

Period of Performance:

March 2005 to
December 2006

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

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Stakeholder:

NAVSEA PMS 378

S2044 – Extended Metallurgical and Manufacturing Evaluation of Improved High Strength Ballistic Steel

Objective

Related projects, such as High Strength and Toughness Naval Steels for Ballistic Protection (S1066), have identified high-strength steels, as potential candidates for providing increased structural strength at reduced weight. This project investigated how to optimize the steels for desired characteristics, predicted the effects of various factors on mechanical properties and performance, and developed a better understanding of the specific manufacturing issues related to shipyard use. The ultimate goal was to help prepare shipyards for the implementation of the selected steel by identifying potential issues earlier in the development and optimization stages, thereby reducing risk and allowing for the incorporation of such knowledge into implementation procedures. An Integrated Project Team (IPT) performed extensive metallurgical evaluations, investigated heat treatments, evaluated hot and cold forming effects, verified magnetism effects and recommended fabrication procedures based on its findings.

Payoff

The improved HSLA-115 material retained or exceeded material performance levels relative to the currently used HSLA-100 material, and the thickness of the steel plating can be reduced to achieve the desired weight reduction. This thickness reduction should result in a 175 long ton weight reduction and a lower center of gravity. Weld volume was also reduced with HSLA-115 for the intended application. In addition, by investigating manufacturing issues, such as forming and dimpling effects in addition to the metallurgical aspects of candidate materials, risk should be reduced regarding the successful implementation. This project documented that HSLA-115 can be formed and dimpled successfully for the CVN 78 application.

Implementation

The project consisted of a multifaceted IPT with the Navy Metalworking Center (NMC) working closely with PMS 378; the Naval Surface Warfare Center, Carderock Division; Mittal Steel USA; the Navy Joining Center; Naval Sea Surface Command; QuesTek Innovations, L.L.C.; and Northrop Grumman Newport News (NGNN). NGNN was the task lead for forming and dimpling validation testing at the shipyard. The implementation plan supported the larger S1066 High Strength and Toughness Naval Steels for Ballistic Protection project and was targeted to satisfy the design and construction schedule requirements for the production of CVN 78.

Predictive Weld Distortion Techniques Reduce Need for Flame Straightening and Associated Costs

S2056 – Predictive Weld Distortion in Thick Navy Structures

Objective

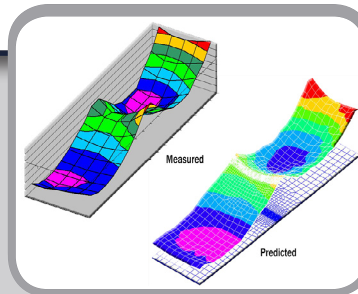
Flame straightening is often used to remove the distortion caused during the welding process. This labor and time- intensive method adversely affects product cost and schedule and is a complicated trial-and-error process that takes years of experience to master. The problem is exacerbated by a shortage of skilled labor as age, attrition, and outside opportunities reduce the number of welders skilled in the "art" of flame straightening. By using finite element analysis (FEA) methods, alternative welding methods can be used to predict ways to reduce the need for flame straightening and pre-construction mock-ups. In this project, a Northrop Grumman Newport News (NGNN)-led team evaluated current FEA methods to determine if they are ready for shipbuilding application. In particular, the team investigated their application to the thick Navy structures of Nimitz class and CVN 21 class carriers.

Payoff

As a conservative estimate, Predictive Weld Distortion (PWD) techniques could eliminate one-third to one-half of all the man-hours spent per ship on flame straightening. An estimated 70,000 hours, or $3.5M per ship in cost avoidance may be realized. These techniques will also be able to reduce or even eliminate the need for physical mock-ups and their associated material and labor costs.

Implementation

This is the first step in implementing PWD tools on naval structures. As weld distortion is a major problem in ship construction and the technology has the potential to be used on any welding process, many of the major U.S. shipyards have expressed an interest in the outcome of the PWD analysis program. If proven technically feasible, the NGNN weld engineering and structural engineering groups will have an additional tool to be used for solving heavy plate welding problems. Physical mock-ups and modeling, Phase 1, was completed in early 2006. Computational numerical simulation and analysis, Phase 2, is in progress, and will culminate with a selection of a single software supplier for a heavy plate PWD analysis tool, scheduled for late Summer 2006. In Phase 3, the PWD software will be used by the Advanced Materials Technology Department of NGNN to model and analyze a current CVN structure. Once successfully proven for restricted production application, NGNN will collaborate with NAVSEA representatives on future programs to determine additional uses, develop acceptance criteria, and develop the required certifications to permit general production use.



Period of Performance:

November 2004 to
June 2007

Platform:

CVN

Affordability Focus Area:

Distortion Reduction

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$541,000

Computed Radiography Has Potential to Greatly Reduce Cycle Times

S2057 – Digital Radiography

Period of Performance:

November 2004 to September 2008

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$1,371,000

Objective

The current film-based radiographic inspection process used in ship construction is very cycle-time intensive, requiring manual handling of materials throughout the entire process. The film-based inspection process uses expensive, non-reusable film, wastes thousands of gallons of water every year, and relies on chemicals that contain materials (such as silver) which are potentially hazardous to the environment. This Northrop Grumman Newport News (NGNN)-led project will use commercially-available computed radiography (CR) equipment to develop processes and standards that will replace the current film-based process in critical naval applications, including the CVN 21 and VIRGINIA Class submarine construction programs.

Payoff

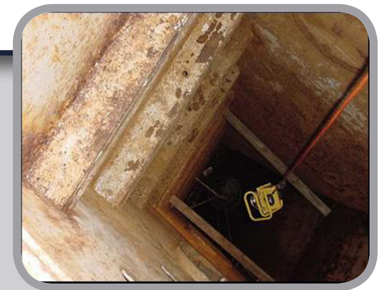
NGNN estimates that this technology has the potential to improve cycle-times by as much as 10 times for 70% of the NGNN operations through the elimination of film developing, manual transport of conventional radiographic materials and manual storage, and retrieval of film and records. Additionally, CR will substantially reduce consumption of radiographic expendables (films and development chemicals) by as much as 100%, as the film makers move toward all-digital technology.

Implementation

This project seeks to confirm the feasibility of using CR in the shipbuilding environment, to prepare working standards, and to obtain sufficient statistical data to commence production testing by April, 2007. CR will then be implemented in the NGNN Welding School, where virtually all weld coupons will be radiographed “on-site” with inspection results provided to welding instructors with considerably reduced cycle-times. With U.S. Navy authorization, the next phase will be in NGNN’s foundry operation for heavy metallic casting inspections. Building on the successes and innovations from the first two phases, and again with U.S. Navy authorization, the third phase will move to inspection of heavier structural welds. In all phases of implementation, both conventional and CR methods will be employed simultaneously to build confidence with the CR standard. NGNN has conducted additional technical presentations for the NAVSEA technical codes. Also, NGNN completed a two-day workshop on Computed Radiography for Inspection of Welds and Castings on Naval Applications. The project was briefed at several CVN 21 Integrated Product Team (IPT) progress reviews. Currently, the Image Plate Processing improvements are being evaluated by the project team based on recommendations from leading industry CR experts and equipment manufacturers. NGNN provided additional computed radiography technical assistance to NAVSEA in the area of valve position indication and piping corrosion detection.

Water Jet Blasting Avoids Significant Costs Related to Abrasive Blasting

S2072 – Carrier Tank Coatings



Period of Performance:

January 2004 to September 2007

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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tdb14@psu.edu

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$455,000

Objective

Due to ship operational tempos and current limitations of dry abrasive blasting, there is insufficient time during scheduled availabilities to preserve the over 700 tanks and voids on an aircraft carrier. As the Navy moves toward a projected 12-year docking cycle, preservation opportunities will become further restricted. Currently, preservation is performed during pierside availabilities imposing a substantial burden on vessel and crew due to noise and dust. Also, abrasive blasting is considered “hot-work” due to the propensity of abrasive blasting to create sparks. The abrasive blasting process requires that adjacent tanks and voids be pumped down, opened, inspected, and certified gas-free before preservation can begin. Ultra-High Pressure (UHP) water jet blasting, however, doesn’t have this requirement. The objective of this project is to develop tools and techniques to allow the use of UHP water jet blasting technology for the removal of coatings and corrosion products in enclosed spaces.

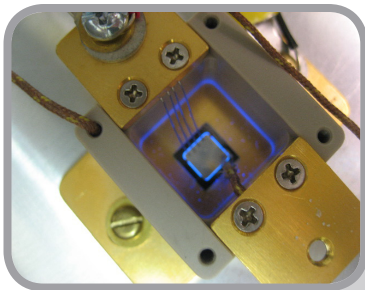
Payoff

Based on recent experience, the cost to abrasive blast a tank with a surface area of 4000 square feet (the average surface area for CVN tanks) is ~ $160K. Pierside UHP water jet blasting performed on fuel-oil service (FOS) tanks on the USS Kennedy was ~$104K per tank for a 35% reduction. According to COMNAVAIRLANT, approximately 70% of the approximately 730 tanks or voids per carrier are candidates for UHP water jet blasting. Assuming 10 carriers in US fleet and 12 year average coating life, the total annual cost to maintain these tanks using abrasive blasting is $97M / year (CVN only) vs. $74M / year with UHP water jet blasting, for an annual cost savings of $23M or 24%. This estimate does not include the elimination of non-value added tasks such as opening adjacent tanks and certification of these tanks to be gas-free prior to beginning the preservation process.

Implementation

This project includes a field demonstration of quantitative flash rust measurement tools and a prototype closed-cycle UHPWJ cleaning tool for use in tanks and voids. NAVSEA 05M1, the technical authority, has approved a Production Process Instruction (PPI) for UHP water jetting in ballast tanks and floodable voids. The flash rust level may not exceed the level set forth in SSPC WJ 2½-L, “light flash rust”. Closed-cycle UHP water jet cleaning will produce substantially less flash rust than open-cycle blasting. Once this process has been proven to meet requirements, COMNAVAIRLANT will immediately begin using this technology on tanks and floodable voids. With concurrence from NAVSEA 05M1, COMNAVAIRLANT will also implement this technology on FOS tanks and voids using Test & Evaluation PPI for UHP water jetting, as appropriate.

Silicon Carbide Diodes Enable a Reduction in Size and Weight of Components in Power Conversion Circuit



Period of Performance:

December 2005 to March 2009

Platform:

CVN

Affordability Focus Area:

Integrated Power and Propulsion

Center of Excellence:

EOC

Point of Contact:

Mr. David Ditto
(724) 295-7011
dditto@eoc.psu.edu

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$2,938,000

S2099 – High-Power SiC PiN Diode Manufacturing

Objective

The Department of Defense is moving towards platforms and weapon systems which utilize electrical power in new ways. The concept of an “electric warship” depends on the ability to rapidly switch power to major loads to meet tactical needs. To meet these performance challenges new wide bandgap semiconductor materials and devices based on silicon carbide (SiC) are required to enable solid state power substations (SSPS) for future Navy ships. Compared to similarly sized devices fabricated from standard silicon, high-voltage power switches and diodes fabricated from SiC offer a reduction in on-state resistance of more than 100 times. Furthermore, SiC offers dramatically lower switching losses which allows the use of higher frequency AC power, thus enabling a reduction in the size and weight of passive components in the power conversion circuit. The objective of this project is to address the manufacturing issues which presently limit the yield of high-voltage SiC PiN diodes needed for the switching modules of the SSPSs for future Navy ships.

Payoff

Traditional approaches for power distribution being considered for the next generation of carriers and destroyers employ 13.8 kV AC power that is stepped down to 450 V AC by using large (6 ton and 10 m3) 2.7 MVA transformers. The advanced power electronic components of interest under this effort will enable the realization of a SSPS that converts the same total power level as the traditional approach with a reduction in size of 60% and reduction in weight of approximately 2.6 tons for a single 2.7 MVA transformer. Thus, the payoff for an aircraft carrier generating more than 100 MVA of power is a total reduction in weight and volume which exceeds 100 tons and 240 m3.

Implementation

The subcontractor in this project is Cree Inc., the leading provider of SiC materials and devices. Cree is presently developing SiC power switching transistors and diodes targeted for 10kV, 110A power switching modules. The manufacturing technology developed in this effort is required to enable these switching modules to be produced for the SSPSs of future Navy ships such as CVN 21 and DDG 1000.

Adhesive Bonding for Composites Results in Increased Carrier Performance

S2122 – Adhesive Bonding Processes for CVN 78 Composites Structures

Objective

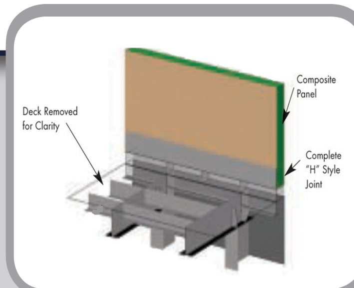
This project developed adhesive bonding methods to join composites to metals and meet the design and cost goals for the CVN 21 aircraft carrier program. This joining technology facilitates the reliable integration of composites into the island design to reduce the weight of the aircraft carrier. Implementation of composite structures is expected to involve replacement of selected steel panels with composite panels for enclosure bulkheads above the 010 island level. The bonded joining technology must be producible, cost-effective, and meet the functional requirements of the structures. The objective of the project was met by demonstrating through testing and analysis that the primary functional requirements of the joint and manufacturing processes are attainable. Producibility of the design concepts was demonstrated by producing a full-scale joint for performance testing.

Payoff

The manufacturing technology developed minimizes the costs of materials and labor associated with integrating composite structures aboard the carrier. Additional benefits from this project include reduction of topside weight and a lower center of gravity that increases the performance of the carrier.

Implementation

The design, fabrication, and inspection protocol developed as part of this project will be transitioned to Northrop Grumman Newport News (NGNN) and Northrop Grumman Ship Systems (NGSS). Pending all results of the project (including estimates of ownership cost, and weight reduction, and qualification testing), the participating shipyards have stated their intent to assess composite structural designs that will utilize adhesive bonded joints as candidates for a lightweight island design on future hulls CVN 79 and out.



Period of Performance:

April 2006 to May 2007

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$650,000

Tandem Gas Metal Arc Welding Reduces Rework and Increases Weld Quality

Period of Performance:

April 2006 to December 2007

Platform:

CVN

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy J. Trapp
(614) 688-5231
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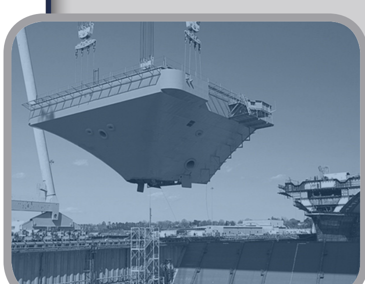
Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$527,000



S2123 – Tandem GMAW for Ship Structures

Objective

The Navy Joining Center (NJC) participated in an integrated project team along with PMS 378, PMS 450, Northrop Grumman Newport News (NGNN), and Naval Surface Warfare Center (NSWC)-Carderock to develop and implement high productivity Tandem GMAW for out-of-position mechanized butt welding of high-strength steel erection joints for ship structures. The NJC objective was to develop and demonstrate welding procedures necessary to support the required productivity improvements. The technology will initially be implemented on SSN 781, but will also transition to CVN 78 for horizontal and vertical butt joints as well as overhead joints on the flight deck. The welding technologies developed during this project are expected to have wider applications to other Navy ships, including DDG 1000 and T-AKE ships for the Military Sealift Command.

Payoff

Tandem GMAW has the potential to increase deposition rates by a factor of two or more over conventional mechanized GMAW. Preliminary estimates on the amount of out-of-position welding are approximately 5,800 feet for CVN 78 and 1,400 feet for SSN 781. This represents over 30,000 labor hours annually. Two- to three-fold improvements in deposition rate, therefore, offer potential for significant labor hour reductions. Additional cost reductions are expected though an increase in weld quality. The T-GMAW process has been shown to reduce weld root defects and improve weld bead profile with proper optimization. A cost-avoidance of approximately $750,000 per hull for CVN is anticipated.

Implementation

The Integrated Project Team includes PEO (Carriers), PEO (Subs), and NGNN to help ensure implementation of the T-GMAW on both SSN 781 and CVN 78. In Phase Three of the project, a shipyard system will be acquired by NGNN. Procedures will then be refined, qualified, demonstrated, and validated. NGNN has stated their intent to implement the developed welding procedures pending the results of the project. Initial implementations of these technologies are expected to occur in calendar year 2008.

Significant Weight Reduction of Current Power Conversion Equipment

S2154 – Evaluation of High Power Package Suppliers for Advanced Power Systems

Objective

The new Wide Band Gap (WBG) semiconductor materials, principally SiC, offer the necessary materials properties to address higher power performance challenges. Continuous power switches, power diodes, and pulsed power switches fabricated from SiC offer reductions in on-state resistance and switching loss over conventional silicon power devices planned for future ship construction. For a given power rating, these components can operate at a higher duty cycle, leading to a reduction in the size of inductors and transformers in power circuits. SiC power electronics also extends solid state technology by offering higher breakdown voltage levels than current silicon technology, to address voltage levels presently managed by electromechanical switch technology. Use of SiC power conversion on Navy ships is expected to reduce the current conversion equipment size by approximately 60% with weight savings approaching 2.68 tons for each converter implemented with the new technology. The objective of this effort was to carefully assess and evaluate the capabilities of all interested high power package suppliers and make a recommendation for a specific supplier for inclusion in a follow-on three-year effort aimed at developing high power packaging and implementing WBG semiconductors in naval platforms. This effort also included the work required to develop a reliability model for packaged high power SiC devices.

Payoff

This project was detailed to provide support to the follow-on multi-year cooperative program between DARPA, ONR, and PEO CARRIERS aimed at implementing WBG semiconductors for ships' High Power Distribution. The benefits of these WBG materials in power conversion include a reduction in the size of the current power conversion equipment by 60% and significant weight reduction for each converter implemented with new technology. The insertion of solid state power conversion technology will increase the power factor and improve the voltage control. The immediate benefit of this effort was the evaluation of all potential suppliers of high power packages for SiC devices and a specific recommendation for Powerex to be included in the multi-year program. It was noted that none of the suppliers possessed all of the required capabilities, and an additional effort is needed to supplement and upgrade their capabilities.

Implementation

This effort was independent of an insertion target platform. It is expected that the package supplier recommended by this evaluation will be included in the follow-on multi-year effort aimed at implementing WBG semiconductors in naval platforms and afterwards become a supplier of high temperature, high power packages to the DoD community. The reliability models developed will be tested in the multi-year effort.

Period of Performance:

August 2006 to October 2007

Platform:

CVN

Affordability Focus Area:

Integrated Power and Propulsion

Center of Excellence:

EMPF

Point of Contact:

Mr. Michael Frederickson
(610) 362-1200
mfrederickson@aciusa.org

Stakeholder:

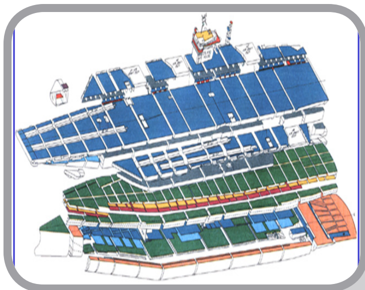
NAVSEA PMS 378

Total ManTech Investment:

$409,000

Tools to Reduce Planning and Scheduling Delays of CVN

S2167 – CVN Virtual Erection Visualization



Period of Performance:

February 2007 to
December 2008

Platform:

CVN

Affordability Focus Area:

Production Engineering

Center of Excellence:

iMAST

Point of Contact:

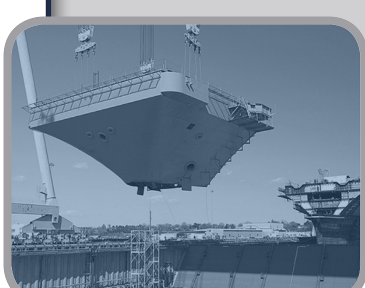
Mr. Tim Bair
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$325,000



Objective

The project objective is to develop a tool to visualize the 3-dimensional erection of the CVN 21 hull, allowing for immediate validation of resequencing due to build strategy modifications or delays in the construction schedule. The intent is to also extend Spatial Scheduling Tool (SST) development to include new dock-side facility dedicated to the construction of the CVN 21 power units to ensure on-time shipboard installation.

Payoff

It is estimated that this project over a four year construction period for CVN 21 hull will lead to an estimated $5264K per hull cost avoidance and PV Return on Investment (ROI) of 21.9:1.

Implementation

Two technologies are planned to be implemented as a result of this project: 1) the PUAF Spatial Scheduling Tool (SST) and 2) the 3D Erection Visualization Tool (EVT). Upon completion, the tools will be delivered to the appropriate end users and are anticipated to be immediately used to support the planning operations of CVN 78. A Go / No-go decision will be made after the delivery of the 3D EVT to determine the need to integrate within the previously implemented FAP SST. If Northrop Grumman Newport News (NGNN) elects to move forward with this, an updated version of the FAP SST will be delivered to NGNN that includes the necessary hooks to the 3D EVT.

LASCOR Panel Evaluation to Reduce Cost for CVN 21 Applications

S2170 – LASCOR Panel Evaluation and Implementation Phase II

Objective
The objective of this project is to complete laser-welded corrugated-core (LASCOR) structural / closeout validation testing, complete material / corrosion testing and implement the technology into shipyard applications while incorporating material, design and manufacturing improvements to reduce cost.

Payoff
The project will establish a steel lightweight, stiff and modular structural system to reduce weight and improve performance while evaluating opportunities to reduce cost for CVN 21 applications.

Implementation
LASCOR is being evaluated for future applications on CVN 21 in parallel with completion of the structural and material testing required for NAVSEA endorsement of the technology. Provided that LASCOR designs offer the shipyard improved performance or cost reduction, LASCOR may be incorporated into baseline designs for future construction. Also, LASCOR is being considered for other ship platform use, and this project will help to streamline future shipyard implementation efforts. Successful transition of the technology occurs when the structural testing is validated and approved by NAVSEA and LASCOR is integrated into a baseline design for a shipyard application.

Period of Performance:

February 2007 to
April 2011

Platform:

CVN

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

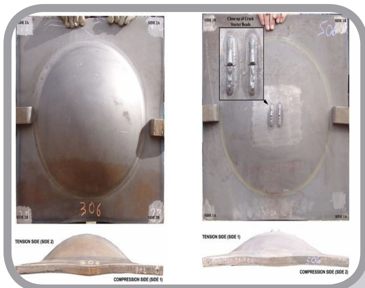
Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

NAVSEA PMS 378

HSLA-115 Implementation on CVN 21 Has Potential to Greatly Reduce Weight per Hull

S2171 – HSLA-115 Evaluation and Implementation Phase II



Period of Performance:

February 2007 to February 2010

Platform:

CVN

Affordability Focus Area:

Materials Process Improvements

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
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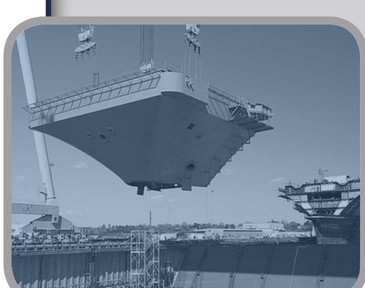
Stakeholder:

NAVSEA PMS 378

Total ManTech Investment:

$3,507.000



Objective

The objective of this project is to evaluate HSLA-115 for production plate performance and manufacturability, welding optimization and performance as well as shipyard practices so that HSLA-115 can be accepted for use.

Payoff

Implementation of HSLA-115 for the target application on CVN 21 may result in 175 long tons of top-side weight reduction per hull. A cost-neutral impact to acquisition cost for HSLA-115 implementation is estimated. The improved minimum yield strength level of the HSLA-115 (115 ksi) also offers enhanced factor of safety in areas where the application thickness may not be reduced, but where the design performance and strength are enhanced without a weight penalty. Additional applications may be considered in future designs.

Implementation

HSLA-115 is incorporated into the ship specifications and the fabrication document to allow its use for CVN 21. These revisions allow the use of HSLA-115 for CVN 21 and the impact to HSLA-115 implementation is estimated to be cost-neutral as compared to the baseline design. HSLA-115 is being considered for integration into the CVN 78 baseline application design. The testing and evaluation planned in Phase II is necessary for Northrop Grumman Newport News (NGNN) to incorporate HSLA-115 into the baseline design and implement into the CVN 78 construction schedule.

DDG 1000 Projects

Period of Performance:

April 2001 to October 2007

Platform:

DDG 1000

Affordability Focus Area:

Not Applicable

Center of Excellence:

NJC

Point of Contact:

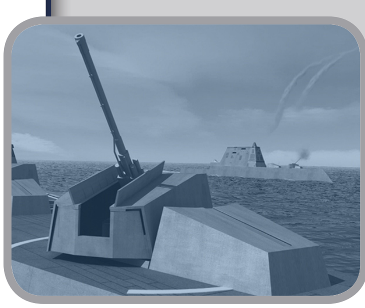
Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$6,801,000



Composite Joint Successfully Demonstrated

S1002 – DDG 1000: Large Marine Composite / Steel Adhesive Joint

Objective

New composite materials are being used to achieve the advanced performance and warfighting capabilities of the DDG 1000 multi-mission surface combatant. Composites are strong, lightweight, and not susceptible to corrosion. These materials will be used to fabricate helicopter hangers, superstructures, and masts to reduce ship weight above the waterline. Mechanical fasteners used to join composites to steel on Navy ships are expensive. The installation procedures for fasteners are labor-intensive and the joints require in-service maintenance. New technology to replace bolted connections with adhesive bonding processes can be cost-effective and meet the functional requirements of DDG 1000. This project developed and demonstrated producible and cost-effective composite-to-steel adhesive joining technology that meets DDG 1000 requirements. A concurrent engineering approach was used to demonstrate through engineering analysis and physical testing that the functional and manufacturing requirements for an adhesive bonded joint are attainable. The project was performed by a team with participation from Bath Iron Works, Northrop Grumman Ship Systems, the Composites Manufacturing Technology Center of Excellence (CMTC) (Project Number S2124), Penn State University / Applied Research Lab, Boeing, Edison Welding Institute (EWI), and the Navy Joining Center (NJC).

Payoff

Adhesive bonding the joint eliminates mechanical fasteners, reduces manufacturing costs, and cuts life-cycle costs through reduced maintenance. Estimates for the cost of installation of a bonded joint are $250 per foot compared to a baseline cost of $667 per foot for a bolted joint (a 60% reduction). This yields a minimum estimated cost avoidance of $340K per ship. The adhesive bonding technology also reduces the weight of the joint by 40% while improving fatigue and shock performance.

Implementation

The developed adhesive bonding technology has been demonstrated successfully at Northrop Grumman Ship Systems (NGSS) Gulfport composite facility. The successful design analysis, manufacturing development, and performance tests conducted during this project resulted in the bonded joint being considered as a design option for the DDG 1000. The vital technology emerging from this effort will serve as the building block for future composite ship structures and designs.

Hybrid Laser Welding Shows Potential for Cost Avoidance and Reduction in Welding Times

S2073 – Hybrid Laser Beam Welding

Objective
Hybrid laser arc welding is being developed as a means to increase affordability in ship construction. Under this program, hybrid welding processes will be developed, tested, and demonstrated within the shipyard for welding thin steel panel structures. The target platform is DDG 1000; however, the successful process could be implemented to support the construction of other vessels, including LPD 17, CVN 78, LHA 6, and CG(X). A Qualification Roadmap will be developed, outlining the required welding qualification testing and evaluation that must be performed prior to welding on ship structures. Transition occurs when a shipyard suitable hybrid process has been developed, demonstrated and proven to be technically and economically feasible.

Payoff
The implementation of a hybrid welding process for distortion control is an immediate need for production of thin steel Navy structures. This technology will impact applications aboard DDG 1000, as well as current and future Navy designs such as LPD 17, LHA 6, CVN 78, and CG(x). It has been conservatively estimated that for implementation of a hybrid welding process for panel butt welds, that the potential savings could be between $0.8M and $2.9M per DDG 1000.

Implementation
There are two major transition events for the program: (1) execution of the Qualification Roadmap and (2) successful demonstration and adoption of the hybrid welding process within the shipyard. Initial qualification testing will provide supporting data that the hybrid welding process is sufficiently under control to produce welds in thin steel panel structures that meet weld performance and fabrication criteria (according to NAVSEA S9074-AW-GIB-010/248 and MIL-STD-1689, and/or Part 8 of the ABS Naval Vessel Rules). Demonstration of the hybrid process for welding of a typical ship structure within the shipyard will enable the confirmation of critical program metrics, that the process exhibits at least 50% less distortion, and is economically justifiable as compared to the conventional welding process. Attaining these goals will provide sufficient evidence to the implementer (shipyard), stakeholder (PMS 500) and technical warrant holder (NAVSEA 05P24) that the hybrid welding process for panel line applications is technically and economically feasible, thereby transitioning the technology to the implementer. Implementation is achieved when NAVSEA approves, PMS 500 includes in the design, and the shipbuilder acquires the equipment necessary to hybrid weld thin panel structures for DDG 1000. Implementation for selected applications at a shipyard is targeted late FY09.

Period of Performance:

January 2005 to
December 2008

Platform:

DDG 1000

Affordability Focus Area:
Distortion Reduction

Center of Excellence:

iMAST

Point of Contact:

Mr. Timothy Bair
(814) 863-3880
tdb14@psu.edu

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$1,714,000

Thermal Tensioning Realizes Significant Cost Avoidance by Reducing Rework

Period of Performance:

June 2005 to October 2007

Platform:

DDG 1000

Affordability Focus Area:

Distortion Reduction

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$1,064,000

S2084 – Thermal Tensioning of Thin Steel Ship Panel Structures

Objective

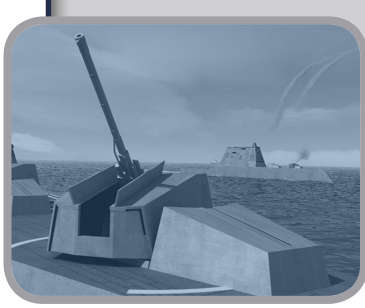
Shipboard applications for lightweight structures in naval vessels have increased in recent years. Buckling distortion of complex lightweight panels has historically had a significant impact on manufacturing costs and production throughput, limiting the ability of shipbuilders to produce innovative ship designs. This Northrop Grumman Ship Systems (NGSS) led effort will expedite and continue efforts to facilitate the implementation of a distortion mitigation program specific to the welding of stiffened thin steel panel ship structures. The successful completion of this project will lead to a better quality ship for the U.S. Navy, while realizing significant cost avoidance by reducing rework. Ultimately NGSS intends to develop transient thermal tensioning technology to reduce the amount of flame straightening required for thin steel structures and to improve deck plate flatness.

Payoff

This project is anticipated to reduce labor associated with flame straightening of thin steel structures and improve deck plate flatness, resulting in reduced maintenance and life-cycle costs. Anticipated cost reductions fall into two categories: acquisition cost avoidance and life-cycle cost avoidance. With acquisition cost avoidance, preliminary estimates are $11M per vessel due to reduced distortion. Life-cycle cost avoidance would be due to reduced maintenance and flatter panels that result in less standing water and, therefore, less corrosion. Initial cost avoidance estimates for DDG 1000 are over $60M in ship maintenance and over $5M in reduced corrosion control costs per ship.

Implementation

NGSS started developing and refining the numerical modeling process for transient thermal tensioning in late 2006. Once the modeling is complete and the system is designed and fabricated, prototype equipment will be installed and tested on the NGSS panel line. The project team will assist with operator training and will verify the operation and functionality of the equipment. Validation tests will be performed prior to shipyard production trials. The system will be turned over to production, and the team will monitor and report the results of shipyard use. Once completed, a workshop will be conducted to transfer this technology to the shipbuilding industry.



Efficient Welding Procedures for Thin Titanium Structures Reduce Welding Time

S2094 – Gas Metal Arc Welding Thin Titanium Structures for Navy Applications

Objective

Titanium offers a number of advantages as a lightweight material for Navy ship structures and components. These advantages include good strength-to-weight ratio, high-temperature strength, and corrosion resistance. The benefits of using titanium structures on Navy ships are reduced weight, extended service life of components, and reduced maintenance costs. The end result is reduced total life- cycle costs for the Navy. Currently, the use of titanium on Navy ships is limited to piping and component parts and is being considered by system designers for a number of applications including exhaust uptakes. Concept designs for exhaust uptakes and intakes would use thin titanium sheet. The fabrication costs and other manufacturing challenges faced by the shipyards for the welding of thin titanium structures are limiting factors for the expanded use of titanium on Navy ships. Currently, gas tungsten arc welding (GTAW) is the only process qualified for welding titanium on naval vessels. Although this process produces extremely high quality welds, it is very slow and costly. This project developed efficient and cost-effective arc welding procedures and shielding methods for the fabrication of thin titanium structures that will allow U.S. shipyards to weld these structures with maximum quality and productivity while minimizing cost to the Littoral Combat Ship (LCS) and other Navy platforms.

Payoff

Project cost avoidance occurs by reducing the time involved to weld titanium structures. There are also weight reduction advantages and life-cycle cost avoidance due to the exceptional high-temperature and corrosion resistance of titanium. The production time required to weld a titanium exhaust uptake with the manual GTAW process is significantly longer than what is presently required for the current stainless steel components that are being produced for the DDG 51-class ships with the gas metal arc welding (GMAW) process. Based on the results of this project, welding a titanium DDG 51 uptake is estimated to be 87% cheaper than welding the same structure with GTAW. The baseline cost to weld a titanium DDG 51 uptake using the GTAW process is estimated to be $6,400,000, and the GMAW welding costs for the same structure are estimated to be $820,000, for an estimated cost avoidance of $5,580,000 (an 87% cost avoidance). Similar avoidance cost will result from using GMAW vs. GTAW on any future sheet metal titanium structure.

Implementation

The project team was led by the Navy Joining Center (NJC), who worked closely with Bath Iron Works (BIW), and included NAVSEA and NSWC, Carderock. The project included demonstrations of the developed technology and training of shipyard personnel in the use of the procedures that were developed. BIW has stated their intent to implement the welding processes developed, pending the final results of this project, including ownership and qualification costs. Once proven, the technology is expected to have broader implementation across a number of weapon systems, including CVN 21 and the DDG 1000.

Period of Performance:

July 2005 to May 2007

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$627,000

First Time Weld Quality Program Improves Control of Welding Operations

S2095 – Implementation of Weld Process Control

Period of Performance:

July 2005 to July 2007

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy J. Trapp
(614) 688-5231
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Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$541,000

Objective

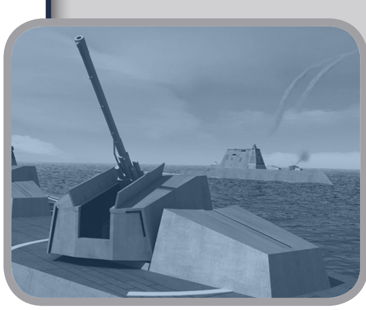
Significant advances have been made in welding equipment and procedures that support Northrop Grumman Ship Systems (NGSS) shipyard structural fabrication operations. To take full advantage of these technologies requires the insertion of additional tools and skills into the shipyard. This project addressed the need to improve weld quality, reduce weld distortion, and reduce rework on ship structural assemblies by applying the First Time Weld Quality (FTWQ) program to improve the control of welding operations through improved workforce knowledge and implementing solutions to current production problems. The technical approach provided information on weld quality attributes, inspection devices, and acceptance criteria as well as demonstrated the ability to produce, measure, and analyze structural welds. These tasks were followed by gathering data on production welds and assemblies, analyzing this data using the FTWQ program, and correcting weld quality issues. Corrective actions were documented and a cost-benefit analysis was conducted.

Payoff

The application of the principles of the FTWQ program improved the control of welding operations, resulting in improved weld quality, reduced distortion, and reduced rework. The primary payoff was a reduction of labor hours required to produce structural assemblies. The goal of the project was to achieve a minimum of 5% reduction in man-hours. During this project, NGSS compared 33 units that were built at the same site for LPD 21 and LPD 22. After implementation of the FTWQ program, rework rate was cut in half for LPD 22 compared to the baseline units for LPD 21. This resulted in a 100% reduction in welding rework man-hours in the piloted area. NGSS conducted a similar comparison analysis of 32 units for LPD 20 and LPD 22. Comparing all unit classes, there was a 14.6% reduction in welding man-hours in the piloted areas for those units.

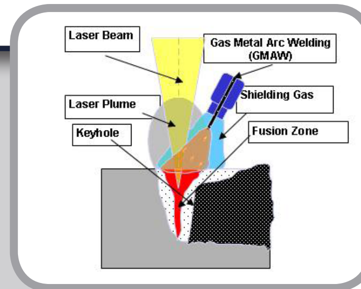
Implementation

This project resulted in the implementation of the FTWQ program into the NGSS New Orleans shipyard and in the NGSS Pascagoula shipyard in support of LHD 8, LPD 21, LPD 22, DDG 103, DDG 105, and NSC 2. NGSS is continuing the implementation of the FTWQ throughout the New Orleans and Pascagoula shipyards for LPD 22, DDG 107 and NSC 2 and for future LPD, DDG and NSC ships built in the foreseeable future.



Hybrid Laser Welding Technology Reduces Distortion and Improves Shipbuilders Productivity

S2103 – Hybrid Laser Welded Ship Structure



Objective

The Navy Joining Center (NJC) supported a project team led by the Institute for Manufacturing and Sustainment Technologies (iMAST) to develop laser-arc hybrid welding technology capable of shipyard implementation. The objective was to develop and demonstrate the viability of hybrid laser-arc welding for manufacture of panel inserts. The project assessed the robustness of the process for ship- building applications and supported the business case for shipyard implementation. The results show that hybrid welding is capable of increasing the travel speed, decreasing heat input, and thus reducing welding related distortion. Hybrid welding can be completed on as-cut edges produced by laser cutting without requiring additional machining of a joint preparation. In addition, a vision document was prepared describing an approach to providing a self-contained, portable system capable of performing plate insert welding operations within the context of an existing panel line operation in a shipyard. The envisioned concept provides a laser hybrid welding solution that is independent of major shipyard infrastructure, thus permitting greater flexibility in panel welding activity.

Payoff

The developed technology enables Navy shipbuilders to improve their welding productivity and increase "First Time Weld Quality." The process also enhances "Neat Construction" by reducing distortion. This results in reduced fabrication and repair costs, production cycle times, and acquisition cost for Navy weapon systems.

Implementation

Pending the results of the project, including ownership cost and qualification, the participating shipyards have stated their intent to implement laser and/or hybrid laser welding processes at their facilities. The project delivered a report and implementation options for a portable system that can help justify hybrid laser system for LPD 17, DDG 1000, and other ship platforms.

Period of Performance:

February 2006 to June 2007

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

Point of Contact:

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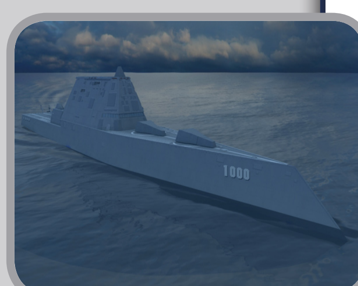
Stakeholder:

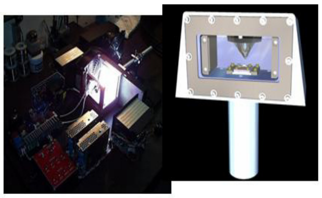
NAVSEA PMS 500

Total ManTech Investment:

$109,000



New Fiber Technology Reduces Illuminators and Cost for Ships' Lighting



Period of Performance:

February 2007 to June 2008

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

EOC

Point of Contact:

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Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$611,000

S2119 – Remote Source Lighting Fiber Performance Improvement

Objective

The objective is to develop the manufacturing technology to significantly improve the efficiency of Remote Source Lighting (RSL) systems at reduced cost by increasing fiber Numerical Aperture (NA), so that more light can be coupled into the RSL fiber over larger collection angles, resulting in more lumen output, more luminaries per illuminator and less illuminators per ship. It is anticipated that increasing the NA from 0.33 to approximately 0.48 will provide a 50% improvement in light collected by the fiber.

Payoff

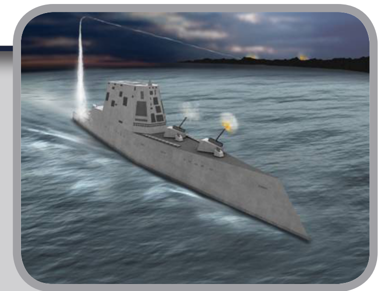
This project will leverage recent manufacturing improvements in specialized hard cladding designs of silica optical fiber for improved efficiency, at reduced cost, for next generation RSL for deployment on DDG 1000. The improved optical fiber technology drawing technique and cabling process will provide compatibility with the existing cable, connection hardware, coupling hardware, termination methods, and coupling optics. This will result in more light being coupled into the RSL fiber over larger collection angles, resulting in more lumen output, more luminaries per illuminator, and less illuminators per ship. The new fiber technology will reduce the number of illuminators from 75 to 50 for the DDG 1000, with corresponding cost savings of $250,000 per ship.

Implementation

The Northrop Grumman Ship Systems (NGSS) team, comprised of Omni Technologies Inc (OTI), RSL Fiber Systems LLC (RSLFS), Polymicro Technologies, and Draka, has been selected to complete this project. This utilizes the extensive experience of the same team which was responsible for earlier RSL development. Successful transition and implementation will be achieved when the NGSS system integrator incorporates the new RSL fiber / cable system into the DDG 1000 design and manufacturing plan. To assure this, testing and measurements of the optical fibers, the single fiber termination performance, and the complete new cable with the new cladding will demonstrate required performance characteristics. The testing will demonstrate manufacturability of optical fibers with enhanced hard cladding to achieve the targeted improvement in Numerical Aperture and increased light collection. The other conditions for successful implementation include maintaining acceptable fiber cladding thermal conditions, acceptable fiber yields and fiber optic cable yields, and consistent repeatability of fiber/cable processes to ensure consistent improved light collection increase. The new RSL technology will be implemented at Northrop Grumman Ship Systems in Pascagoula, Mississippi in November 2010.

Safety and Survivability Improvements for Low Cost Pallet Systems

S2132 – Low Cost Pallet Systems Phase I



Objective
The MK 100 Advanced Gun System (AGS) pallet is used to package, handle, store and transport the long-range land attack projectile charges through the logistic channels and within the AGS magazine for DDG 1000. The objective of this project is to reduce cost and/or weight of the AGS pallets by 20%. The project will also evaluate opportunities to reduce the weight of the AGS pallet.

Payoff
As a result of this effort, 20% reductions in weight and/or cost of the AGS Pallets are anticipated. The additional margin on weight will allow for potential safety and survivability improvements, as well as improve the ability to handle the pallet through out the logistic channel.

Implementation
The Navy Metalworking Center (NMC) will review the manufacturing approach and identify opportunities for reduced cycle time, enhanced material selections, alternate manufacturing approaches—such as injection molding or near-net-shape casting—and weight and cost reductions. Proposed production methods will focus on decreasing the time and cost to manufacture the pallets, while maintaining the tight tolerances needed for the pallets to function properly.

Period of Performance:

May 2007 to September 2008

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NMC

Point of Contact:

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Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$1,289,000

System-on-Chip Technology Produces Low-Cost, Lightweight T/R Modules for Phased Array

Period of Performance:

July 2006 to June 2008

Platform:

DDG 1000

Affordability Focus Area:

Radar and Communications

Center of Excellence:

EMPF

Point of Contact:

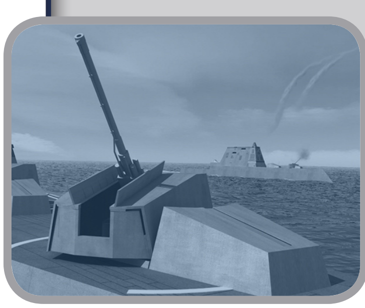
Mr. Michael D. Frederickson
(610) 362-1200
mfrederickson@aciusa.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$2,531,000



A2147 – SiGe-Based System—On-Chip Low-Cost / Weight Phased Array Antennas

Objective

This project will demonstrate three phased array antennas (receive, transmit, and combined transmit / receive T/R) for development. Boeing is providing the multi-beam Ku-band Communications Data Link (CDL) Phased Array Antenna (PAA) system to DDG1000. These antennas will be designed for operation in the Ku band which is suitable in both surface and airborne applications. For several years, Boeing has been doing research into new technologies that promise a breakthrough in phased array antenna cost, with significant improvements in size and weight. This work has helped prove feasibility of many necessary technology building blocks, but the building blocks have not yet been integrated into a comprehensive demonstration. The primary new technologies involve the use of flip-chip and chip-on-board interconnect technologies to replace current wire-bonding and multi-chip-module technologies and the development of a highly-integrated system-on-chip using silicon-germanium (SiGe) process technology to replace current gallium-arsenide (GaAs)-based Microwave Monolithic Integrated Circuit (MMIC) chipsets.

Payoff

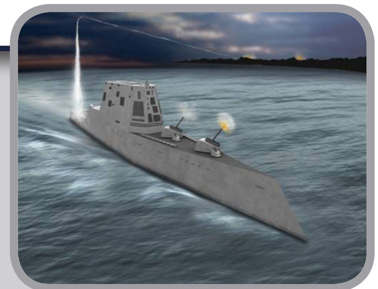
The main benefit of this project is to provide smaller, lighter T/R modules using a system-on-chip technology that can also reduce cost due to integration savings. A cost avoidance of 50-65% and a weight reduction of 15-25% compared to current phased array antenna technology can be achieved using Boeing's chip-on-board approach based on the use of GaAs technology. The use of SiGe technology can further reduce semiconductor chip-set costs by up to 90%. In addition, the chip-on-board technology currently in development at Boeing is limited to ~15-20 GHz due to the lattice spacing requirements and the size of GaAs chips necessary to perform the module functions. SiGe has the potential to reduce the chipset footprint, thus extending the practical frequency range for this architecture to 40 GHz or beyond. Cost avoidance starts at 793K per ship set for the DDG 1000. This reduction is obtainable by reducing the chipset die element parts such as RF distribution, array system components, element assembly and test labor.

Implementation

The technologies developed as a result of this work will have potentially wide applicability to Navy programs. Based on the current generation of technology, the following applications can be addressed: multi-chip module (MCM), brick-style antenna packaging, and MMIC chipsets. These basic proven technologies can be adapted to meet a diverse range of antenna requirements. The basic packaging architecture can also be adapted, depending on number of elements, number of beams, radio frequency band, and many other application-specific requirements. The underlying package design and manufacturing approach as well as the underlying SiGe technology design and fabrication methods will be proven and common between applications.

Affordable Stiffener Manufacturing Methods to Result in Significant Savings to the Navy

S2149 – Cost-Effective, Integrated Stiffener Manufacturing for DDG 1000 Integrated Deckhouse and Hangar (IDHD)



Objective

The DDG 1000 ship system requires a helicopter hangar with extended, unsupported spans that result in demanding stiffness requirements for the materials used in the hangar. The hangar must also support two guns and associated equipment on the aft corners of the structure. A complex cross-section, composite design was shown to meet the design requirements of the DDG 1000 hangar, however these materials have only recently been considered for Navy applications. The size and complexity of the beams, and the fact that these beams intersect complex composite-to-composite and composite-to-steel joints, present manufacturing challenges not dealt with in the DDG 1000 program or previous U.S. Navy composite shipbuilding programs. The objective of this project is to develop and demonstrate methods for manufacturing large composite stiffeners and stiffener joints. Carbon/vinyl ester will be the primary composite material, and the box beams will be on the order of 36” x 36” in cross-section. The project has emphasis on a multiple VARTM infusion process, with alternate processes such as autoclave curing, singles-stage VARTM, and pultrusion also being considered. Methods for constructing the required beam intersections and joints are conceptualized, analyzed, and tested for optimization. The final portion of the project will be to produce demonstration articles incorporating one or more stiffeners and associated joints.

Payoff

The proposed project will result in the most cost-effective manufacturing technology for the DDG 1000 composite hangar. The principal benefit is an economical, robust beam configuration with goals of reducing weight and increasing stiffness. The use of composites on the DDG 1000 and future surface combatants will ensure mission capability, increased performance resulting from light weight, and a reduction in life-cycle costs. Therefore, cost-effective composite manufacturing techniques represent a significant benefit to the Navy. The resultant beam configuration and chosen production method performed during the project will enable Northrop Grumman Ship Systems (NGSS) to significantly reduce rework and the associated schedule impacts that could occur during production. The typical composite transverse beam has a projected weight of about 10,000 lbs. and an estimated cost of over $100K.

Implementation

Transition will be realized by December 2008 after the test data has been received and evaluated and the manufacturing process developed during the project is transitioned into a work package that will be used by NGSS to fabricate hangar box beams for DDG 1000, the USS Zumwalt. Project exit criteria include the down selection of a hangar box beam configuration, the efficient production of a full-scale article, and the successful static testing of that article. To ensure implementation NGSS must select the most efficient and robust manufacturing process, build the representative down-selected box beam configuration and that article must pass static testing. NGSS also recognizes that Navy Technical Authorities must be integral to every aspect of the project and approve any and all article designs, test plans and test reports produced as part of this project.

Period of Performance:

August 2007 to July 2008

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CMTC

Point of Contact:

Mr. Charlie Rowe
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charlie.rowe@scra.org

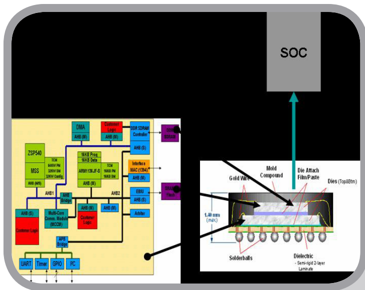
Stakeholder:

PMS 500 DDG 1000 Zumwalt Class Destroyer

Total ManTech Investment:

$1,505,000

Packaging Methodology Assesses Survivability and Improves Design of Electronics for Guidance Units



Period of Performance:

September 2006 to March 2008

Platform:

DDG 1000

Affordability Focus Area:

Sonar and Navigation

Center of Excellence:

EMPF

Point of Contact:

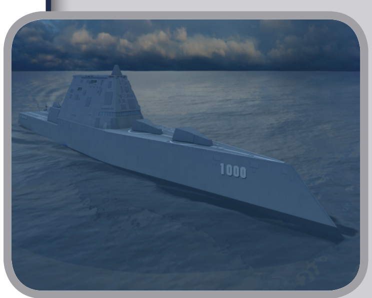
Mr. Michael D. Frederickson
(610) 362-1200
mfrederickson@aciusa.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$2,564,000



S2153 – High-g Packaging and Miniaturization of Electronics for Deeply Integrated Inertial Guidance Units

Objective

Honeywell's BG1930G deeply integrated Inertial Navigation System – Global Positioning System with Anti-Jam capability (INS-GPS / AJ) product has been baselined as the primary production navigation, flight control, and mission computer for Lockheed Martin's Long Range Land Attack Projectile (LRLAP) utilized in conjunction with the Navy's Advanced Gun System (AGS) for the DDG 1000 destroyer. This project will study the packaging of the BG1930G or similar product to assess its survivability to different gun launch environments and suggest improvements to the design. Another aspect of this project is the application of multi-chip module (MCM) technology to the discrete semiconductor approach used in the BG1930G, hereafter referred to System-On-a-Chip (SOC). The SOC approach is to combine the mission processor, inertial sensor assembly interface, digital anti-jam functions, user serial interface, and corresponding electronics functions onto a single substrate. Development and incorporation of SOC technology will effectively eliminate an entire printed wiring board from the product baseline.

Payoff

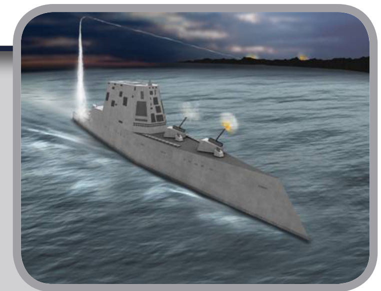
In the past, projectiles and components have been designed to a specification of "survive x-thousand G's", which has resulted in program extensions and overruns, and advances in modeling and simulation have proven this method of specification insufficient. An improved method of specifying design criteria is to specify a representative load curve (with margin) that includes the dynamics of the system. This project will apply this design methodology to the simulation of components for the Deeply Integrated Navigation and Guidance Unit (DIGNU) to determine survivability to gun launch and also make recommendations for design improvements. This project will also seek to determine the survivability of some MEMS sensors to the high shock of gun launch. If implemented, these recommendations would improve survivability. The application of MCM technology will reduce INS / GPS unit cost and will also reduce the INS / GPS size to fit more DoD weapon applications. The use of SOC technology will eliminate an entire printed wiring board from the product baseline and enable the achievement of aggressive Average Unit Production Pricing objectives, producibility, reliability, weight, and volume objectives mandated by LRLAP and other Joint Navy / USAF program applications.

Implementation

The effort detailed in this project is independent of an insertion target platform. The simulations to be performed, while dependent on the details of the individual IMU being modeled, can also form the basis for a methodology for improving the shock resistance of MEMS sensors and electronics modules for other precision guided munitions. At the conclusion of this ManTech effort, the memory system, processors and custom interface functions will have been successfully integrated into a single 27mm x 27 mm package, and both its functionality and suitability for gun-hard applications, such as the BG1930 and BG1940 family in INS-GPS / AJ products will have been confirmed. At this point, the Technology Readiness Level (TRL) of the SOC will be TRL 6—suitable for integration into a viable product.

Manufacturing Techniques for Very Large Radomes for DDG 1000 Could Reduce Cost by $1.6M per Ship

S2159 – Low-Cost Manufacturing Technology for Very Large Format Low Observable DDG 1000 Radomes



Period of Performance:

June 2007 to May 2008

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CMTC

Point of Contact:

Mr. Charlie Rowe
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Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$1,034,000

Objective

Future ship communications and radar systems require very large-scale low observable (LO) radomes for mission success. Additionally, these radomes are supporting high frequency multi-band communication systems such as the Navy Multi-band terminal (NMT) and high power systems such as VSR. Many of these systems involve multiple frequency bands within X, K, Ka, and Q. For example, EHF SATCOM requires a transmit band centered in K-band and a receive band in Q-band. Consequently, future ship radomes require large-scale Frequency Selective Surface (FSS) structures and laminate materials with tolerances held to values that are state-of-the-art for current (sizes less than 50 square feet) production radomes. The size of DDG 1000 proposed installations can reach 100-200 square feet. The FSS installations require seams, grounding, embedded treatments, anti-ice grids, and accurate FSS etch tolerances. To achieve the desired radome radio frequency (RF) performance levels, laminate wrinkling must be minimized, fiber volume fraction must be accurately controlled, and laminate thickness must be maintained within thousandths of an inch over the entire radome surface area. The objective of this project is to develop and demonstrate a low cost manufacturing method that integrates tailorable ply kits and optimized debulk cycles with in-process non-destructive inspection (both geometric and ultrasonic) and robust repair protocols to ensure very high yield DDG 1000 deckhouse EHF and X/Ka-band radomes.

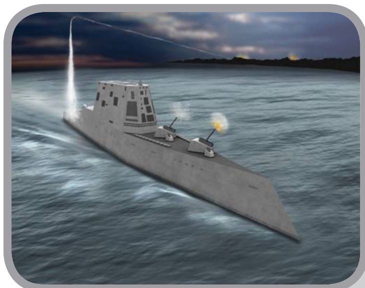
Payoff

The cost of these radomes can exceed $1M each, and the radomes have become a significant portion of the DDG 1000 communications and radar system cost. In order to reduce radome acquisition costs, production radome fabrication yields must be pushed to nearly 100 percent. Without an innovative manufacturing approach, communication systems for future ships systems will remain expensive. Successful execution of this plan will help improve quality control for the fabrication of the Very Large, Multi-band EHF and X/Ka Radomes for DDG 1000. The proposed manufacturing techniques will improve yields by 20%, realizing a cost avoidance of $1.6M per ship. This results in a total savings for DDG 1000 and CG(X) of $21M (ROI=10). Savings based on the document "Report to Congress on Annual Long-range Plan for Construction of Naval Vessels FY2007" using build rates of seven DDG 1000 and six CG(X).

Implementation

Raytheon is currently funded to design, develop, and integrate (DDI) the new generation of electronics systems for DDG 1000, and the Navy is committed to deployment of these technologies. The technologies developed as part of the ManTech project will be inserted into the DDG 1000 DDC programs in 2008-2009 and will have an immediate impact on the first qualification and production EXCOMM radomes to be delivered in 2010.

Composite Twisted Rudder Improves Performance and Results in Cost Savings of $1M per Hull



Period of Performance:

February 2007 to February 2008

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CMTC

Point of Contact:

Mr. Charlie Rowe
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Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$1,749,000

S2165 – Composite Twisted Rudder (2007)

Objective

Rudders on DDG 51 class destroyers experience severe cavitation-induced, corrosion / erosion problems as a result of propeller wash. NSWCCD developed a "Twisted" rudder geometry that better aligns the vertical rudder chord profile with the local hydrodynamic conditions. Steel twisted rudders were evaluated on the DDG 84 and indeed the onset of cavitation damage was delayed until higher ship speeds were reached. However, the complex rudder geometry is difficult to build out of steel. Additionally, coatings continued to deteriorate during the sea trials of the Twisted Rudder. The DDG 1000 class baseline design calls for a more complex rudder geometry to further improve hydrodynamic performance. About ten years ago, Structural Composites teamed with Lockheed Martin to design, build, and qualify a hybrid metal-composite rudder for use on the Navy's Mine Countermeasure ships under ManTech sponsorship. A unique manufacturing process that utilizes low-cost, female molds and vacuum / pressure-assisted resin injection was developed for that project. The rudder was shock-tested and installed on MCM-9, which has operated since then without incident. The basic manufacturing technology developed in that ManTech project is being updated and refined for the much larger and more complex DDG 51 rudders. Since the Composite Twisted Rudder (CTR) must be retrofitted on an existing DDG 51, the internal hub casting resembles the fleet rudder design. This HY-80 casting is "pressure fit" onto a tapered shaft. Welded to the casting, a vertical I-beam supports a series of horizontal fins and flanges. The vertical flanges are used to transmit shear loads to the CTR composite skin. A foam core serves primarily as a form for wrapping the dry E-glass reinforcement. A hybrid steel / composite structure is also envisioned for the DDG 1000, which is why that Program Office has supported the effort to field CTRs on a DDG 51 for at-sea evaluation. A molded, cavitation-resistant surface treatment is also a key element of this program. Various surface treatments applied as coatings to steel rudders have been unsuccessful. By casting a surface treatment to the CTRs using the female molds, dimensional tolerances and surface smoothness will be much enhanced. Once female molds have been produced, production costs for CTRs are expected to be half that of similar steel rudders and are expected to require minimal maintenance over the life of the ship.

Payoff

A shock-qualified DDG 51 composite rudder with two years at-sea experience will mitigate risk for composite DDG 1000 rudders. Composite rudders with cavitation-resistant coating will be more survivable than current steel rudders. Acquisition cost for composite twisted rudders should be half of twisted steel rudders roughly $1M savings per hull.

Implementation

The successful design, fabrication, testing and at-sea demonstration of a DDG 51 CTR will serve as the baseline for development of a DDG 1000 CTR. Ideally, full transition will not take place until the two-year at-sea demonstration period for the DDG 51 rudder is complete. However, the procurement process for DDG 1000 will begin this year. Therefore, successful installation of CTRs on a DDG 51 class ship in early 2008 will serve as the key project transition event.

Weld Seam Facing Tools to Substantially Increase Productivity for DDG 1000

S2172 – DDG 1000 Weld Seam Facing

Objective

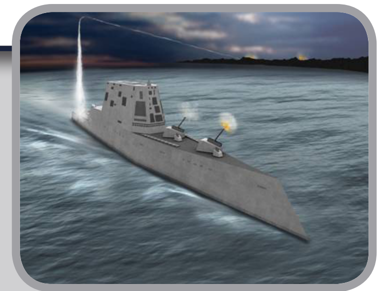
DDG 1000 Class ships require that hull plating butt welds be ground flush with the hull. Mechanizing the grinding process will avoid damaging the surfaces adjacent to the welds, as well as reduce workforce hazards, such as ergonomic strain, eye injuries, particulate and gaseous emissions and high-decibel noise levels.

Payoff

The 24-month project is expected to substantially increase productivity and decrease production costs, including a reduction in lost-time injuries. There is also a potential weight reduction to the ship.

Implementation

Two prototype weld seam facing tools, one each at Bath Iron Works (BIW) and Northrop Grumman Ship Systems (NGSS), will be evaluated and implemented at both shipyards.



Period of Performance:

July 2007 to July 2009

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$1,100,000

Smart Manufacturing Reduces Defect, Material and Labor Rates Associated with Current Infusion Inspection Methods

Period of Performance:

May 2007 to June 2008

Platform:

DDG 1000

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$757,000

S2179 – Smart Manufacturing Methods for Carbon / Vinyl Ester Composite Structures

Objective

The primary objective of this project is to develop a resin infusion process for fabricating carbon / vinyl ester composites that is predictable, repeatable, and reduces the defect rate experienced with current manual processes. Infusion-related defects are highest among the composites process, which leads to significant rework costs and schedule interruptions. This single-phase effort will address factors contributing to infusion-related defects: insufficient resin distribution, improper tooling and handling, and incorrect placement of injection ports. To accomplish these objectives, the project team will develop computer models of each infusion, provide engineering and design services for panel production, provide hardware to instrument panels with "smart molding" sensors, and fabricate / test panels to US Navy acceptance criteria.

Payoff

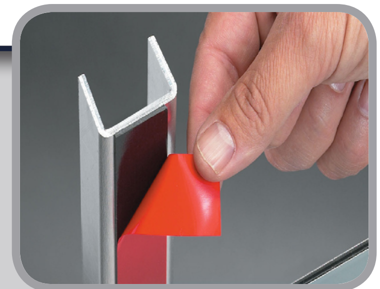
The repair procedures for most infusion-related defects are complicated and involved, and in some cases lead to a "scrapping" of the part. This is of particular concern for the DDG 1000 superstructure, which consists of carbon / vinyl ester composite components that are more costly and more difficult to inspect. If successful, the results of this project show promise to increase first-time quality yields and simultaneously reduce defects, scrap rates, labor hours, and cycle time. Discounted labor and material cost avoidance estimates result in a 3-year, 112% return on ManTech investment, and a payback period of only 1.14 deckhouses.

Implementation

Results are scheduled for implementation at Northrop Grumman Ship Systems (NGSS) Pascagoula, MS, ship construction facilities in February 2008. This timeline will allow cost avoidances and cycle time reductions resulting from this project to be implemented in the DDG 1000 lead ship hull. These manufacturing process improvements will require little or no contractual action by the customer or other major investments to be implemented. Furthermore, implementation will not require high-level Navy approval or program office involvement. No additional prerequisite testing, qualifications, or certifications are required for successful implementation at NGSS; nor is non-ManTech funding required.

Alternate Mounting Methods Reduce Outfitting Time by 20% to 50%

S2182 – Alternate Mounting Methods for Lightweight Structures



Period of Performance:

June 2007 to February 2009

Platform:

DDG 1000

Affordability Focus Area:

Outfitting

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 500

Total ManTech Investment:

$708,000

Objective

The goal of this project is to identify, validate, and qualify alternate methods for mounting lightweight (i.e., less than 40 lbs) items onboard US Navy ships, specifically the DDG 1000 platform. The conventional, labor-intensive method of welding and bolting adds unwanted cost, time, and weight in new ship construction and repair activities. There are commercially available products that shows promise to reduce cycle time for installation of lightweight outfitting items. Bath Iron Works (BIW) and Northrop Grumman Ship Systems (NGSS) have identified two groups of outfitting items – Category I and Category II – separated by the degrees of difficulty required to mount these items, such as unit weight, purpose, shape, and location. Phase 1 project activities will identify and categorize these items; evaluate and down-select adhesives that meet operational requirements; and conduct testing on Cat-I items. Provided satisfactory go / no-go metrics are achieved, Phase 2 efforts will test Cat-II items.

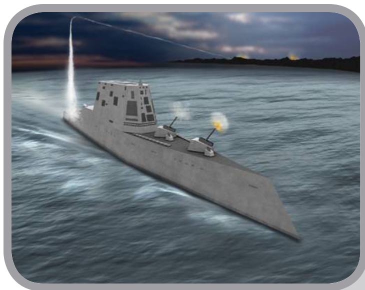
Payoff

There are dozens of unique items weighing less than 40 pounds (e.g., bulletin boards, coat hooks, mirrors) that are outfit onboard US Navy ships and total over 20,000 pieces. The average time to install these items using the current methods ranges from one to four hours; set up time alone varies from 1.5 to 2.5 hours per shift. To compound the problem, 100% visual inspection of the welded attachments is required for quality assurance. This manufacturing technology issue, if resolved, has the potential to reduce outfitting time by 20% to 50% for approved items, resulting in cost avoidance on the order of $1.5M to $3M per ship for the DDG 1000 program. Findings from this project should be applicable and benefit construction activities at other major shipyards.

Implementation

The potential for cost savings is not only dependent on the adhesive technology, but also upon approval by the appropriate Navy Technical Authority / Codes. As such, implementation will follow a phased approach where the "easier" items to pass inspection and qualification testing will be investigated first. Upon successful project completion, both BIW and NGSS will commence implementation activities at their ship construction facilities. Results will be disseminated industry-wide, as improvements to this methodology are not limited to destroyers, but are applicable to aircraft carriers and other surface combatants as well.

Improved Manufacturability of Power Electronic Module Results in an Estimated Savings of $500,000 per Ship



Period of Performance:

May 2007 to July 2008

Platform:

DDG 1000

Affordability Focus Area:

Integrated Power and Propulsion

Center of Excellence:

EMPF

Point of Contact:

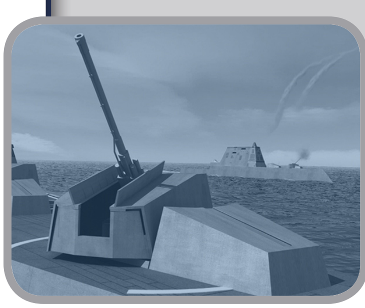
Mr. Michael D. Frederickson
(610) 362-1200
mfrederickson@aciusa.org

Stakeholder:

PMS 500

Total ManTech Investment:

$1,697,000



S2203 – Power Electronic Module Cost Out for the IFTP

Objective

The multi-mission DDG 1000 destroyer introduces a wide range of new technologies that will generate tangible breakthroughs in performance and affordability. Advances such as the Integrated Power System (IPS) provide continuous power throughout the ship allowing enhanced survivability by reducing the susceptibility to damage and increasing the ability to fight-through damage. This integrated fight through power (IFTP) is based on a modular power system building block or Power Electronics Module (PEM) that can be connected in parallel or in series to support a wide range of horsepower. The objective of this effort is to investigate and implement additional cost out opportunities for the PEM that will improve the affordability of the IFTP System. By demonstrating that the proposed changes can reduce the materials and assembly price of each system, the manufacturing learning curve will substantially accelerate. The four PEMs that are manufactured can be used to perform early full-power testing of IFTP, validate that the design meets performance requirements, and investigate and resolve any anomalies sooner than could be done under the plan of the awarded IFTP contract. Furthermore, this effort will reduce the risk of encountering performance issues during First Article manufacturing and test phases and ensure that delivery schedules will be met.

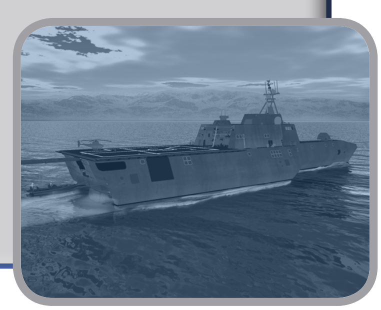
Payoff

This effort will help reduce the cost of each PEM through improved manufacturability and early full power testing will reduce schedule risk. Preliminary estimates indicate that these improvements will result in an estimated cost avoidance of approximately $500,000 per ship.

Implementation

The project completion is planned for June 2008 in time for the initial July 2008 First Article Qualification testing of the PEM system for Bath Iron Works (BIW). Transition of the developed technology will occur when the PEM manufacturing process and Brass Board testing have demonstrated that the PEM meets the original design requirements. The redesigned second-generation PEM will then be supplied for the already scheduled First Article Qualification testing for BIW.

LCS Projects



Visual Weld Reference Samples Aid in Defining Weld Acceptance Criteria

Period of Performance:

November 2005 to July 2007

Platform:

LCS

Affordability Focus Area:

Not Applicable

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVSEA PMS 501

Total ManTech Investment:

$37,000

R064436 – Aluminum Visual Weld Reference Samples

Objective

Weld bead geometry is important for fatigue-critical aluminum welded structures such as those on the Navy's newest classes of ships, including the Littoral Combat Ship (LCS). While the requirements for weld geometry are defined in ship specifications, physical reference specimens are needed to demonstrate the full range of acceptable geometries. To fill this need, the Navy Joining Center worked with NAVSEA 05M2 on this rapid response project to generate visual reference samples of aluminum gas metal arc welding (GMAW) for the LCS. These specimens will help define acceptance criteria for geometry factors that include weld toe angle, undercut, and contour improvement techniques such as grinding. Weld samples have been delivered to NAVSEA 05M2.

Payoff

The aluminum weld reference samples will support worker training and visual weld inspection. Improved inspection methods will reduce inspection costs and rework for LCS.

Implementation

The visual reference samples were provided to NAVSEA for use in developing plastic replicas for shipyard fabrication of aluminum ship structures.

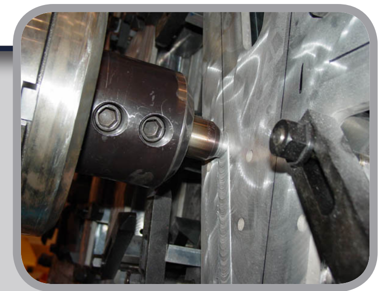
Friction Stir Welding of Aluminum Provides Vast Improvements for Littoral Combat Ship

S2100 – Low-Cost Friction Stir Welding of Aluminum for LCS Applications

Objective
The objective was to develop a low-cost friction stir weld machine and evaluate the costs and benefits of implementation.

Payoff
The Navy Metalworking Center (NMC) designed, built, and demonstrated a transportable friction stir welding (FSW) system that is housed at the shipyard. By limiting the design's functionality to the specific needs of Littoral Combat Ship (LCS), the machine was less costly and provides a quicker return on investment (ROI) for the shipyard. The simpler machine requires minimal site preparation and is sized for mobility among and within shipyards. By locating the FSW operation at the construction yard, the benefits of FSW are more fully realized because the panels are built to the size needed for construction, rather than limited to a panel size for transportation. The machine's simplified controls and operation also reduce the skill set and technical support required for the operator. LCS incorporates significant amounts of aluminum. FSW is an ideal joining process for aluminum and provides vast improvements over conventional marine aluminum construction methods because it offers decreased distortion, improved joint properties, and reduced production costs.

Implementation
Implementation is to develop procures and deliver a low-cost friction stir welding machine to the LCS Program for use on site in construction of Flight 0 and later Littoral Combat Ships.



Period of Performance:

August 2006 to August 2007

Platform:

LCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
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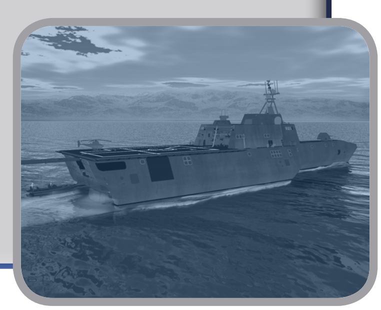
winter@ctc.com

Stakeholder:

NAVSEA PMS 501



New Antenna System Utilizes Less Space on Ships

S2126 – Flexible Antenna System for Littoral Combat Ship

Period of Performance:

April 2007 to December 2008

Platform:

LCS

Affordability Focus Area:

Radar and Communications

Center of Excellence:

EMPF

Point of Contact:

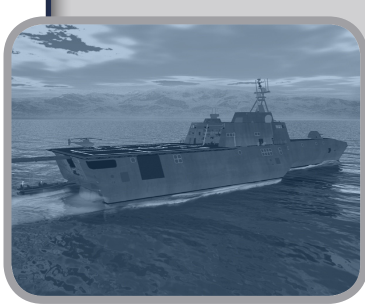
Mr. Michael D. Frederickson
(610) 362-1200
mfrederickson@aciusa.org

Stakeholder:

NAVSEA PMS 501

Total ManTech Investment:

$3,571,000



Objective

Requirements for next-generation shipboard communications equipment needed to support multiple mission scenarios include performing the following roles: intelligence gathering, surveillance and reconnaissance, mine hunting, interdiction of enemy ships, and personnel transportation. The Littoral Combat Ship (LCS) philosophy is centered on the concept of a reconfigurable platform that will be utilized to counter anti-access littoral threats. To meet the various mission requirements of the LCS, electronic communications equipment tailored for that particular mission will be installed on the ship. This presents a problem for interfacing to the various antennas mounted on the ship. The real estate on the ship is limited, and, therefore, it is not possible to mount every antenna that is required for each possible frequency range and application. Hence, there is a need to define antenna systems to be more flexible in terms of their original operating parameters such as frequency, gain, radiation pattern, etc. The objective of the Flexible Antenna System for Littoral Combat Ship - Phase 2 effort is to mature developed demonstration technology to design, build, and test critical hardware components over a section of the 3MHZ-2GHz band and to integrate the hardware to provide a system for transition. The focus is on the development of key technologies that will lead to a significant reduction in cost and the number of communication antennas needed to support LCS mission requirements.

Payoff

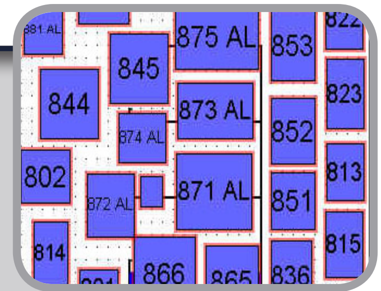
The benefits of this project will reduce: the number of antennas required on the LCS, the impact on the antenna farm of reconfiguring the ship for various missions, and the overall cost of the antenna system. This project will develop key technologies that will form a flexible antenna system called the Omni Digital Package (ODP). The system will lead to a significant reduction in the cost and the number of communication antennas needed to support LCS mission requirements. The estimated cost avoidance is $660,000 per ship and the antenna farm number will reduce from 26 to 5 antennas. This entails the reduction of the 26 specialized antennas through the integration of 1 multi-band integrated mast (OE-538) antenna and approximately 5 additional ancillary antennas that can send and receive over the range 3MHz to 2GHz. Reducing the antenna count will decrease the maintenance burden of the LCS communications system. A 50% weight reduction is also achievable as fewer antennas will be mounted on the antenna mast.

Implementation

Other programs with flexible communications needs will benefit from the techniques developed in this effort. Northrop Grumman Systems Corporation (NGSC) and BAE are working cooperatively to integrate the combined antenna technology on the LCS platform that is being integrated by General Dynamics (GD). Transition of the ODP system onto LCS is scheduled to occur in FY 2009. The key to successful implementation of the ODP on LCS is coordination by BAE Systems, NGSC, and GD with multiple program management offices throughout the approval process for the design. PMW 170 will provide acceptance of performance characteristics of the ODP, while PMS 501 will provide overall approval of the system for insertion on the LCS platform.

Process Improvements Offer Significant Benefits to Blast and Paint Production Flow for LCS

S2134 – Paint Facility Design (LCS)



Period of Performance:

May 2006 to September 2008

Platform:

LCS

Affordability Focus Area:

Production Engineering

Center of Excellence:

iMAST

Point of Contact:

Mr. Timothy Bair
(814) 863-3880
tdb14@psu.edu

Stakeholder:

NAVSEA PMS 501

Total ManTech Investment:

$500,000

Objective

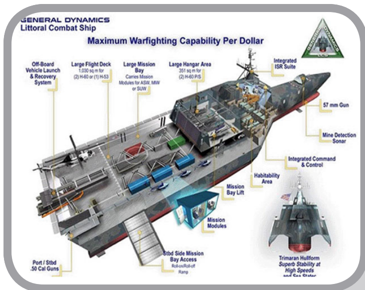
The objective of this project is to evaluate facility production capacity and develop production flow lines to meet emerging Littoral Combat Ship (LCS) demand, to evaluate and incorporate new technology options of blast and paint, and to assess the benefits of the alternative(s) to existing shipyard production flow through simulation analyses.

Payoff

A significant amount of the cost of new ship production is associated with blasting and painting. Using existing processes, it is estimated that blasting and painting will account for approximately 7% of LCS direct labor at Marinette Marine. Therefore, process improvements and technology insertion projects in this area could result in significant productivity improvement and cost avoidance, improved quality and reduced rework, and reduced overall production lead-time for the ships.

Implementation

Marinette Marine has expressed interest in state-of-the-art facilities as well as blast and paint technologies, and it is expected that new technologies will be implemented in the facility upgrade. Blast and paint costs are tracked to the assembly level, and current process costs will be collected in the data collection task and will be compared to the improved process to determine actual cost avoidance. The project will develop notional capacity analysis to support Marinette Marine's LCS Flight 0+ (zero plus) bid package, and conduct industry surveys for best practices in blast and paint technologies. New technologies will be implemented at Marinette Marine at appropriate insertion points.



Period of Performance:

May 2006 to February 2008

Platform:

LCS

Affordability Focus Area:

Production Engineering

Center of Excellence:

iMAST

Point of Contact:

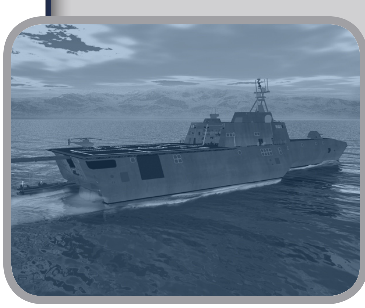
Mr. Timothy Bair
(814) 863-3880
tdb14@psu.edu

Stakeholder:

NAVSEA PMS 501

Total ManTech Investment:

$280,000



Spatial Scheduling Tool to Help Optimize Facility Design for LCS Construction

S2135 – Austal USA Facility Design and Simulation

Objective

The objectives of this project are to evaluate facility and technology options at Austal USA (one of the Littoral Combat Ship (LCS) shipyards), estimate processing times based on these new facility and technology options, and assess the benefits of the alternatives on the shipyard production flow and ultimately LCS makespan and cost.

Payoff

This project will support the design of new facilities in terms of space requirements and workflow through the shipyard which will increase production efficiency and decrease acquisition cost of the LCS platform. This will result in a reduced risk of facility under / over utilization and decreased ship makespan due to improved facility designs. Projected cost avoidance from this project is estimated at $2.2M per LCS hull. Assuming a production rate of 1 hull per year, the total cost avoidance for the program over 5 years is estimated at $11M.

Implementation

A spatial scheduling tool is being developed to assist production planners in floor space allocation and scheduling. Discrete Event Simulation models of the facilities are being developed and analysis reports and models are planned for transition in Q1 FY08.

Upgrades to Shipyards Internal Supply Chain Result in Significant Material Cost Avoidances

S2156 – Internal Supply Chain

Period of Performance:

December 2006 to October 2007

Platform:

LCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 501

Total ManTech Investment:

$516,000

Objective

Marinette Marine Corporation (MMC) currently designs and constructs vessels for the U.S. Navy, U.S. Coast Guard, and commercial customers. Its Navy contracts include Improved Navy Lighterage System (INLS) and the Littoral Combat Ship (LCS) prototype. It also plans to produce Flight 0+ of LCS, which may require the delivery of two to three ships per year. As a result of the volume of work, the mix of customers and the need to contend with design changes typical of a naval combatant, substantially improved material management processes and systems are required. Various business system and material control solutions are used successfully in similar environments, including other shipyards. MMC (a subsidiary of The Manitowoc Company) will collaborate with LCS prime contractor Lockheed Martin Corporation and leverage established Six Sigma process improvement methods to upgrade the shipyard's internal supply chain. Potential solutions will be benchmarked, options will be examined, and the most promising will be tested in pilot implementations.

Payoff

The implementation of improved material management and control methods / systems will directly impact the Navy LCS and INLS programs, as well as the Coast Guard Response Boat Medium program and various current and future commercial efforts. These re-engineered systems and processes are projected to reduce material-related costs by 2.5%, saving $3.1M per LCS. Total estimated material cost savings are $28.7M for the LCS program and $10M for the INLS program; significant labor cost avoidances are also expected. The shipyard anticipates increased competitiveness for Navy work, resulting in optimal resource utilization while minimizing overhead costs.

Implementation

Analysis of the pilot implementation results identified required process and system refinements, and gave rise to a plan for full-scale implementation. Pilot scale implementation, testing, and evaluation efforts were scheduled for completion in August 2007, with a plan for full-scale roll out submitted by October 2007. Results will be implemented to all MMC ship construction activities upon successful and timely project completion; lessons learned will be disseminated industry-wide.

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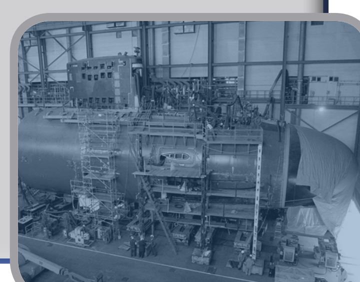
VCS Projects



Facility Design Significantly Reduces Fabrication Time

S2029 – Product Centric Facility Design

Period of Performance:

June 2004 to December 2007

Platform:

VCS

Affordability Focus Area:

Schedule Compression
Production Engineering

Center of Excellence:

CNST

Point of Contact:

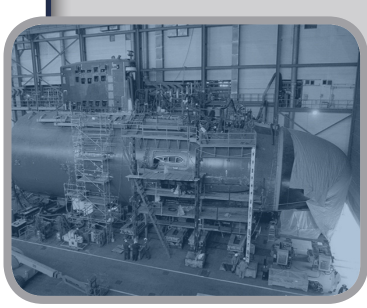
Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,578,000



Objective

Structural fabrication constitutes approximately 20-30% of the recurring costs for each VIRGINIA Class submarine (VCS) delivered to the Navy. The major objectives of this project are to significantly reduce the time expenditure required by the construction schedule of VIRGINIA Class vessels and to achieve a step improvement in the cost of major structural units. Through this project, Electric Boat (EB) will use a product-centric approach to design a new structural fabrication facility optimized for fabricating all types and sizes of structural components. A robotic welding system will be integral to this facility. A second task will be to implement procedures that will significantly increase weld mechanization using robotics. This will be accomplished by developing software that assesses structural welds in submarine construction and determines which welds are candidates for robotic welding.

Payoff

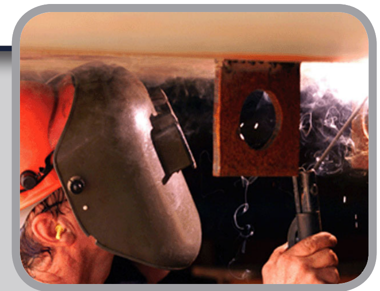
Electric Boat projects that the new fabrication facility will reduce steel fabrication time by 20%. Approximately 10% of the reduction will be attributable to this project (the balance being due to improved facility equipment, automation investments, etc.). Over the five-year production schedule for the VIRGINIA Class submarine (FY08 – FY12), this results in an avoidance of over 42,000 hours, or more than $2.5M. Increasing the efficiency of the robotic welding equipment will avoid another 2,000 hours of pre-production effort and 4,800 hours of production labor each year (worth approximately $300K per year). Total estimated cost avoidance over a five-year period is in excess of $4M.

Implementation

Electric Boat expects to complete a new fabrication facility at their Quonset Point, RI facility during FY08. The layout of this facility will take a product-centric approach, and production activities will focus around families of major structural components. The project will also improve the efficiency of EB's Programmable Automated Welding Systems (PAWS) by developing software that identifies candidates for robotic welding and determines which candidates are most likely to be successfully produced with PAWS. The new Poly Workcell resulted in over 50% savings from previous hulls in certain installation applications. The team also successfully demonstrated a structural shape manufacturing cell concept and the potential for cost and time improvement. Work is now being planned and routed directly to the PAWS Workcell.

Portable Welding System Avoids Set-Up Costs

S2030 – Ultra-Light Welding System



Period of Performance:

June 2004 to August 2007

Platform:

VCS

Affordability Focus Area:

Outfitting

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,175,000

Objective

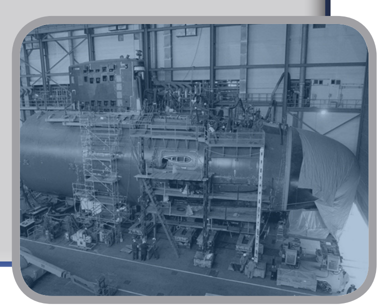
A significant cost in shipbuilding is set-up time and labor during unit erection and outfitting to support welding operations. For small welding jobs such as hanger and tack welding, the labor associated with equipment relocation and set-up can be a large part of the total cost of welding. In submarine construction, simple welds that take minutes to perform may take several days to set up, primarily due to the need to move large and cumbersome welding equipment and cables through confined structures. Electric Boat (EB) is leading a project to develop a lightweight system for pulsed gas metal arc welding (GMAW-P). The portable GMAW-P system incorporates a new lightweight and compact power supply that eliminates the set-up procedures associated with large equipment and enables a cleaner process with less debris and welding fumes. Furthermore, the 220-volt lightweight system will present a reduced shock hazard compared to the 440-volt system currently in use.

Payoff

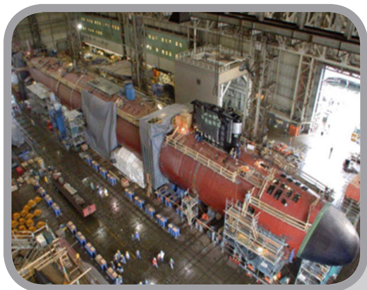
Based on expected workload, Electric Boat estimates cost avoidance of over $300K per year and labor hour reduction of over 5,600 hours for VIRGINIA Class submarine construction. An additional $120K per year cost avoidance is expected from the reduction in material purchases that support the current methods. For the five-year period following the implementation of man-portable GMAW-P units in the shipyard, a total cost avoidance of $2.1M is projected.

Implementation

The "Alpha Manufacturing" phase of this project was completed, producing ten GMAW-P power supplies. Five units will be used for verification and validation testing, and the remaining units will be tested in a shipyard's production environment. Following the successful completion of this project (approximately August 2007), Electric Boat intends to purchase at least 25 power supplies followed by the purchase of approximately 50 additional power supplies over the following two years. Effective technology transfer of shipyard use of man-portable GMAW-P equipment is expected to lead to additional use of the technology.



Computational Weld Distortion Prediction Reduces Man-Hours and Costs



Period of Performance:

November 2004 to
May 2008

Platform:

VCS

Affordability Focus Area:

Distortion Reduction

Center of Excellence:

CNST

Point of Contact:

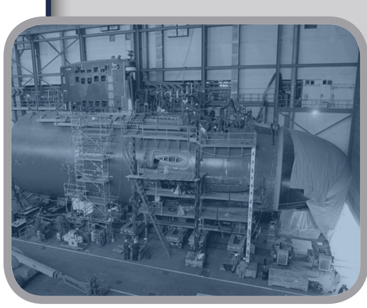
Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,224,000



S2058 – Weld Distortion Prediction in Submarine Construction

Objective

Weld distortion during fabrication of VIRGINIA Class pressure hull sections can cost hundreds of thousands of dollars to repair and can cause several months in schedule delays. The current practice of relying on experience to specify the overall welding operation is not always effective at preventing weld-distortion-related repair work. This project will evaluate existing weld distortion prediction software tools and validate their ability to predict the types of weld distortion likely to occur during the construction of submarine pressure hulls.

Payoff

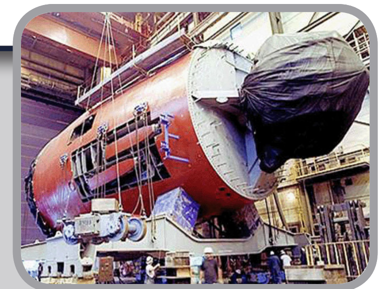
Electric Boat (EB) estimates that on average, 25% of all welding labor costs are spent dealing with weld distortion, either in a preventative mode or a corrective (rework) mode. Based on an assumed 1.25M welding man-hours for a VIRGINIA Class Submarine, this means that 312,500 welding labor hours are spent dealing with weld distortion. With effective implementation of distortion prediction software, one-half of the extra weld distortion costs can be avoided, resulting in a cost avoidance of 156,250 hours per hull or an estimated $7.8M per hull. Within three years of completing the project, the estimated total cost avoidance amounts to over $21M over a five year period. This is considered a conservative estimate, since there are direct support trades such as fitters, grinders, chippers, inspectors, and others that enable the welding process and are not accounted for in this estimate.

Implementation

Computational weld distortion prediction will be used to reduce rework due to weld distortion on VIRGINIA Class construction and on all future contracts. The two candidate software packages are being evaluated by EB. The five-month Phase 2 of the project will validate the software by comparing calculated and measured results. After the validation phase, the technology will be implemented and gradually transitioned to welding engineering to assist in predicting weld distortion and identifying practical up-front avoidance solutions. In addition, Manufacturing Work Methods will include sequencing and implementation of analytical tools. EB continues to work to adapt the commercially available predictive weld distortion software to address the complex welding needs of submarine construction.

Facility Design Tool Reduces Planning Time and Enables Early Decision-Making

S2074 – VIRGINIA Class Submarine Facility Optimization



Period of Performance:

December 2004 to December 2006

Platform:

VCS

Affordability Focus Area:

Production Engineering

Center of Excellence:

iMAST

Point of Contact:

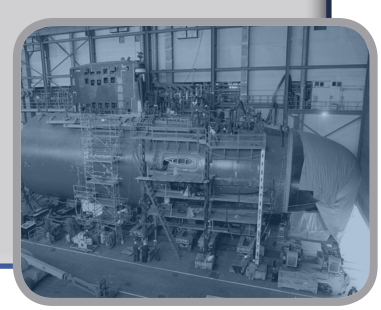
Mr. Timothy Bair
(814) 863-3880
tdb14@psu.edu

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$265,000



Objective

To meet the existing program objectives for ships under contract and to possibly double production, Northrop Grumman Newport News (NGNN) must have a more robust method to manage facility utilization and evaluate the impact of any added work on existing facilities. Traditionally, the planning for production floor space has been accomplished using very basic tools. Updating these plans to reflect changes in planned schedules, however, involves a significant cost and level of effort. Coordinating the use of available floor space given requirements that dynamically change over time is a challenging task. Additionally, limited space must also accommodate special features of each ship with regard to orientation and position as well as access by unique ground equipment and cranes capable of handling the heavy lift requirements for the modules. The primary objective in this project is to provide NGNN with a robust facilities planning tool for the Modular Outfitting Facility (MOF) supporting VIRGINIA Class Submarine (VCS) construction. This tool includes a user-friendly front-end interface that displays the MOF footprint over time and allows the user to make modifications directly through the interface. The underlying solutions procedure that automatically generates the MOF footprint on demand is an expert system that maintains the facility rules and constraints collected from NGNN expert knowledge.

Payoff

This project expects an overall reduction in planning costs due to the reduction in manual labor for generating long-term facility footprints from three weeks to approximately one day. Additionally, the project provides increased planning visibility and the ability to more easily assess the impact of changing space requirements and deviations in schedule. Therefore, decision-making can be enabled earlier in the construction process. The avoidance in construction costs due to reduced material movement and unit blockages is expected to be 2,600 man-hours, with an additional 1,000 man-hours avoided in footprint and facility layout planning. This results in an expected average annual cost avoidance of $180K.

Implementation

The activity-based MOF SST has been delivered to NGNN in early 2007 and is currently being used by planners for long-range spatial planning. The use of the tool is being used to validate NGNN's ability to support the VCS 84-60 initiative and an accelerated VCS acquisition rate of two ships per year.

Alternative Materials Reduce Damping Cost by 20% for VIRGINIA Class Submarines

S2139 – Damping Material Application Improvements Phase I

Period of Performance:

May 2007 to June 2008

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NMC

Point of Contact:

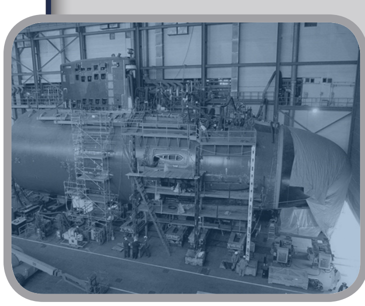
Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,102,000



Objective

The objective of this project is to identify and qualify alternative damping materials that can be applied more efficiently and reduce the total cost of damping material for VIRGINIA Class submarines.

Payoff

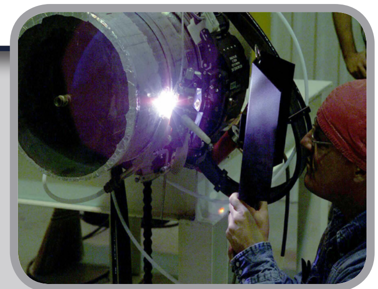
The benefit of this project is a reduction in the total cost of damping by 20% for VIRGINIA Class submarines.

Implementation

Damping materials are used to reduce vibration. The tiles must meet MIL-PRF-23653, MIL-DTL-24487 and MIL-A-24456 requirements, which include damping characteristics, adhesion strengths in peel and shock, toxicity, flame retardancy and others. The application process for the tiles is labor-intensive and has significant potential for reduction. Materials with more efficient application rates will be identified and qualified for use as damping materials. An alternative material is intended for inclusion on the Qualified Products List (QPL)-23653 for use on SSN 784 after execution of follow-on phases of the project.

Cost-Effective Methods Eliminate Root-Weld Defects in Alloy 625 Pipe Welding for VIRGINIA Class Submarines

S2140 – Alloy 625 Pipe Welding Phase I



Period of Performance:

February 2007 to February 2008

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$363,000

Objective

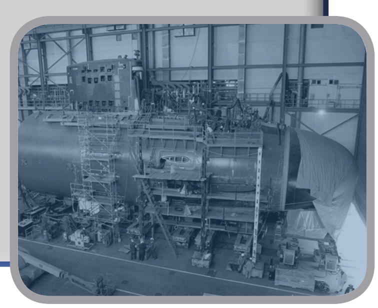
The objective of this project is to develop cost-effective methods for reducing or eliminating root-weld defects in large diameter Alloy 625 consumable insert pipe welds. This will result in an ID contour that meets the requirements of MIL-STD-2035A. Additional objectives are to decrease fabrication time for VIRGINIA (SSN 774) Class submarines by reducing or eliminating root-related defects that are in the critical path of ship construction and to decrease costs due to reduced ship schedule delays.

Payoff

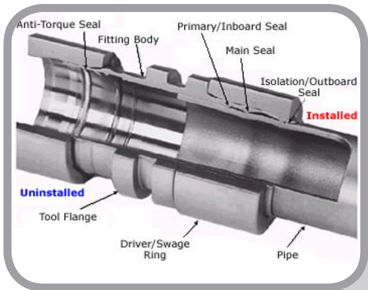
Quantitative benefits will be developed as part of the go / no-go decision point in Phase I. Qualitative benefits include: decreased fabrication time by reducing root-related defects and decreased costs due to reduced ship schedule delays.

Implementation

The project team includes shipyards General Dynamics Electric Boat (GDEB) and Northrop Grumman Newport News (NGNN), Program Office (PMS 450), technical warrant holder (NAVSEA 05P24), the Navy Metalworking Center (NMC) and Navy Joining Center (NJC) and technical codes (NSWCCD). As methods are developed to meet the objective, testing will be performed to meet technical warrant holder requirements.



Simplified Pipe Joining and Fitting Processes to Yield Significant Cost Avoidance for VIRGINIA Class Submarines



Period of Performance:

February 2007 to August 2008

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
(814) 269-6840
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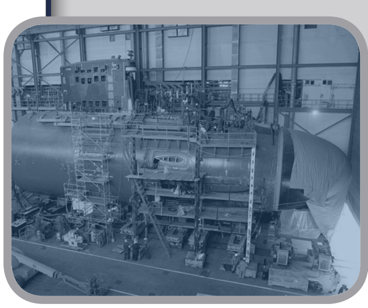
Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,140,000



S2141 – Alternative Pipe Joining and Fitting for VIRGINIA Class Submarines

Objective

The objective of this project is to reduce production costs of the VIRGINIA (SSN 774) Class submarines by simplifying the preparation, installation and inspection process for pipe joining and fitting. This will be accomplished by replacing butt and socket welded joints with options that require less preparation time and simplified inspection procedures, such as mechanically attached fittings (MAF) and belled end fittings (BEF). Concurrently, the objective is to reduce the time (therefore, the cost) required for fabrication. The targeted pipe systems will be identified and down-selected during Task one.

Payoff

Engineering rough order of magnitude (EROM) cost avoidance estimates for MAFS are anticipated to be $1.2M per ship and for BEFs, $2.25M per ship, for a total of $3.45M per ship. Qualitative benefits include:

- Improved fleet readiness;
- Reduced fleet life-cycle costs;
- Reduced installation training time;
- Reduced inspection requirements / time;
- Reduced fire watches, flushing, ventilating requirements;
- Reduced manufacturing injuries; and
- Reduced manufacturing rework required.

Implementation

The project team includes shipyards General Dynamics Electric Boat (GDEB) and Northrop Grumman Newport News (NGNN), Program Office (PMS 450), technical warrant holder (NAVSEA 05Z9), the Navy Metalworking Center (NMC), and technical codes (NSWCCD). As methods are developed to meet the objective, testing will be performed to meet technical warrant holder requirements.

Composite Manufacturing Processes Reduce Cost for Fabricating and Installing Sail Cusp

S2158 – Composite Manufacturing Technology for Reduced Cost Sail Cusp

Objective

The current VIRGINIA Class Sail Cusp is a stiffened steel structure comprised of numerous pieces which are welded together, filled with syntactic foam, and welded to the sail and hull structure. Considerable material and labor expense is required to fabricate the steel baseline structure due to the Sail Cusp's complex double curvature and the number of parts required for fit up. In addition, because the steel Sail Cusp must be welded to the sail and hull, the Sail Cusp cannot be readily removed for maintenance and thus the void space is filled almost entirely with syntactic foam to inhibit corrosion adding additional weight and manufacturing cost.

The Integrated Bleeding Manufacturing (IBMP) and the SCRIMP / VARTM (Seemann Composite Resin Infusion Manufacturing Process / Vacuum Assisted Resin Transfer Molding) processes both offer the potential to reduce the cost of the legacy steel Sail Cusp by enabling the fabrication of the Sail Cusp as a one piece unstiffened monocoque composite structure bolted to the sail and hull. Because of the unique challenges in fabricating this complex structure, some assurance that these manufacturing processes can be used to fabricate a full-scale Sail Cusp and meet all of the performance requirements and cost objectives needs to be demonstrated.

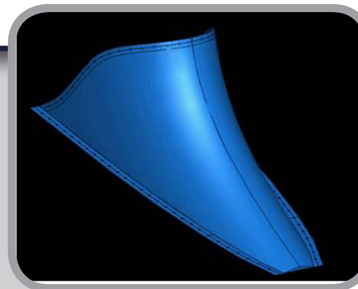
Thus the objective of this Composite Manufacturing Technology effort is to demonstrate the feasibility of using these different manufacturing methods for the VIRGINIA Class Sail Cusp by fabricating subscale and/or full-scale Sail Cusp manufacturing demonstration articles using each process, and then selecting the most cost-effective approach which meets the VIRGINIA requirements. The proposed approach will provide the ability to address any fabrication concerns, to more firmly establish realistic costs for fabricating and installing a full-scale Sail Cusp, and insure that all required performance issues can be met. Emphasis will be placed on developing processes that show significant reduction in fabrication costs with respect to the steel baseline.

Payoff

A cost savings of $150,000 per hull will be met or exceeded as a result of this project.

Implementation

The Composite Manufacturing Technology for Reduced Cost Sail Cusp project will demonstrate the feasibility of two alternative manufacturing approaches to fabricating the VIRGINIA Class Sail Cusp using composites by reviewing requirements, fabricating subscale and a full-scale prototypes and assessing the manufacturing quality and ability to meet requirements. An Electric Boat material specification exists for the each of the two manufacturing processes, insuring that if performance and manufacturing requirements are met that the transition to implementation should be straight forward. During the ManTech project, program reviews will be held with representatives from NAVSEA PMS 450 and other appropriate NAVSEA technical codes to insure that all issues and concerns are being addressed during the manufacturing technology development process.



Period of Performance:

March 2007 to April 2008

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CMTC

Point of Contact:

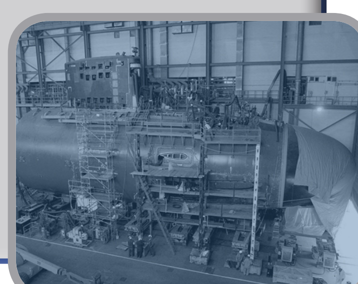
Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

Stakeholder:

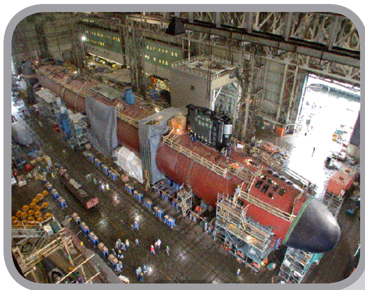
NAVSEA PMS 450

Total ManTech Investment:

$844,000



World Class Material Flow System to Improve Multiple Facets of the Shipbuilding Operation



Period of Performance:

June 2007 to March 2009

Platform:

VCS

Affordability Focus Area:

Production Engineering

Center of Excellence:

CNST

Point of Contact:

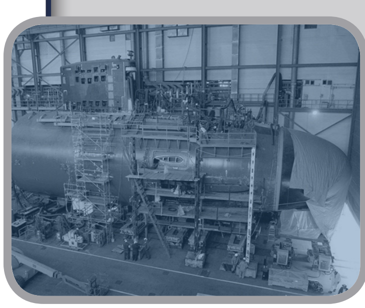
Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$350,000



S2160 – VCS Material Management

Objective

The objective of this project is to implement a world-class material flow system to support VIRGINIA Class submarine (VCS) construction at Electric Boat Corporation (EB). Material flow management challenges at the shipyard contribute to high cycle times, excess inventory, low material availability rates, and re-manufacture / re-procurement of rejected, damaged, or lost parts. A new system could improve multiple facets of the shipbuilding operation, including material procurement, scheduling, storage, handling, tracking, and delivery. This includes point-of-use storage, material kitting, and electronic tracking, and could also include a material distribution center that optimizes receiving, inspection, storing, and delivery functions. The project team will develop a current state value map that illustrates process flow and performance metrics; conduct on-site evaluations of companies considered to have “best in class” material flow processes; capture the materials flow future state vision and future state value map; and develop an implementation plan that identifies and prioritizes improvement projects that can bridge the gap between the current and future states.

Payoff

An estimated 30% of a submarine’s construction cost is directly related to material procurement and management. The material flow system resulting from this project will contribute to lower cycle times, optimal inventory levels, higher material availability rates, and reduced re-manufacture / re-procurement of rejected, damaged, or lost parts. Given there are approximately 200 warehousing/transportation personnel employed at EB, these manufacturing technology issues, if resolved, have the potential to save an estimated $3M annually in labor costs (resulting from a 15% warehouse workforce reduction) plus an additional $150K in lost/damaged materials for each VCS hull constructed. Findings from this effort will benefit both EB yards and their VCS co-build partner, Northrop Grumman Newport News (NGNN).

Implementation

Implementation of a world-class material flow system would improve multiple facets of the shipbuilding operation, including material procurement, scheduling, storage, handling, tracking, and delivery. Pending successful project results, implementation of these material management systems at EB is scheduled to commence January 2008. Implementation will be executed in a phased approach, with consideration given to the most significant opportunity areas, the length of time required for implementation, and the cost/benefit analysis. Because material flow processes are not subject to additional testing, qualification, or high-level Navy certifications, the likelihood of implementation is high.

Design for Production Methodology Eliminates Wasteful Steps in the Manufacturing Process

S2161 – Design for Production Process Improvement

Period of Performance:

April 2007 to April 2009

Platform:

VCS

Affordability Focus Area:

Production Engineering

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$767,000

Objective

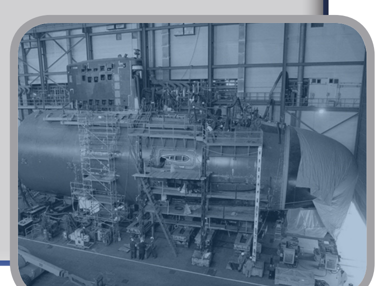
The objective of this project is to assess and evaluate a new methodology utilizing "design for production" (DfP) process improvement techniques targeting three key areas: cost-based design, design standards / rules, and seamless deliverables. Navy ManTech funded this two-year, multi-phase effort to ensure the VIRGINIA Class submarine (VCS) production workforce receives accurate, configuration-managed, electronic data that meets their information needs in a timely manner. This project will employ a new knowledge management system and rule-based / cost-based / standardized designs with advanced visualization technology to improve the process for ships' systems. Research activities will capture the best lean manufacturing capabilities; transform them into design standards; apply them during design activities; and produce seamless, "on demand" deliverables derived from 3D product models for cost-effective manufacturing. The investigation will also address implementation issues such as overall process changes necessary to incorporate the new technologies.

Payoff

Upon successful implementation, these improved DfP processes will reduce design / engineering and production labor hours and eliminate wasteful steps in the manufacturing process. Cost avoidances are estimated at $3.65M per year and total $16.9M (present value) through 2012. The resulting technology may be relevant to any shipbuilding new construction program, and will provide the design community with manufacturing capabilities, best practices, cost information, and design rules / standards; allowing for design decisions that reduce manufacturing, assembly, and testing costs downstream.

Implementation

New technologies will be implemented at General Dynamics Electric Boat in both the Groton, CT and Quonset Point, RI sites at appropriate insertion points. Targeted technologies will be implemented relatively quickly in the short-range phase of the project and longer-range / systems technologies will be implemented 18 to 24 months after award. Project results and lessons learned will be disseminated across the shipbuilding industry, as improvements through DfP processes are not limited to submarines but are applicable to aircraft carriers and other surface combatants as well.



Outfitting Process Improvements Reduce Activities Time by 30%

Period of Performance:

June 2007 to June 2009

Platform:

VCS

Affordability Focus Area:

Outfitting

Center of Excellence:

CNST

Point of Contact:

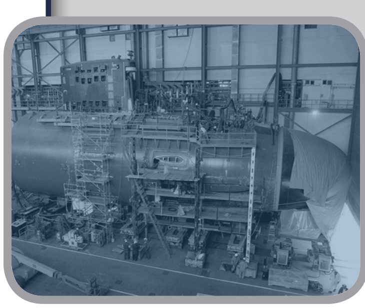
Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$450,000



S2162 – Outfitting Process Improvement

Objective

Reducing VIRGINIA Class submarine (VCS) construction costs to $2B and cycle time to 60 months is key to increasing acquisition and maintaining the submarine industrial base. With the VCS design essentially complete and the bulk of the construction work ahead, one of the greatest opportunities for cost avoidances and cycle time reduction lie in the outfitting realm. The objective of this project is to analyze the major processes employed during the outfitting stage of construction, prioritize the areas targeted for improvement, and recommend improvement solutions. This includes analyzing foreman time constraints, current scheduling methods and techniques, as well as understanding the various hand-offs of work, information, and material.

Payoff

Outfitting activities consume over 30% (1.5M man-hours) of the total VCS manufacturing span time. The process / tool improvements resulting from this effort will save an estimated 300K man-hours of labor, which equates to $15M per hull. In addition, as much as 30% of the time spent in early outfitting activities could be eliminated. Since VCS construction activities are shared between Electric Boat (EB) and Northrop Grumman Newport News (NGNN), results from this project have the potential to benefit both yards. Other expected benefits of this ManTech project include, but are not limited to: increased presence of foremen in outfitting work cells; increased amount of outfitting activities while cylinder / section is in vertical position; earlier layout work for attachments, inserts, cut-outs, and tank marginal plates; reduced amount of manufacturing activities happening in outfitting work cell; and increased efficiency in hand-offs of material, information, and work within and among crews.

Implementation

The VCS Program will directly benefit from the process / tool improvements resulting from this effort, at both EB and NGNN ship construction facilities. The results may also be relevant to other shipbuilding new construction programs as well. Once the outfitting processes have proven feasible for implementation, immediate specific process adaptation / inclusion can begin. As such, implementation activities could commence as early as 12 months into the project.

Two New Technologies Help in Reaching Shipbuilding Affordability Goal

S2164 – Image Projection and Local GPS

Objective

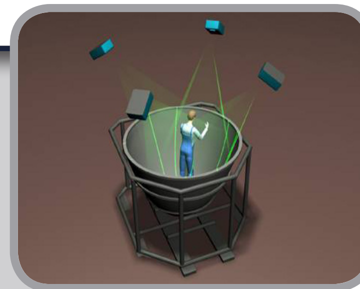
This project will investigate and evaluate new methodologies for locating attachments and penetrations onboard VIRGINIA Class submarines (VCS). The current process is labor-intensive and lacks automation. Location information, garnered from 2D engineering drawings and physical placement, is determined by using tape measures, templates, and string reference lines. The availability of 3D ship design data in digital format and the development of new layout technologies present opportunities for considerable improvement. This project will evaluate two such technology solutions: laser image projection and local global positioning system (GPS). The image projection system will be used to pinpoint the locations of hull attachments in portions of a VCS hull; the local Global Positioning System (GPS) will investigate the integration of local GPS technologies with stud welding tools. For each, the investigation will include a requirements analysis, survey / assessment of available technologies, and test plan development. Additionally, both will address implementation issues and will also evaluate the accuracy and quantify the benefit compared with the current methodology.

Payoff

In order for the VCS program to be affordable, the cost to build one submarine must be less than $2B and must be completed in less than 84 months. The adaptation of these technologies will help reach this goal. Thousands of labor hours will be avoided (projected to exceed $14M for the VCS program), and potential cycle time reductions are estimated at 1-3 weeks per major unit. Findings from this project should be applicable and benefit construction activities at other major shipyards. Improvements to this methodology are not limited to submarines, but are applicable to aircraft carriers and other surface combatants as well.

Implementation

Project results will be documented in a final report and implementation plan. Included in this plan will be the hardware and software needs for full implementation, the process definition for use of the new technology, a training plan for the end-users, necessary changes to the construction schedules, and work orders to allow for locating attachments at the earliest point possible. Results will be implemented in Electric Boat and Northrop Grumman Newport News ship construction facilities. Cost avoidances and cycle time reductions resulting from this project are estimated to begin on VCS hull number 783.



Period of Performance:

January 2007 to January 2008

Platform:

VCS

Affordability Focus Area:

Outfitting

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
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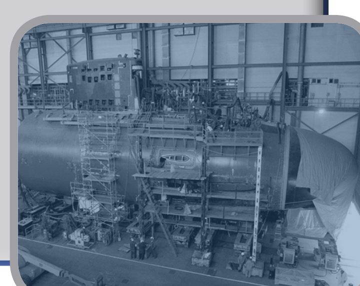
Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$598,000



Improved Cladding Workcell Processes to Reduce Submarine Manufacturing Cost

Period of Performance:

February 2007 to September 2009

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

iMAST

Point of Contact:

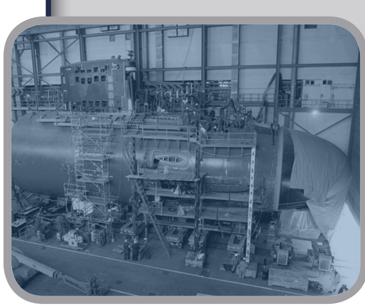
Mr. Timothy Bair
(814) 863-3880
tdb14@psu.edu

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$915,000



S2169 – Cladding Workcell for Submarine Manufacturing

Objective

The objective is to develop and implement a semi-automated work-cell to achieve improved affordability during cladding of components used in the manufacture of submarines. Current cladding methods are effective but limited in production rate. Fabrication times for components are lengthy, as the facilities layouts are not optimized. The recent requirement to produce a boat in 60 months rather than 84 months, combined with a production rate of two ships per year, necessitate that both output and capacity are increased.

Payoff

The successful completion of this project will result in a reduction in time to fabricate components as well as a reduction in cost due to improved cladding processes and resources. Initial estimates indicate a reduction of 30%, a reduction of 21,500 man-hours per hull. Secondary benefits may include improved clad chemistry and corrosion performance, which may impact life-cycle costs.

Implementation

General Dynamics Electric Boat (GDEB) Corporation performs cladding operations at both its Groton and Quonset Point facilities. Initial studies will involve an analysis of equipment and facilities and determination of the best cladding practices at GDEB. Laser cladding will be evaluated to determine if it is a feasible alternative based on a cost-benefits analysis. Analysis and designs will be prepared for a work-cell specifically for cladding. The second phase of the program will involve the development of a laboratory scale cladding system for the testing and analysis of the improved process. The final phase of the program will involve a shipyard scale cladding system for implementation at GDEB.

Composite Technology to Enable an Affordable High Performance Impeller

S2174 – Reduced Cost Impeller

Objective

The current VIRGINIA Class impeller is fabricated using a 5-axis machining process on a forged titanium ingot. This is required to achieve the required shape and associated tolerances to meet performance goals. The machining process is very expensive, and the cost of titanium is escalating. The objective of this project is to demonstrate the ability to fabricate a low cost composite impeller that meets all performance requirements and reduces the cost over the titanium baseline component. The technical approach involves the use of high precision composite segments assembled into a finished impeller.

Payoff

The projected payoffs for this project are lower acquisition cost compared to the titanium design. It is expected that this project will save $1.3M per hull.

Implementation

The implementation plan involves building a full-scale impeller segments and assembling them into a full-scale rotor suitable for a complete set of qualification tests to be conducted by NUWC by the end of December, 2008.

Period of Performance:

June 2007 to May 2009

Platform:

VCS

Affordability Focus Area:

Not Applicable

Center of Excellence:

CMTC

Point of Contact:

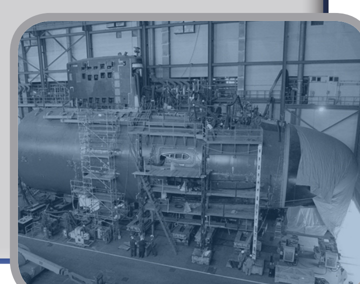
Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,500,000



Lower Acquisition Cost for VIRGINIA Class Submarine Flood Grates

Period of Performance:

May 2007 to October 2007

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

CMTC

Point of Contact:

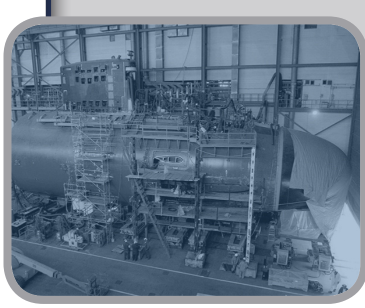
Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$100,000



S2180 – VCS MBT Grates

Objective

The VIRGINIA Class submarine (VCS) program office, as part of the their overall cost reduction efforts, funded an effort by Electric Boat to investigate and down-select various approaches to reducing the cost of the aft Main Ballast Tank (MBT) flood grate design while also addressing performance issues. This effort considered both composite and non-composite solutions for cost reduction. The ManTech Rapid Response effort developed a composite manufacturing plan for affordable AFT MBT composite flood grates as part of the PMS 450 cost acquisition reduction effort. The objective is to demonstrate that form fit and function of composite flood grates with identical geometry to existing flood grates are acceptable for shipboard use.

Payoff

The principal benefit of this project is to lower the acquisition cost for the VIRGINIA Aft MBT flood grates using an all composite flood grate, resulting in a cost avoidance of $390K per ship set beginning with Block III – SSN784. Projected savings for VIRGINIA Class for this replacement is $7.8 M based on 20 remaining VCS. The projected return on investment (ROI) for this project is 78:1 for the remaining ships in the class and 27.5 for the Block III buy.

Implementation

At the VCS Design Review in May 2007, a request was made by NAVSEA and PMS 450 to get the two flood grates to sea earlier. As a result the implementation was moved to the SSN778 which is under construction and will compete in March of 2008. This installation will be a TEMPALT on SSN778 for the sake of time; drawing changes will be prepared for the next ship in the class to encompass all aft flood grates on the remaining VCS.

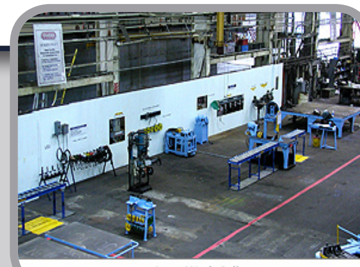
Updated Small Weldment Methods Optimizes Material Flow and Reduce Labor Hours by 20%

S2185 – Small Weldment Optimization Cell

Objective
This ManTech project analyzes, creates a pilot and recommends a process for the assembly of small weldments from fabricated piece parts in an effort to reduce touch labor by 10-20%. Small weldments at Northrop Grumman Newport News (NGNN) are considered any structural part – generally up to 4-ft by 8-ft and weighing up to 5 tons – that is manufactured or assembled in the small component fabrication and assembly shops. Current manufacturing and assembly methods for small weldments are outdated, requiring significant cost and time. In addition, the process at NGNN is at maximum capacity, and supporting two VIRGINIA Class submarine (VCS) hulls per year plus an aircraft carrier will cause scheduling issues and disruption. The proposed process will provide optimized material flow and work sequences, as well as specify new tooling requirements.

Payoff
At NGNN, small weldments account for approximately 1M man-hours on a NIMITZ-class aircraft carrier (FORD-class carriers are expected to require a similar level of effort) and 200K man-hours per VCS hull (not including similar work performed at Electric Boat). By evaluating process lanes and optimized tooling and using state-of-the-art tools, NGNN expects labor reductions of approximately 40K man-hours per VCS hull and up to 200K man-hours on FORD-class aircraft carriers. If successful, this project could eliminate up to 20% touch labor in the small weldments process, yielding per-hull savings of $2.4M and $12M for the VCS and CVN 21 programs, respectively. Findings from this project should be applicable and benefit construction activities at other major shipyards as well, especially VCS co-build partner Electric Boat.

Implementation
The project team intends to determine where the most value lies for investments in new tooling for small weldment assembly. The results will initially be used to pursue a new small weldment production facility or an equipment / resource upgrade of an existing NGNN facility using the VCS Capital Expenditure (CAPEX) program. However, implementation priority considerations will be given to the most significant opportunity areas, the length of time required for implementation, funding availability, and the cost / benefit analysis. Given successful project metrics are achieved, NGNN will commence implementation activities at their ship construction facilities in October, 2008.



Lean Work Cells

Period of Performance:

July 2007 to June 2008

Platform:

VCS

Affordability Focus Area:

Outfitting

Center of Excellence:

CNST

Point of Contact:

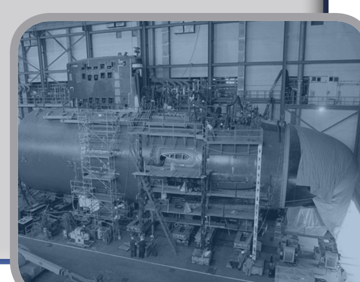
Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

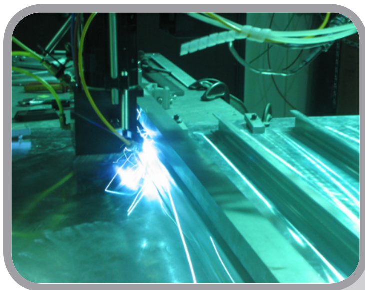
NAVSEA PMS 450

Total ManTech Investment:

$434,000



Joining Techniques Enable Greater Efficiency and Affordability in Sheet Metal Processing



Period of Performance:

April 2007 to September 2010

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

iMAST

Point of Contact:

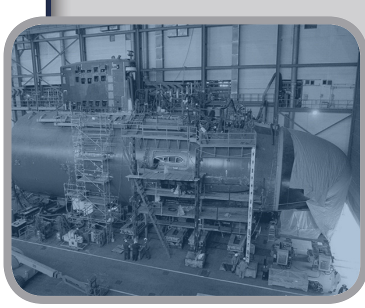
Mr. Timothy Bair
(814) 863-3880
tdb14@psu.edu

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$1,550,000



S2191 – Sheet Metal Processing

Objective

Submarine construction includes significant fabrication of sheet metal products comprised of a wide variety of sizes and shapes that necessitate costly hand fitting and fabrication and utilize manual joining techniques. The primary objective of the program is to identify alternate joining techniques that enable greater efficiency and affordability. Examples include: self-piercing rivets, adhesive bonding, pulsed gas metal arc welding, and laser stir welding of spot welds. To further exploit these alternate joining technologies, the program will utilize a concurrent engineering methodology, along with analyses of process flow, to refine designs and manufacturing schemes that enable the implementation of improved joining and manufacturing technologies. This includes the use of greater laser cutting and CNC forming, maximize self-fixturing techniques, reduce part count, component commonality and the potential complimentary use of flexible fixturing techniques.

Payoff

A 15% improvement in efficiency is anticipated to result in a savings of $1,250K per year. The 15% improvement is based upon a conservative estimate for the increase in efficiency if improved joining and fabrication methods are identified and implemented. If two hulls per year are factored into the analysis, and the second hull benefits at a level of 50% of the initial 15% improvement, anticipated savings would be $937.5K per hull per year. However, it must be noted that the potential savings associated with these improvements ignore secondary savings associated with reduced part count and inventory, reduced rework due to improved accuracy of components, and increased product flow.

Implementation

The primary implementation site for this technology is General Dynamics Electric Boat (GDEB), and a secondary implementation site is Northrop Grumman Newport News (NGNN). Close interaction with the sheet metal fabrication facilities of GDEB and NGNN will aid in transitioning the alternate techniques and methods developed under the program in a timely and effective manner. The initial implementation of the technology at GDEB is Fall of 2008. Procurement of new equipment resulting from this program has been discussed with GDEB, and is considered acceptable based on a positive business case analysis. Funds for potential procurement would be available through internal GDEB investment. Several iterations of manufacturing analysis, representing increasing accuracy of the manufacturing metrics, will be used to determine cost and potential improvements in affordability. Any requirements concerning process modifications or design changes will be identified early in the program and will be specifically addressed. This will include the generation of engineering change proposals and drawings, if required. Because the program has been designed to incrementally utilize improved processing techniques, moderate tracking of these improvements will be made during program execution. The total savings that result from full implementation will be estimated based on projected savings from metrics available at completion.

Process Improves Performance and Reduces Repair Costs for Submarine Propellers

S2196 – Friction Stir Processing of Nickel Aluminum Bronze Propellers

Objective

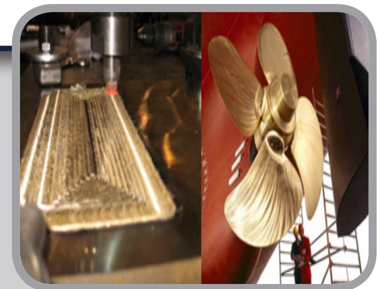
Repair of in-service ship and submarine propellers, is a significant cost to the Navy. Welding of propellers that have been in service is required to repair cracks, corrosion, erosion, and blade deformation. However, arc weld repairs are time-consuming, can result in thinner blades over time and can initiate more cracking in service. Friction stir processing (FSP) is a relatively new solid state process that has the ability to repair casting defects and improve surface integrity and strength in nickel aluminum bronze and other materials. This process has the potential to be faster, higher quality and more reliable than the arc welding methods that are currently used. The objective of this project is to improve performance; reduce the cost and cycle time for in service repair by implementing friction stir processing on nickel aluminum bronze propellers.

Payoff

The cost of maintaining the existing fleet of propellers is a significant expense. Implementing friction stir processing for propellers can speed-up the repair of surface and subsurface casting defects, improve surface layer mechanical properties, locally strengthen critical areas, and reduce residual stresses and associated distortion. This will result in labor cost savings, decreased cycle times, and provide improved propeller performance. It is estimated that friction stir processing can save $400K per year in propeller repair costs.

Implementation

The project supports implementation of friction stir processing and welding for repair of propellers at Wartsilla Lipps in Chesapeake, Virginia, by December 2009. The project will support the specification, design, construction, and installation of a friction stir processing machine. An initial FSP certification document has been reviewed and approved by NAVSEA. The project also will support final qualification of the process.



Period of Performance:

March 2007 to June 2009

Platform:

VCS

Affordability Focus Area:

Materials / Process Improvements

Center of Excellence:

NJC

Point of Contact:

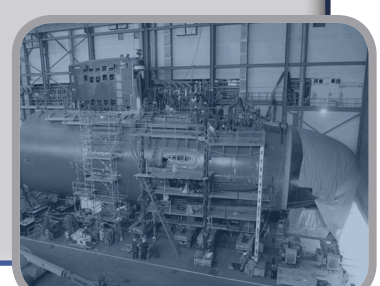
Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$305,000



BMPCOE Helps to Reduce Inefficiencies in the VIRGINIA Class Submarine Supply Chain

Period of Performance:

January 2007 to Present

Platform:

VCS

Affordability Focus Area:

Schedule Compression

Center of Excellence:

BMPCOE

Point of Contact:

Rebecca Clayton
(301) 405-9990

Stakeholder:

NAVSEA PMS 450

Total ManTech Investment:

$262,000

S2220 – VIRGINIA Class Submarine Schedule Compression

Objective

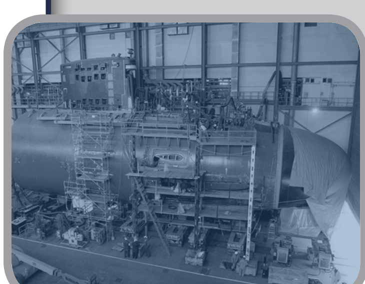
A number of VIRGINIA Class submarine (VCS) systems exist that the supply chain has difficulty delivering by shipyard need dates. With a move to an accelerated 60-month ship delivery, this problem becomes greatly exacerbated. Approximately half of VCS cost is embedded in the supply chain, and the objective of the schedule compression project is to reduce cycle-time and cost of key VCS systems provided by outside suppliers. The task of the Best Manufacturing Practices Center of Excellence (BMPCOE) is to conduct targeted intervention of suppliers of high-risk systems for process improvements, application of known best practices, and alternative contracting or supply / build approaches.

Payoff

Within six months of start, this project has identified approximately $380K in savings per hull on an initial investment of $262K. Five VCS hulls are planned between FY09 and FY12. The project reviews procured components by criticality and potential risk of late delivery. Those items determined to carry the most risk are analyzed for process improvements, alternative contracting, or supply / build approaches to reduce shipbuilding cycle-time and cost. Processes linking the shipyard with its suppliers that impact cycle-time are also reviewed for non-value-added activity or alternative approaches. BMPCOE provides shipyards a means for supplier improvement through process review and, in some cases, recommendations for the use of enhanced or existing technologies to reduce inefficiencies in the supply chain.

Implementation

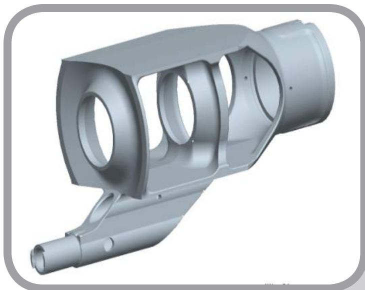
Implementation is incremental and an ongoing process as there is no cost-avoidance product that is being delivered for implementation at the end of the project. Due to the nature of this project, interim reports are made with recommendations the shipyard and vendors can begin implementing immediately. For each of the three on-site manufacturing plant reviews done to date, between 5 and 15 standalone recommendations for cycle-time and/or cost reductions have been made. BMPCOE supports VCS suppliers with a unique combination of knowledge and tools for continuous improvement. In addition to specific recommendations provided to each supplier, BMPCOE is developing a Supplier Risk Management Template. The purpose of this template is to support assessment of the risk inherent in ongoing component procurement and to institutionalize some of the methods used by BMPCOE for future VCS procurements.



Marine Corps Projects

Project Number	Project Title	Page Number
C2049	Implementation of Steel Investment Castings to Enhance Reliability and Decrease Cost for the M777 Lightweight Howitzer	86
C2112	EFV Skirt Armor Manufacturing Development	87
C2152	Development of Friction Stir Welding for Expeditionary Fighting Vehicle (EFV) Hull Components	88

Marine Corps



Steel Castings Eliminate Weldment Failure

C2049 – Implementation of Steel Investment Castings to Enhance Reliability and Decrease Cost for the M777 Lightweight Howitzer

Objective

The M777 Lightweight Howitzer (LW155) program is a joint effort between the U.S. Marine Corps and the U.S. Army to replace aging M198 155 MM Howitzers. The program is in the early stages of full-rate production, with over 400 guns expected to be delivered by 2010. Two components on the gun, the 300-pound muzzle brake and the 66-pound tow bracket, are currently welded together. The project's primary objective was to cast the muzzle brake and tow bracket together to reduce cost and improve reliability. Two other key objectives were to mitigate the foundry supplier risk and address quality issues inherent to casting processes.

Payoff

Up to $8 million in production cost avoidances are anticipated with the subsequent purchase of the replacement parts over the lifetime of each gun. Introducing additional foundries in the manufacturing chain reduces the supplier's risk and mitigates the risk of fielding. Moreover, eliminating the weld joint and improving casting results in improves the reliability in the field.

Implementation

The project demonstrated manufacturing of the single piece part to eliminate the welded joint, introduced additional foundries (MetalTek and Wollaston Alloys) to mitigate supplier risk and developed casting methodologies to improve quality. Once the castings are verified that they meet the required properties, they will be subjected to live-fire field testing by the M777 Lightweight Howitzer Program Office. If the castings pass the field testing, they will be implemented in production.

Period of Performance:

July 2005 to June 2007

Platform:

Marine Corps

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

JPMO-155mm Howitzer

Total ManTech Investment:

$826,000

Composite Armor Panels Reduce EFV Support Costs

C2112 – EFV Skirt Armor Manufacturing Development

Objective

Skirt armor panels form part of the protection for the Marine Corps Expeditionary Fighting Vehicle (EFV) that is slated to begin low rate initial production (LRIP) in FY07. An enhanced metallic-ceramic composite skirt armor design is being developed for this vehicle. Fabrication of this new design requires much larger panel assemblies than can currently be manufactured. Mechanical fastening is not a viable option due to the additional space claim, weight, part count, and complexity of this type of solution. Therefore, methods must be developed to permit manufacture of the full-sized panels needed for the EFV. The objective is to develop technologies to join armor sub-panels to produce panels that make up the EFV armor skirt. A full-scale set of armor skirt panels for one side of the EFV will be joined and delivered to the Navy/Marine Corps for environmental testing.

Payoff

This project aided in developing an enabling technology for fabrication of large encapsulated armor structures. The performance of these structures is expected to increase the service life of EFV skirt armor from the current 7 years to 14 years. This will result in a reduction in life-cycle support costs for the EFV. Assuming a vehicle buy of 1012 and just a 1.5x improvement in the service life, a $42M in life-cycle support costs for the EFV are expected.

Implementation

Environment testing will be performed from July to September 2008. The results of this project will be implemented through technology transferred to BAE Systems and General Dynamics Lands Systems (GDLS) as a retrofit for the seven SDD-II vehicles that will be manufactured in 2008 and then later for production vehicles starting in 2011. It is anticipated that equipment for the joining processes will be commercially available and will be implemented by BAE, GDLS, or an outside supplier.

Period of Performance:

February 2006 to December 2007

Platform:

Marine Corps

Affordability Focus Area:

Not Applicable

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

PM AAA

Total ManTech Investment:

$300,000

Friction Stir Welding of the Expeditionary Fighting Vehicle Improves Performance and Reduces Production Cost

Period of Performance:

August 2006 to
December 2007

Platform:

Marine Corps

Affordability Focus Area:

Electronics Radar and Communications

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

PM AAA

Total ManTech Investment:

$540,000

C2152 – Development of Friction Stir Welding for Expeditionary Fighting Vehicle (EFV) Hull Components

Objective

Friction Stir Welding (FSW) of the lower hull assembly of the Expeditionary Fighting Vehicle (EFV) has the potential to improve the mechanical and ballistic performance while reducing the cost of production compared to conventional robotic Gas Metal Arc Welding (GMAW). The FSW process has been demonstrated and tested on 2519 aluminum during prior Navy Joining Center (NJC) projects for the Advanced Amphibious Assault Vehicles (AAAV). A primary task of this project is to develop FSW parameters to join the EFV joint geometries while leveraging the prior ManTech work. This project will also design, build and demonstrate the feasibility of using modular tooling and local clamping to fabricate large structures using FSW. The primary objective of this project is to demonstrate these technologies while delivering a demonstration EFV lower hull assembly for subsequent testing.

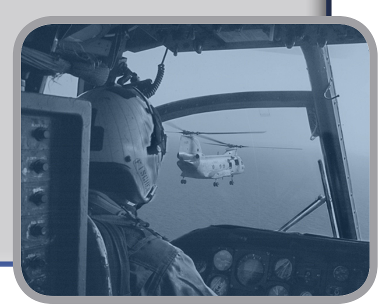
Payoff

Implementation of FSW for joining the EFV hull assembly will improve the mechanical and ballistic performance of the structure. The FSW process provides a 2x improvement in welding cycle time over conventional GMAW. Based on the current EFV production order of 1,013 vehicles, this will represent a cost savings of $1.05M after considering equipment acquisition costs.

Implementation

Friction stir welding and tooling technologies will be transferred to General Dynamics Land Systems (GDLS) where it will be implemented in 2009 in support of the EFV low rate initial production (LRIP) and continue through the full production order.

NAVAIR Projects



Technology Transition Aims for Maturity of New Airframe Design

Period of Performance:

May 2003 to December 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

CMTC

Point of Contact:

Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

Stakeholder:

N-UCAS Advanced Development Program Office

Total ManTech Investment:

$11,149,000

A1075 – Carrier-Compatible Navy-UCAS Composites Technology Transition: Systems Design and Manufacturing Demonstration

Objective

The Boeing Navy Unmanned Combat Air System (N-UCAS) ManTech project is a multi-phase effort ultimately leading to an alternate, low risk, more affordable N-UCAS airframe product. The project is being conducted in two phases – Concept Exploration (CE) (completed) and Systems Design and Manufacturing Development (SDMD) (the thrust of the current effort). During the CE Phase, Boeing St. Louis conducted trade studies and engineering analyses on portions of the air vehicle. The Boeing Team identified promising design concepts, manufacturing approaches, and assembly methods that could lead to an airframe lower in cost than today's systems while meeting all other requirements. The current SDMD Phase includes execution of the plan for product development and full-scale test validation of the most promising configuration determined by the CE trade studies.

Payoff

The projected payoffs for this project are lower acquisition cost, improved life-cycle cost and lower weight of primary aircraft structure. A thorough cost / benefit analysis was performed in the CE phase and is frequently updated during the SDMD phase to ensure goals are being met. The primary benefit of this project will be that the most affordable material system for each structural component will be selected leading the most affordable wing assembly.

Implementation

The overall goal of the N-UCAS projects was to mature the affordable airframe design and manufacturing process to a level such that it replaced conventional construction as the demonstration vehicle proposal baseline. The Navy UCAS demonstration vehicle contract was awarded to Northrop Grumman and, as a result, the technologies developed will not be immediately implemented on these aircraft. However, the technologies will be available to meet other program needs and platform implementations as applicable.

Technology Transition Aims for Maturity of New Airframe Design

A2024 – Advanced Stiffening for Composite Weapons Bay Door

Objective

The weapons bay door on the F-35 Joint Strike Fighter (JSF) is a highly contoured and highly loaded structure that is required to survive a very dynamic operating environment. As a result, the baseline design is an extremely complex assembly that utilizes traditional paper-based core for stiffening. This results in weight penalties and high manufacturing costs. By using a design concept that employs an integrated structural approach using very high performance titanium core material integrated with the composite, the weapons bay door can be fabricated to have a more efficient strength-to-weight ratio.

Payoff

The projected payoffs for this project are lower acquisition cost, improved life-cycle cost, and lower weight of primary aircraft structure. A thorough cost / benefit analysis has been performed in the project and was frequently updated during the project to ensure goals are being met. The primary benefit of this project was that approximately 9 pounds of weight could be saved per ship set. It is projected that, if implemented, the total cost savings could be as high as $29M over the life of the F-35 program.

Implementation

The ManTech project developed the manufacturing processes to fabricate a titanium-core composite door and demonstrated it on a half-scale demonstration article. The project also showed by analysis, component testing, and structural testing of the demonstration article that a titanium core door could meet or exceed the performance requirements for the F-35. The titanium core door is currently being considered for implementation on a test aircraft and ultimately future production fighters.

Period of Performance:

February 2005 to March 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

CMTC

Point of Contact:

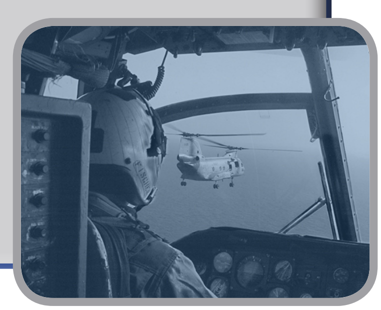
Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

Stakeholder:

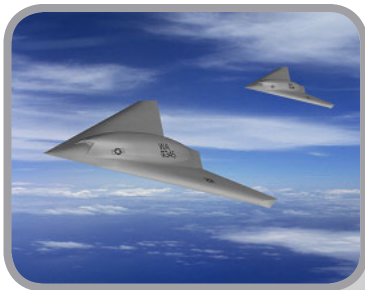
NAVAIR Joint Strike Fighter Program Office

Total ManTech Investment:

$1,957,000



Advanced Manufacturing Technologies Create Cost Avoidance for N-UCAS



Period of Performance:

July 2005 to June 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

N-UCAS Advanced Development Program Office

Total ManTech Investment:

$999,000

A2052 – N-UCAS Metallic Manufacturing Technology Transition Program

Objective

The purpose of this project is to reduce the weight and cost of airframe components through the utilization of advanced metalworking technologies. Two manufacturing technologies, advanced High Speed Machining (HSM) and Electron Beam Free Form Fabrication (EBFFF) were down selected during a prior concept exploration project for further evaluation in Phase I of this project. HSM will be utilized to manufacture ultra thin, aluminum spars. EBFFF technology will be utilized to produce lower-cost titanium components. Phase II of the project will build and test a full-scale significant structural component consisting of both metal and composite parts and demonstrate the applicability of the new metalworking technologies.

Payoff

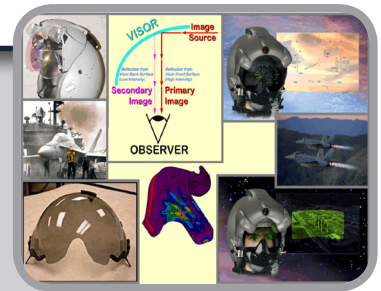
Navy Metalworking Center (NMC) estimates that this project will result in significant acquisition cost avoidance and a 35% weight reduction of affected parts. In addition to the reduced fuel cost, the weight savings may lead to performance enhancements such as increased payload and endurance.

Implementation

The technical aspects of the System Design and Manufacturing Development (SDMD) will conclude with the full-scale demonstration of wing and fuselage structures. By inserting ManTech solutions early in the design process, this project will reduce life-cycle costs, preserve development schedules and promote timely transition to the N-UCAS Platform. The next opportunity to transition the SDMD technologies into the Navy UCAS Production Vehicle will be the follow-on System Design and Development phase.

New Technology Enhances Manufacturing of Helmet Mounted Display Visors

A2076 – Helmet Mounted Display Visor Manufacturing Technology



Objective

This project addressed manufacturing technology enhancements for the production of F/A-18 Joint Helmet Mounted Cueing System (JHMCS) and Joint Strike Fighter (JSF) Helmet Mounted Display (HMD) Visors. The project had three main focus areas. The first was the creation of dedicated optical coating capabilities to increase coating throughput, reduce production cycle-time, and advance the uniformity and optical performance of the visors' anti-reflective and beamsplitter coatings. The project also sought to improve the hardcoat layer protecting the visors' optical coatings from mechanical damage. The third area was the replacement of the current expensive and labor-intensive composite visor retention tangs with a thermoplastic, injection-molded tang that meets the stringent original mechanical specifications protecting pilots in the event of ejection from the cockpit.

Payoff

Due to higher production yield and throughput, more cost-efficient HMD visors will be made available to the Navy through the Electro-Optic Center's (EOC's) industry partner, Rockwell Collins Display Systems (RCDS). These visors feature a four-fold reduction of distracting secondary reflection intensity, an advanced beamsplitter design, and a more rugged hardcoat layer protecting the visor from scuffs and scratches. The new visor retention tang design will reduce the unit production cycle-time and cost. The cost avoidance targeted by this project is over $300 per unit, an estimated total product life-cycle cost avoidance in excess of $30M for the Navy.

Implementation

Subcontractor Rockwell Collins Display Systems developed, over the course of this effort, visor-specific in-house optical coating capabilities and upgraded the visors' hardcoat and the visor retention tangs in close dialog with the stakeholder (NAVAIR PMA 265 F/A-18 and JSF Avionics Program Office) and the system integrator (Boeing). The project yield F/A-18 and JSF HMD Visor deliverables for the stakeholders, who will evaluate the optical visor performance. The new visor retention tangs passed ejection and windblast testing at NAS Patuxent River and are qualified for production insertion. These verifications complement RCDS's in-house testing conducted throughout the project. Some of the visor deliverables will be used for system integration, windblast and ejection testing, and flight testing. The ManTech visor implementation on the F/A-18 commenced in September 2007 and the JSF visor implementation will occur after completion of all testing.

Period of Performance:

February 2005 to October 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

EOC

Point of Contact:

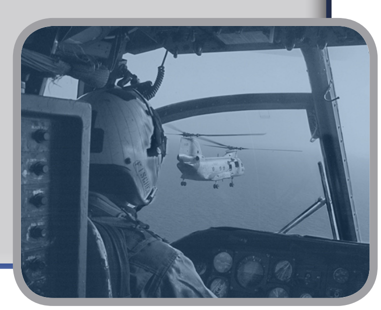
Mr. David H. Ditto
(724) 295-7011
dditto@eoc.psu.edu

Stakeholder:

NAVAIR PMA 265

Total ManTech Investment:

$220,000



Period of Performance:

March 2005 to August 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

NJC

Point of Contact:

Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVAIR PEO (W)

Total ManTech Investment:

$1,000,000

Fabrication Costs of Beams Could Be Reduced by Approximately 55%

A2088 – Advanced Aircraft Structure Joining for N-UCAS

Objective

The objective of this project was to develop cost-effective design and fabrication techniques for producing advanced titanium aircraft spars and beams. Welded structures are desired over conventional machined and/or riveted aluminum and titanium structures for weight and cost reduction on the Navy Unmanned Combat Air System (N-UCAS). Structural weight is reduced by using upgraded fabrication technologies such as cold and hot forming to produce more accurate corrugations and precision cutting to produce accurate beam subassemblies. Fabrication costs are reduced by using low distortion welding methods to reduce or eliminate post-weld machining.

Payoff

Fabricated lightweight spars and beams provide many advantages, including reduced weight, reduced part count (i.e. no rivets, fasteners, splice plates), reduced sealing operations, improved load carrying capacity and fatigue performance, and improved corrosion performance. The welded concept also reduces the effect of thermal and acoustic stresses and associated fatigue issues compared to riveted construction, thereby increasing reliability. By using an advanced welded titanium structure, beam weight could be reduced by as much as 25%, or 8 pounds per beam including ballast, while reducing fabrication costs by 55%—approximately $5K per beam. In addition to reducing fabrication costs, significant operational cost avoidance may be achieved due to reduced fuel requirements and the superior corrosion resistance of titanium.

Implementation

Fabrication techniques for cost-effectively producing advanced titanium aircraft spars and beams were successfully demonstrated, and this technology is available to support the use of fabricated structures to help reduce the weight and improve the performance of future aircraft designs.

Digital Display Replaces Current System and Improves Reliability

A2113 – Digital Heads Up Display

Objective
This project addressed manufacturing issues associated with a reflective micro-display for an F/A-18 Digital Heads Up Display (DHUD) to replace the current Cathode Ray Tube (CRT)-based Heads Up Display (HUD). This DHUD is a line replaceable unit (LRU) for the HUD; therefore the unit must fit within the confines of the original HUD unit, operate to all HUD specifications, and operate without modification to all external inputs.

Payoff
The current mean time between failures (MTBF) for CRT-based HUDs is nearly 400 hours. This causes the HUD to be one of the most unreliable LRUs on the aircraft. This is impacting aircraft availability and support costs. In comparison, the DHUD is expected to improve the MTBF of this LRU tenfold. Along with an improved MTBF, all parts associated with the DHUD are expected to be readily available for decades to come. Many of the older technologies in the aircraft are difficult to repair due to replacement parts becoming obsolete, and the CRT is one such item. The DHUD promises to be more reliable with lower servicing costs than the HUD.

Implementation
Rockwell Collins Display Systems (RCDS), the subcontractor for this effort, utilized the concept of a "virtual factory", whereby RCDS identified companies to subcontract specific tasks of the project and oversaw the transition and the required interactions as the displays were being designed, wafer chips fabricated, and the final unit packaged. RCDS performed technical evaluations of potential companies. Aurora Systems, Jazz Semiconductor and Hana Microdisplay Technology were selected to work with this manufacturing approach. It is anticipated the DHUD will be implemented in the Boeing F/A-18 production line for Lot 33, currently scheduled for FY10.

Period of Performance:

April 2006 to September 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

EOC

Point of Contact:

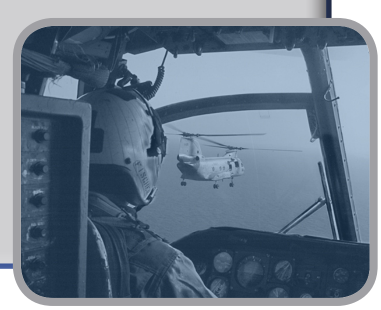
Mr. David H. Ditto
(724) 295-7011
dditto@eoc.psu.edu

Stakeholder:

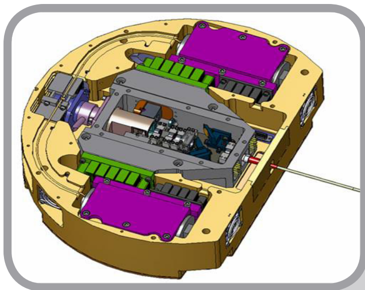
NAVAIR PMA 265

Total ManTech Investment:

$1,958,000



Novel Approaches in Mid-Infrared Laser Technology Allows for Size and Weight Reductions



Period of Performance:

January 2007 to
October 2009

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

EOC

Point of Contact:

Mr. David H. Ditto
(724) 295-7011
dditto@eoc.psu.edu

Stakeholder:

NAVAIR PMA 272

Total ManTech Investment:

$2,881,000

A2115 – Multispectral Mid IR Lasers for Directional IR Counter Measures

Objective

Advanced Man Portable Air Defense Systems (MANPADS) are a current and ongoing threat to helicopter, tactical aircraft, and commercial airliners. Mid-Infrared laser-based infrared countermeasure (IRCM) systems, such as the Army's Advanced Infrared Countermeasures (ATIRCM), could provide state-of-the-art MANPADS protection for the helicopters, but, due to the system's prohibitively high cost, it is limited to Special Forces applications only. As such, the majority of the rotary wing fleet is unprotected from advanced MANPADS. Current DIRCM systems typically use lasers which require good thermal management systems to remove excess heat which add to the overall power consumption and size of the device. While these devices have proven successful in countering MANPAD threats, their size, weight, and cost of the device makes them difficult to employ on small military aircraft as well as commercial planes. The objectives of this project are to develop the manufacturing technology to address laser manufacturing issues for critical near-term programs such as PMA 272's Strike (F/A-18) and Assault (helo) DIRCM Programs. The technical approach addresses issues such as a reduction in size, improvement in the yield of critical components and subsystems, and a decrease in cost. This may be accomplished by improving the technology, methodology, or materials for the designs currently in use or under development, developing key components and materials, and incorporating pilot production runs to validate technological approaches.

Payoff

Current mid IR lasers for DIRCM applications typically have limitations resulting from their use of nonlinear wavelength converters that require good thermal management that can add to the power consumption, size, and weight of the subsystem. These lasers are also limited in the wavelength range they can emit as well as their output power levels that can make them unsuitable for current DIRCM systems. Using novel approaches in mid IR laser development, a reduction in size and weight of the DIRCM laser transmitter subsystem can be realized while improving the wavelength and power requirements necessary for next generation DIRCM system.

Implementation

Lightweight, low cost mid IR lasers for DIRCM systems are applicable for any aircraft requiring protection against MANPADS threats. PMA 272's Strike and Assault DIRCM programs require mid IR laser subsystems that are both lightweight and low cost so they can be deployed on smaller aircraft. The subcontractor on this effort has extensive experience in current mid IR laser development and a novel technical approach to address the mechanical, electrical, and performance requirements of the Strike and Assault DIRCM programs. Platform insertion is planned as follows: AH-1W - Cobra assault helicopter – 2010; AH-1Z - Cobra – 2010; SH-60 Seahawk – 2010; and F/A 18 – 2012.

Advanced Manufacturing Technologies Create Cost Avoidance for N-UCAS

A2145 – N-UCAS, Phase II

Objective

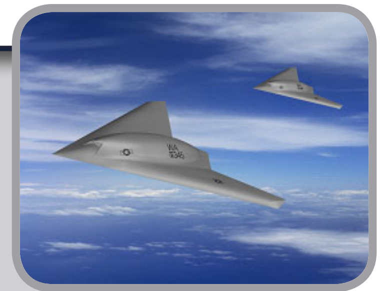
The purpose of this project is to reduce the weight and cost of airframe components through the utilization of advanced metalworking technologies. Two manufacturing technologies, advanced High Speed Machining (HSM) and Electron Beam Free Form Fabrication (EBFFF) were down selected during a prior concept exploration project for further evaluation in Phase I of this project. HSM will be utilized to manufacture ultra thin, aluminum spars. EBFFF technology will be utilized to produce lower-cost titanium components. Phase II of the project will build and test a full-scale significant structural component consisting of both metal and composite parts and demonstrate the applicability of the new metalworking technologies.

Payoff

Navy Metalworking Center (NMC) estimates that this project will result in significant acquisition cost avoidance and a 35% weight reduction of affected parts. In addition to the reduced fuel cost, the weight savings may lead to performance enhancements such as increased payload and endurance.

Implementation

The technical aspects of the System Design and Manufacturing Development (SDMD) will conclude with the full-scale demonstration of wing and fuselage structures. By inserting ManTech solutions early in the design process, this project will reduce life-cycle costs, preserve development schedules and promote timely transition to the N-UCAS Platform. The next opportunity to transition the SDMD technologies into the Navy UCAS Production Vehicle will be the follow-on System Design and Development phase.



Period of Performance:

November 2006 to April 2008

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

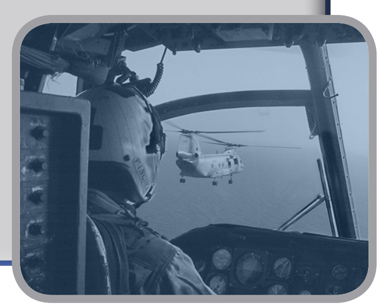
Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

N-UCAS Advanced Development Program Office

Total ManTech Investment:

$999,000



Production Yield Improvement Mitigates Cost and Delivery Risks

Period of Performance:

June 2006 to June 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

EMPF

Point of Contact:

Mr. Michael D. Frederickson
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mfrederickson@aciusa.org

Stakeholder:

NAVAIR PMA 234

Total ManTech Investment:

$770,000

A2146 – Manufacturability of Output Traveling Wave Tubes for Jammer Applications Phase 2

Objective

The EA-6B Prowler Band 4 Transmitter conducts support jamming against radar and communications threats. The output traveling wave tube (OTWT) is the final output stage of the Band 4 Transmitter's Radio Frequency (RF) amplifier chain. For the current OTWT design, manufacturing yield cannot keep pace with the Navy demand for spares to replace failed OTWTs. The goal of this project was to assist in the mitigation of cost and delivery risk for Band 4 Transmitter OTWTs, which will benefit procurement of other bands of Transmitter OTWTs, such as the Band 5/6.

Payoff

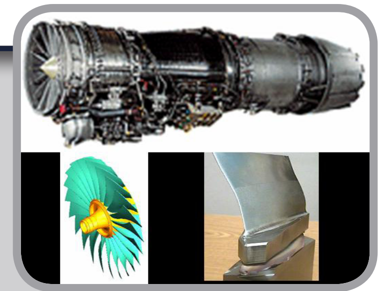
The main benefit of this effort was the improvement of the production yields of Band 4 OTWTs for the EA-6B Prowler aircraft. In the recent past, these yields were reported as less than 30%, presenting cost and delivery issues to the Navy. Improving yields of the current design as well as improving the readiness of potential replacement OTWT designs will significantly impact the availability of spare OTWTs for the Band 4 Transmitter. At the completion of this project, there was 100% yield on 2 OTWTs that were completed. The overall yield going forward is predicted to be at least 60%, which will be double the prior yields.

Implementation

Four manufacturing improvements - a new insertion machine, e-beam welding, laser striping, and metalizing of support rods - were implemented at L-3 Communications, the OTWT manufacturer. The initial two modernized OTWTs successfully passed both electrical and antenna functional testing at L-3. Success of this project is achieved when the following two criteria are accomplished; one, PMA 234 approves the improved OTWT and, two, the OTWT is installed into the EA-6B Prowler aircraft. To gain PMA 234 approval, vibration qualification testing of the improved OTWTs has started at NSWC (Crane) in Crane, Indiana. The improved OTWTs are scheduled to be installed on the EA-6B Prowler aircraft in April of 2008.

Fabrication and Repair of Turbine Bladed Disks Enabled By Translational Friction Welding

A2148 – Translational Friction Welding of Titanium Engine Blisks



Objective

A previous Navy Joining Center (NJC) project, A1008 Translational Friction Welding of Titanium Engine Blisks, developed the translational friction welding (TFW) process to attach individual airfoils to the disk hub or blisk for the upgraded F414 aircraft engines for the F/A-18E/F. The need to develop a procedure to remove and replace individual airfoils, which may be damaged in service, also was identified. Preliminary work established the requirements for further development to successfully achieve the goal of airfoil replacement. To date, this project has developed and demonstrated removal, low heat input restoration of the attachment area (stub), and re-welding of an airfoil using TFW. Initial development involved producing sub-scale, single-sector mock-up hardware. Process development and verification tests were performed to compare methods to produce low heat input build-ups on a blisk airfoil stub as a preparation for TFW blade replacement. Laser additive manufacturing (LAM) was selected as the preferred build-up process. Airfoils were attached to the restored stubs by TFW and evaluated to characterize quality, microstructure, and process capability. Based on successful completion of the single sector mock-up repair activities, a follow-on effort will be performed to demonstrate multiple airfoil replacement on a full-scale blisk.

Payoff

There will be a cost avoidance for engine repair and overhaul that is presently involved with blisk replacement. The potential for at least $1M / year in savings can be realized by salvage of ten (10) foreign object damaged (FOD) blisks per year.

Implementation

The TFW technology to manufacture welded blisks will be implemented in production by General Electric Aviation USA (GE) for the upgraded F414 aircraft engines for the F/A-18E/F in mid-2008. The repair technology will be implemented following successful repair of a full-scale blisk demonstrator blisk and subsequent component testing in late-2008.

Period of Performance:

July 2007 to January 2007

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

NJC

Point of Contact:

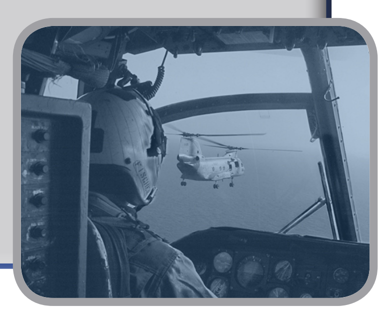
Mr. Timothy J. Trapp
(614) 688-5231
ttrapp@ewi.org

Stakeholder:

NAVAIR PMA 265
NAVAIR Joint Strike Fighter

Total ManTech Investment:

$482,000



Improved Manufacturing Methods Reduce Replacement Cost for Transmission Housings

Period of Performance:

May 2007 to March 2008

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

NMC

Point of Contact:

Dr. Daniel L. Winterscheidt
(814) 269-6840
winter@ctc.com

Stakeholder:

NAVAIR PMA 261

Total ManTech Investment:

$745,000

A2150 – Improved Manufacturing Materials and Processes for Corrosion Resistant Transmission Housings Phase I

Objective

The objective of this project is to evaluate methods to improve the CH-53E Sea Stallion transmission housing service life and life-cycle costs by focusing on production yield, corrosion and maintainability.

Payoff

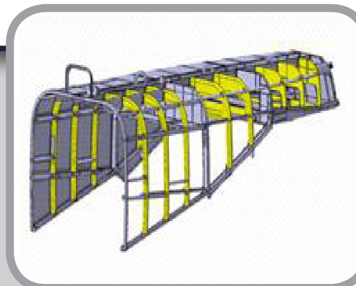
Cost avoidance will result from reduced cost of replacement transmission housings, including the cost of the housings themselves and the labor and out-of-service time required to remove, test and replace the housings. Additional cost avoidance will result from reduced removal of transmissions for repair of corrosion.

Implementation

Implementation through drop-in part replacements will be done through attrition. Maintenance organizations authorized to replace the housings will obtain the improved parts through normal spares orders. Improved repair methods may be implemented sooner through Local Engineering Specification changes.

Developments in Composite Frame Manufacturing Result in Both Weight and Cost Savings

A2151 – Composite Frame Manufacturing



Period of Performance:

April 2007 to October 2008

Platform:

NAVAIR

Affordability Focus Area:

Not Applicable

Center of Excellence:

CMTC

Point of Contact:

Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

Stakeholder:

NAVAIR PMA 275 (V-22)
NAVAIR PMA 261 (CH-53K)

Total ManTech Investment:

$3,446,000

Objective

Current frames are costly, heavy, and prone to fatigue and corrosion. The V-22 and CH-53K programs could benefit from a less expensive composite fabrication technology. Due to the inherent specific strength and stiffness properties of composites, an advanced composite solution will offset potential weight growth and provide margin for future capability upgrades to the aircraft. The objective of this project is to evaluate and mature candidate manufacturing technologies that offer significant cost reduction over traditional composite manufacturing processes. The technologies include: pultrusion of pre-impregnated material, 3-D braiding of complex shapes, SQRTM (Same Qualified Resin Transfer Molding), and other advanced RTM techniques. These developments will allow the weight benefits of composite to be realized at economic levels and will enable the V-22 and CH-53K program to insert composite frames where appropriate.

Payoff

For the V-22, a recent V-22 composite frames business case demonstrated a minimum of 30% potential cost savings by substituting an automated lay-up RTM process for a conventional composite process and a potential 40% cost savings when compared to aluminum frames. Additionally, the composite frame solution has the potential to lower O&S (Operations and Sustainment) costs by providing superior fatigue and corrosion properties. The O&S cost could be reduced further by the utilization of standard composite repair methods and procedures currently used on the V-22 program. Updated cost, benefits analysis will be included as part of the project and continuously updated. For the CH-53K, composite frames offer both weight savings and potentially cost savings for certain frames, including cabin lower beams, cabin upper beams, and aft transition frames.

Implementation

The V-22 project is scheduled for completion in June 2009, which is over one year prior to Lot 14 firm design configuration and over eighteen months prior to Lot 14 frame manufacturing. Transition at this point will provide adequate time for the V-22 Program to complete necessary design, manufacturing, and qualification activities in time for Lot 14 production allowing the cost benefits to be realized over approximately 100 fuselage shipsets. The transition for CH-53K will occur after the interim program gate review scheduled for the first quarter of CY2008. Within that time frame, a recommendation to proceed will be presented, supported by a business case assessment that balances weight and unit cost savings against non-recurring implementation costs. Additional applications requiring greater levels of technology maturation will be evaluated at the program final briefing to be held in early 2009, and prior to the CH-53K Critical Design Review. Major CH-53K airframe subcontractors have been made aware of and are actively participating in the ManTech program as part of their ongoing CAIV task statement of work. This will ensure not only endorsement of the technology by the Navy and Sikorsky Aircraft but by the program major subcontractors who are responsible for detail design and delivery of major aircraft sections such as the cabin, cockpit, aft transition, etc.

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NAVSEA – Other Projects

Project Number	Project Title	Page Number
S2060	Hybrid Laser / GMA Pipe Welding System (ARL)	104
S2107	Nested Material Manufacturing Technology Improvement	105

NAVSEA – Other

Hybrid Welding Decreases Processing Time and Reduces Rework

Period of Performance:

November 2004 to
November 2007

Platform:

NAVSEA – Other

Affordability Focus Area:

Materials / Process
Improvements

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA (PEO Ships)

Total ManTech Investment:

$2,133,000

S2060 – Hybrid Laser / GMA Pipe Welding System (ARL)

Objective

Current pipe welding procedures involve beveled joints using flux-core arc welding (FCAW), gas-metal arc welding (GMAW), or gas-tungsten arc welding (GTAW). These multiple-pass welds are very time-consuming, and the resulting frequent starts and stops are a source of many defects in final products. The Applied Research Laboratory (ARL) at Penn State University is leading a team that includes National Steel and Shipbuilding Company (NASSCO) to design and build a hybrid laser / GMAW system that combines the deep keyhole penetration of laser welding with the high metal deposition rate of GMAW to enable single-pass butt welding of pipe. NASSCO will conduct a three-month demonstration of the hybrid system using shipyard welders in a production environment as part of the T-AKE combat logistics ship construction program.

Payoff

The hybrid method will significantly decrease weld processing time and is expected to reduce rework by eliminating many of the weld defects that result from the frequent starts and stops required by multi-pass welding. The project team estimates reduction of approximately 100,000 hours and 15,000 pounds of weld wire over five years, totaling over $6M in cost avoidance.

Implementation

The system was successfully installed and tested at Penn State ARL and later transferred to NASSCO's pipe shop. NASSCO completed some additional parameter development and completed several hundred welds, first in a pre-production environment, and after qualifying the procedures with the American Bureau of Shipping, in a production environment as well. CNST, Penn State ARL and NASSCO are currently investigating options for shipyard implementation once the project ends in November 2007.

Automated Pipe Nesting Technology Improves Efficiency in T-AKE Pipe Spool Manufacturing

S2107 – Nested Material Manufacturing Technology Improvement

Objective

The National Steel and Shipbuilding Company (NASSCO) will develop and implement an automated pipe nesting process for use in building the T-AKE-class ships. This automated pipe fabrication planning system will combine defined rules for pipe component routing and nesting with the ability to account for work plan changes, emerging schedule changes, and shop loading. NASSCO will evaluate two alternatives for configuring a pipe nesting data system. The first alternative employs the MAC-PAC system for material requirements planning and production control. This system explores bills of material in accordance with end-item schedules and manufacturing routings. The system outputs individually scheduled shop orders describing each task to be performed in the construction of the end-item, and ultimately the entire ship. The second option, referred to as Shop Nesting, generates manufacture orders for pipe spools in MAC-PAC as is done currently. Then, released manufacture orders are input to a new system that maintains pipe requirements data for all released manufacture orders in a database, evaluates the manufacturing process requirements of each stored data set, groups pipe pieces with like manufacturing requirements and material, and then nests those pieces together onto available pipe stock.

Payoff

This project will result in overall improvements in scrap rate reduction, lowering the recurring cost of manual pipe nesting and work planning and the end-to-end production efficiency of pipe spools. There are approximately 22,400 pipe spools on each T-AKE vessel. The average labor required to produce a pipe spool is 5.4 man-hours. Improvement in efficiency of the eligible spools would result in a total $5.5M adjusted cost avoidance and $219K in recurring labor cost (nesting and planning) for a five year period. Tighter schedule adherence, greater material availability at the next stage of construction, and greater work plan stability would result from the implementation of an automated pipe nesting process.

Implementation

Implementation of the new capacity planning and pipe nesting procedures (using the prototype version) was started in January for pipe spools routed to the "large bore" work center. The project team kept statistics on the actual operations in that work center and assessed the fidelity of those operations with the plan. Valuable insight was gained into the effects of continued near term schedule instability on operational fidelity with the plan. Full-scale implementation of the Pipe Shop Management System started in July and is intended to validate the new process to the full adaptation of the new process by the Pipe Shop Planners. NASSCO will collect performance data from the results of spool fabrication performed by the plans created by the new system to quantify the improvement achieved.

Period of Performance:

February 2006 to November 2007

Platform:

NAVSEA – Other

Affordability Focus Area:

Production Engineering

Center of Excellence:

CNST

Point of Contact:

Mr. Kevin Carpentier
(843) 760-4364
carpentier@aticorp.org

Stakeholder:

NAVSEA (PEO Ships)

Total ManTech Investment:

$661,000

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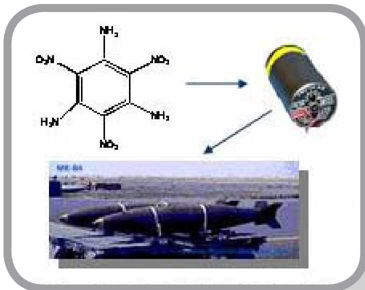
Energetics Projects

Energetics

Synthesis Technology Provides Readily Available Domestic Source of TATB Explosive



Period of Performance:

November 2000 to January 2008

Platform:

Energetics

Affordability Focus Area:

Not Applicable

Center of Excellence:

EMTC

Point of Contact:

Mr. Charles R. Painter
(301) 744-6772

Stakeholder:

NAVAIR (PMA 201)

Total ManTech Investment:

$3,018,000

A0983 – Alternative Manufacture of Energetic Material TATB

Objective

Triamino-trinitrobenzene (TATB) is one of the least sensitive explosive materials known and is a critical ingredient in the booster explosive PBXN-7, used in bomb and missile fuzes. However, availability and cost issues have limited its use. All U.S. sources for this material have ceased production, primarily due to environmental issues with the current manufacturing routes. The objective of this project was to investigate and evaluate several alternative TATB chemical synthesis processes, to determine the best approach, scale-up, and demonstrate the process at full production scale.

Payoff

A secure and readily available domestic source for TATB in required quantities at a reasonable cost has been implemented. The completion of this project provides the Navy and DoD, not only a qualified domestic source for this critical material, but also replaces the only previously qualified source that closed abruptly in 2005 without prior notice.

Implementation

The ATK Thiokol Propulsion synthesis technology was determined to be the best synthesis route based on product quality and suitability, process engineering data, the ability of the proposed plan to meet acquisition requirements, and cost. ATK Thiokol developed the process from lab to production scale while improving on the safety and efficiency of the TATB manufacturing process and completing the 500-gallon full-scale demonstration. Testing and evaluation of the resulting TATB product is currently underway at Naval Air Warfare Center, Weapons Division (NAWCWD) and Naval Surface Warfare Center, Indian Head Division (NSWCIHD), with positive results thus far. Subsequent to the start of the ManTech project, BAE Systems, Ordnance Systems Incorporated (OSI), contract operator of the Holston Army Ammunition Plant, independently had success in developing another synthesis route to manufacture TATB. PBXN-7 has been manufactured using both ATK and OSI TATB, and, currently, a side-by-side evaluation of both TATB products and the qualification of PBXN-7 made with both ATK and OSI TATB are being performed. The new TATB specification and qualification of the PBXN-7 is expected to be completed in January 2008. This provides the DoD and DoE with multiple procurement options for TATB and also provides the Navy and the Air Force with procurement opportunities for PBXN-7 to support bomb fuze programs such as the FMU-139, the FMU-143, and the FMU-152 Joint Programmable Fuze. These fuzes are used in the Joint Direct Attack Munition (JDAM) and the laser guided bomb (LGB). PBXN-7 is also used in fuze boosters for missile systems such as the Tomahawk Land Attack Missile (TLAM), and the Stand-off Land Attack Missile Expanded Response (SLAM-ER).

Continuous Extrusion Process Enhances Safety and Efficiency of Propellants

S0984 – Flexible Manufacturing of Nitrogen Based Gun Propellants (Flex Man)

Objective

Continuous processing is a revolutionary lower-cost technology being used for the manufacture of gun propellants and other energetic materials. Navy systems such as the Extended Range Munition (ERM) and the Advanced Gun System (AGS) require higher-performing gun propellants to increase stand-off range and to engage targets further inland. Novel propellant formulations and geometries, such as propellants that include high nitrogen ingredients and co-layered propellants, have the potential to offer this higher performance while also decreasing gun barrel erosion and improving sensitivity. The objective of this project is the development of a continuous process to manufacture low cost, high volume nitrogen-based gun propellants, including a co-extrusion process for the manufacture of co-layered propellants.

Payoff

The primary focus is to establish the manufacturing capability to produce energetics using continuous extrusion processes. As an added benefit, cost avoidances of approximately 25% are historically realized when switching from conventional batch processes to a continuous extrusion process. Operating efficiency is obtained by replacing numerous labor-intensive operations of the batch process with a single automated process. Lower environmental costs are derived from reducing explosive waste and eliminating waste solvents. Enhanced operator safety is realized because the continuous process incorporates remote and automatic control. Improved reliability results from better dimensional control of the propellant and improved product quality.

Implementation

The process development and demonstration will be conducted at Naval Surface Warfare Center, Indian Head Division (NSWCIHD) by mid-2009. This technology will be implemented for numerous Navy programs, including the Extended Range Munition (ERM), the High Energy BB round, and the Extended Range Long Range Land Attack Projectile (ER-LRLAP) for AGS. The High Energy BB round and the ER-LRLAP are being developed in parallel with this propellant manufacturing technology. ERM will go into production in 2012, but qualification of this unit will take place in 2010. After a successful demonstration, the process will be transitioned to an energetics manufacturer. If a willing industrial source cannot be found, NSWCIHD will implement this technology into production.

Period of Performance:

April 2001 to March 2009

Platform:

Energetics

Affordability Focus Area:

Not Applicable

Center of Excellence:

EMTC

Point of Contact:

Mr. Charles R. Painter
(301) 744-6772

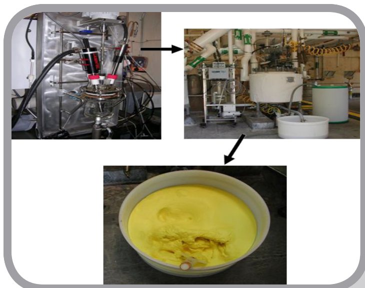
Stakeholder:

NAVSEA (PEO IWS3C)

Total ManTech Investment:

$6,409,000

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



Period of Performance:

June 2006 to February 2009

Platform:

Energetics

Affordability Focus Area:

Not Applicable

Center of Excellence:

EMTC

Point of Contact:

Mr. Charles R. Painter
(301) 744-6772

Stakeholder:

NAVSEA (PEO IWS3C)

Total ManTech Investment:

$2,792,000

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

Objective

The manufacturing processes and cost of emerging, novel energetic materials poses a challenge for transition into fleet applications. The requirements for high performance gun propellants require the use of novel ingredients and processing techniques. This project will develop and establish a flexible manufacturing capability using real time analytical tools for the optimization and scale-up of state-of-the-art energetic materials such as Guanidinium Azotetrazolate (GUZT), one of several specific energetic ingredients being addressed. GUZT is a high-nitrogen material with potential application as a burning-rate modifier in gun propellants and ingredient for explosives. It appeals to the energetics community because of its straightforward synthesis and relative insensitivity to friction and impact.

Payoff

Real-time analytical tools aid in producing these state-of-the-art materials at the multi-kilogram scale to support research and development formulation efforts and are easing the transition from development to production. Based on the use of these tools, synthesis modifications can be incorporated to lower manufacturing costs by improving operating efficiency and enhancing safety. Optimizing the synthesis process will reduce labor cost as more GUZT is produced per batch. The overall cost avoidance is based on reduced labor requirements, increased product yields and quantities, reduced explosive waste, and improved product quality. The increased capabilities afford a more efficient, advanced manufacturing process for GUZT. The use of automation also reduces human error as well as removes the operator from a hazardous environment.

Implementation

The process development and demonstration will be conducted at the Naval Surface Warfare Center, Indian Head Division (NSWCIHD). The process will be ready for testing at the 500-gallon scale in FY09. At this time, the intent is to solicit industry partners for interest in manufacturing GUZT at their respective facilities. In FY09, a technical data package will be provided to Navy ManTech for transition of the process to any interested industry partner in support of Advanced Gun Propellants. If a willing industrial source cannot be found, NSWCIHD will implement this technology into production. This technology is planned for Navy programs such as the Extended Range Munition (ERM) and the Extended Range Long Range Land Attack Projectile (ER-LRLAP) for Advanced Gun Systems (AGS).

REPTECH Projects

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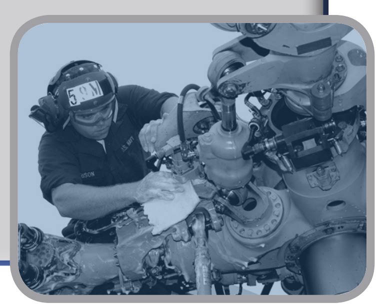
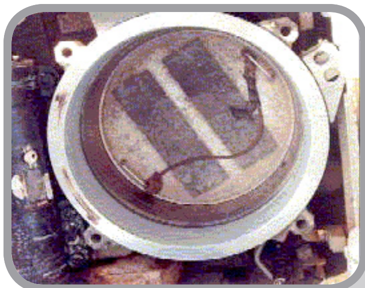
REPTECH



Laser-Based Repair Reduces Life-Cycle Cost and Optimizes Operational Readiness



Period of Performance:

December 2000 to
December 2007

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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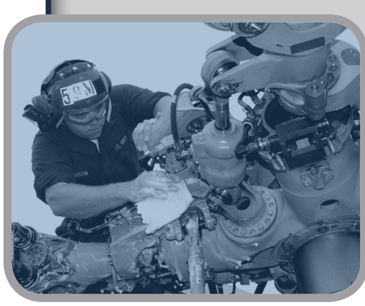
Stakeholder:

COMSUBPAC
NAVSEA SEA 04X2E

Total ManTech Investment:

$1,575,000



S0994 – VLS Tube Repair

Objective

Vertical Launch Systems (VLS) on 688-class submarines are experiencing corrosion damage in missile tube areas. This affects both the weapon system's availability during deployment and maintenance costs pierside. Severe corrosion can result in missile tubes placed out of service until the vessel returns to port. At a minimum, this corrosion damage is resulting in an increased maintenance burden with significant repair costs. The objective of this project is to qualify a laser cladding process to apply a superior method of corrosion protection to the affected VLS tube areas using technology developed at the Applied Research Laboratory (ARL) at Penn State.

Payoff

Benefits of the laser cladding process include a 50% reduction in repair time and an increase in durability to a level equivalent or better than the originally delivered tubes. A laser-based repair will decrease repair costs by reducing the labor necessary to accomplish a repair and by extending the time between repairs. Operational readiness and weapon system reliability will be optimized by this improved process while reducing life-cycle costs. Each submarine has 12 VLS tubes. Assuming shipyard worker direct time to amount to $100 per hour, the cost avoidance per tube will be $18K for a total of $216K per sub. Seventeen subs in the Pacific Fleet will benefit from VLS tube recladding in the next five years, according to schedule availabilities, for a total cost avoidance of over $3.6M.

Implementation

The repair process will be implemented at Pearl Harbor Naval Shipyard (PHNSY) in FY07 with the purchase of a laser machine. Naval Undersea Warfare Center-Keyport will deliver an automated tool that will prep, weld, and grind the VLS seal band area. The Institute for Manufacturing and Sustainment Technologies (iMAST) has established and reported baseline corrosion data to guide the selection of repair material. SEA 05M approval procedures have been established as a supplement to MIL-STD-248 pending any necessary further approval. Regular team meetings are held with formal program reviews to keep the implementation on track. Beta system tool hardware is complete, and integration is nearing completion. The final delivery of the system to PHNSY is expected to occur in December 2007.

New Depainting Process Proves To Be Cost-Effective and Environmentally Friendly

A1014 – Helicopter Blade Refurbishment

Objective
Numerous depainting technologies exist for stripping of helicopter blades requiring refurbishment. The objective of this project has been to analyze available refurbishment methods, select an optimal cost-effective technology process, and help implement the designated process for application on Sikorsky CH-53E helicopter main rotor blades inducted at Fleet Readiness Center East (FRC) Cherry Point (FRC-CP). Previous analysis of a laser-based coating removal (LBCR) technology process was demonstrated and found to be a viable, environmentally friendly alternative to the current conventional blade stripping process. Testing, in accordance with Sikorsky Aircraft specifications, indicates no damage to the substrate will occur relative to the laser stripping process. Laser-based coating removal, therefore, has been identified as the preferred process for implementation. An original equipment manufacturer (OEM)-approved test plan has been carried out, with promising results.

Payoff
The successful completion of this project will result in a viable cost-avoidance. It will also have a beneficial environmental impact relative to worker health and safety concerns. The qualification of a LBCR OEM-approved technology will result in an estimated reduction in processing time from 20 hours per blade to less than two hours per blade (90% reduction). A cost avoidance of approximately $908K per year is anticipated.

Implementation
After successfully proving the new process is both cost-effective and meets requirements established by the Naval Air Systems Command (NAVAIR), the Institute for Manufacturing and Sustainment Technologies (iMAST) is working closely with the system integrator and FRC-CP personnel to design a system that accommodates production flow. A full-scale production system will be installed and integrated at FRC-CP for operational analysis during early FY08. FRC-CP has allocated approximately $100K from internal funds to support facilitization of this effort. A capital equipment outlay has been earmarked for the purchase a LBCR system. A three-month production evaluation is planned to quantify the cost avoidance estimate and further identify potential improvements. Working with National Center for Manufacturing Sciences / Commercial Technology for Maintenance Activities (NCMS / CTMA) team members (Sikorsky, General Lasertronics Corporation, Naval Undersea Warfare Center-Keyport, and Koops System Integrators) adds additional technical guidance, financial support, and eventual commercial suppliers for the technology transition.

Period of Performance:

June 2002 to January 2009

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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Stakeholder:

FRC-CP (Cherry Point)

Total ManTech Investment:

$833,000

Corrosion-Resistant Coatings Increase Lifetimes of Turbine Components

Period of Performance:

January 2003 to September 2007

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

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Stakeholder:

NAVSEA PMS 400

Total ManTech Investment:

$1,673,000

S1017 – Hot Section Corrosion Protection for 501-K34 Gas Turbine

Objective

The overall project objective was to identify a corrosion resistant thermal barrier coating (TBC) system and deposition manufacturing method that would extend the life of 501-K34 gas turbine engine components to 20,000 under Type I and Type II hot corrosion environments, and also allow using low quality fuel. This effort is applicable to next generation marine engines that will operate at much higher temperatures. It is desirable to have a corrosion resistant coating system available for marine gas turbine engine hardware as sustained higher turbine inlet temperatures and thermal cyclic mission temperatures are required. Another project objective was to identify an alternative metallic coating process for various engine components as the present method is being phased out by industry. The primary goal of the joint collaborative efforts between NAVAIR and NAVSEA engine programs is to select and screen candidate coating material systems for use on engine components under various temperature classifications regimes and coating classifications.

Payoff

The current life of turbine components can be increased by almost three times through the use of environmental barrier coatings, thereby resulting in life-cycle cost savings. Assuming 102 platforms with a 25% failure rate every 2.5 years at $250K per repair, current repair costs are $2.55M per year. Fully implementing this project would generate a cost avoidance of approximately $1.68M per year. Corrosion-resistant coatings can also reduce power loss due to material corrosion, reduce down-time for repair, and allow use of less costly fuels.

Implementation

Joint discussion and collaboration efforts with NAVSEA, NAVAIR, Foreign Comparative Test (FCT) Program, and the Navy ManTech engine program provided iMAST an opportunity to assist in identifying alternative metallic coatings and materials and coating deposition processes for improved performance against hot corrosion. In an effort to maximize resource dollars, the Navy ManTech Program collaborated with the FCT Program to test and evaluate the best coating systems for different engine base alloys, temperature ranges, and coating classifications. Various prescreening selections were made on MCrAlX composition applied by various coating techniques to replace the current argon shielded and electron beam physical vapor deposition technique of metallic alloys that is being phased out. The ManTech / FCT burner rig tests showed that Pratt and Whitney's Coating A applied by cathodic arc performed well, and this coating was identified as a go-forward coating for 501K-34 2nd stage vane and blade hardware at engine overhaul. In addition, an Iowa State University coating composition showed outstanding protection against hot corrosion and is an area for follow-on efforts. Based on numerous internal reports, data, testing and analysis, combined with favorable coating microstructures, thickness profiles, and burner rig test results conducted by Pratt and Whitney, Pratt and Whitney's Coating A was transitioned to Stage II blades and vanes for the 501-K34 engine as a repair technology in the Spring of 2007.

Flexible, Accurate Technology Simplifies Alignment and Inspection Procedures

S2025 – Alignments and Inspections

Objective

This project is conducting assessments of four alignment and inspection (A&I) procedures routinely carried out during the maintenance of submarines. The project objective is to identify technologies and establish goals and metrics for dramatically reducing the time and/or costs associated with these procedures. One method currently under investigation is the Faro Portable Coordinate Measuring Machine coupled with the Faro Xi Laser Tracker. This approach provides the capability to measure both near and far field components quickly and at a reduced overall A&I cost. The first step is to perform interviews with technical personnel from the four public shipyards regarding their current Alignment and Inspection (A&I) practices. Next, the project will identify potential solutions for improving the A&I capabilities in the shipyards. The project will address A&I applications such as hull circularities, torpedo tubes, sail, and snorkel, dive planes, and shaft sustainment, and provide demonstrations and recommend solutions for the identified applications. The project is expected to provide return on investment (ROI) justification for acquisition of the identified solution.

Payoff

A significant goal associated with these technologies is the reduction of the number of fixtures required to perform the A&I. Cost avoidance will be considerable, because these fixtures need to be delivered and brought on board the submarine numerous times at each of the four shipyards. Benefits may also include a simplification of A&I procedures at naval shipyards and an improvement in the quality of A&I processes. Using data gathered to date during the project, the cost avoidance per submarine is expected to be approximately $236K and is realized by reducing the time and manpower requirements to gather alignment and inspection data during each submarine maintenance cycle. With 20 assumed submarine availabilities, total cost avoidance would be over $4.7M.

Implementation

Portable Coordinate Measuring Machines provide the flexibility, portability, speed, repeatability and accuracy to perform alignment and inspection tasks. Demonstrations have been coordinated for evaluation and technology identification during the year. Thus far, demonstrations have been held at Puget Sound, Pearl Harbor, and Portsmouth Naval Shipyards (NSYs). The final demonstration was scheduled for Norfolk NSY in October 2006. As a result of these demonstrations, Puget Sound has purchased two laser trackers, and the three other shipyards are planning to purchase similar equipment in the future.

Period of Performance:

May 2004 to September 2007

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

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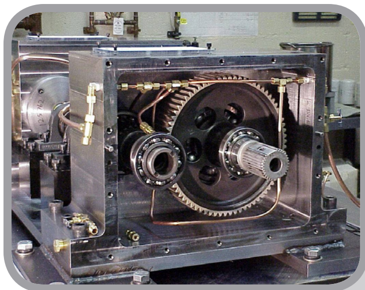
Stakeholder:

Naval Shipyards

Total ManTech Investment:

$473,000



Super Finishing Improves Surface Endurance of Helicopter Gears

A2028 – CH-46 Gear Repair

Period of Performance:

March 2004 to
January 2007

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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tbd14@psu.edu

Stakeholder:

NAWC – Patuxent (TACAIR)

Total ManTech Investment:

$485,000

Objective

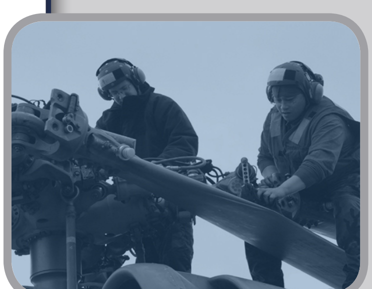
Helicopter gears that are currently being scrapped can be salvaged and re-used with considerable avoidance in procurement and maintenance costs by using the "Super Finishing Process" from REM Chemicals. In this project, the "Super Finishing Process" process was qualified by comparing the dimensions, geometry, metallurgical features, and operational properties (such as bending fatigue, contact fatigue, scoring, and heat loss) of refurbished gears with those of new gears supplied by approved Navy vendors. REM Chemicals, the industrial partner, participated in the execution of this project.

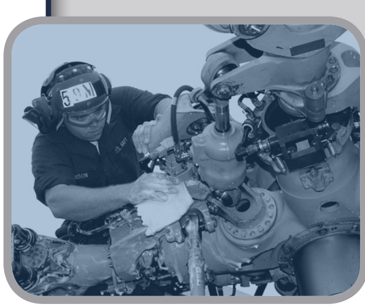
Payoff

Due to foreign object and other surface damage, the Fleet Readiness Center East at Cherry Point (FRC-CP) scraps approximately $1.1M in CH-46 aft transmission input pinions and sun gears on an annual basis. Initial analysis of these "scrap" gears indicates that approximately 50% of these gears can be salvaged, resulting in a cost avoidance of $622K per year. Super finished gears have demonstrated at least a threefold improvement in surface endurance. Anecdotal evidence suggests a 15% reduction in heat losses in the mesh compared to conventionally ground gears. Successful implementation of this project will allow this concept to be applied to other gears on the CH-46 and other helicopters, with further increase in payoff to the Navy and DoD.

Implementation

Testing of new and salvaged gears has been completed. The Naval Air Systems Command (NAVAIR) is reviewing the test data to determine whether an "endurance test plan" (180-hour gear box test) will be conducted. If the repaired gears are tested and found to be satisfactory, flight clearance will be considered. Implementation would be at FRC-CP. The process, as previously noted, will also be available for repair of other aircraft types having similar repair issues.





Erosion Resistant Coatings Avoid Costs and Improve Service Life of Aircraft Compressors

A2087 – Erosion Resistant Coatings for Stage I-Compressor Components

Objective

When aircraft take off and land, vortexes are formed which often result in the ingestion of hard solid particles of sand, dust, and ice into the air flow. 1st stage compressor components of T700 helicopter engines exhibit leading edge curl damage believed to be associated with high angle (60-90 degrees) and large particle impingement of erosive media. Decreased service life and increased maintenance costs occur as the realized time-of-flight is only half of that expected (2,500 hours vs 5000 hours). In some aggressive environments (like Iraq and Afghanistan), only about 100 hours of flight time (50 times less than expected) are achieved before significant maintenance is required to return the aircraft to flying status. The objective of this project is to better understand the leading edge curl phenomena, identify a duplex erosion resistant coating that survives high angle impingement of erosive media, and to develop a manufacturing method / process for applying duplex or multi-layer erosion resistant coatings with improved erosion resistance over a wide range of hard particle impingement angles (20-90 degrees).

Payoff

The anticipated cost avoidance for the SH-60B, SH-60F, and HH-60H helicopters was calculated based on the total number of engine removals to be avoided due to increase in mean time since engine removal (MTSR) associated with the improved configuration. Over a ten year period, the total cost avoidance is anticipated to be $20.5M.

Implementation

The final product goal will be in applying erosion resistant coating system to 1st stage compressor blisk (i.e., prototype hardware) that will be tested at Naval Air Systems Command (NAVAIR) in an erosion rig. The performance goal of the coated prototype hardware will be to achieve a minimum of 1000 hours of operation or a minimum improvement of 2x measured by time-on-wing. If the performance goal is met, ARL-PSU will continue to work with NAVAIR and MDS PRAD to qualify the material system, manufacturing process, and coated hardware via CIP testing / funding. MDS-PRAD has significant prior experience with implementing coatings for T58 and T64 helicopter engines. The current project will assist in establishing a manufacturing company capable of coating T700 engine blisks and meet the project's technology transfer and implementation objectives.

Period of Performance:

April 2005 to July 2008

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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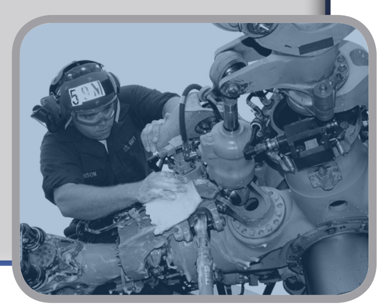
Stakeholder:

NAVAIR

Total ManTech Investment:

$1,539,000



High Velocity Particle Consolidation Application Prevents Corrosion

Period of Performance:

May 2006 to September 2008

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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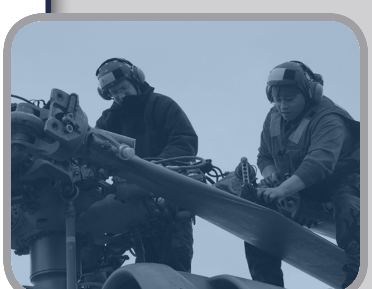
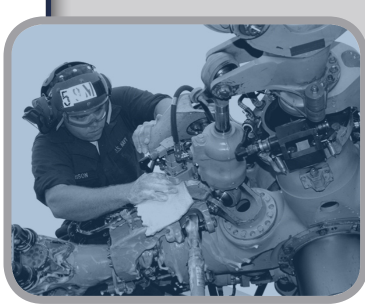
Stakeholder:

NAVAIR 4.4.2.3

Total ManTech Investment:

$550,000





A2138 – Corrosion Resistant Coatings for Magnesium Transmission Gear Boxes for SH 60

Objective

Main gearbox transmission housings are made of cast ZE 41 magnesium alloy. During operation, the magnesium alloy is subject to corrosion and pitting damage. When damage reaches critical levels, the component must be replaced with a new component. The objective of this effort is to develop a coating process that will repair damaged components and return them to service. The repair process will be based on High Velocity Particle Consolidation (HVPC) or Cold Spray.

Payoff

It is estimated that approximately 33% of the transmission housings that have gone through the repair facility have been replaced due to severe corrosion / damage. The average cost of replacement is $20K per component, leading to total annual replacement cost expenditures of $4M. Approximately 60% of the scrapped housings can be recovered using the HVPC repair process. The cost of applying a coating to a housing is estimated to be $500. Anticipated cost avoidance is $2.34M per year. The repair of transmission housings will increase readiness by extending the life of the housings and reducing maintenance / replacement costs.

Implementation

Implementation will be accomplished at the Fleet Readiness Center (FRC) East at Cherry Point, N.C. A coating system has been purchased through the Environmental Security Technology Certification Program (ESTPC) and is being installed at FRC East. The process for coating the SH-60 transmission housings will be fully transitioned to FRC East personnel.

Discrete Event Simulation Models Identify Improved Painting Processes for Combat Vehicles

C2142 – Clean & Paint Lean Production Optimization

Objective

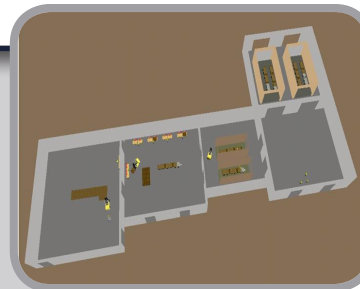
The U. S. Marine Corps (USMC) Maintenance Center Albany remanufactures and repairs over 1,000 ground combat vehicles each year to support Operation Iraqi Freedom (OIF). The Clean / Paint or "Backshop" areas are considered bottlenecks in the depot process critical path. Any improvements to the ++ areas can be translated into cost-avoidance or increased output of USMC Ground Vehicles to support OIF. The objective of this project was to develop, test, and validate process improvement and optimization initiatives using Discrete Event Simulation (DES) for implementation within the Clean / Paint shops at USMC Albany Maintenance Center. Baseline simulation models were developed and used for comparison with proposed process changes in the backshop areas. Targeted areas of improvement were standardized single coat painting processes, semi-automation of the component painting process, and increased camouflage painting capacity.

Payoff

With an established baseline of 1,048 vehicles (LAV, AAV, MK-48 LVS, 7.5 Ton, M-88 Recovery Vehicle, AN / TRC 170, HEMTT, M9-ACE, LVS, LAUNCHER and MTVRs) manufactured per year, current manufacturing costs are approximately $21.9M annually. With the proposed process improvements, total manufacturing costs are estimated to be $18.5M per year, a cost avoidance of $3.4M. Qualitative benefits include improved ease of operations, reduced rework required to achieve acceptable quality in the blast and paint effort, reduced need for unplanned repair, and an improved asset through-put schedule.

Implementation

USMC and iMAST have partnered to identify potential process optimizations and improvement areas within the USMC Backshops, USMC personnel have committed to provide detailed system input, process times, and resource requirements for formulating DES models. USMC stakeholders appointed a lead engineer for transitioning the simulation models developed. Due to the nature of this project, results were implemented as solutions were identified through the DES models. Some examples of improvements identified through the DES models include a 30% increase in overall camouflage painting capacity, resulting in an ability to paint 241 additional vehicles per year. The implementation of a single component paint process (versus the current plural component) also resulted in a 25% reduction in drying time, accommodating the production of 16 more vehicles annually.



Period of Performance:

February 2006 to
October 2007

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
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Stakeholder:

U.S. Marine Corps
Maintenance Directorate

Total ManTech Investment:

$395,000

Paint Application System to Increase Transfer Efficiency to 95% or Greater

Period of Performance:

October 2006 to
November 2007

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

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Stakeholder:

NAVAIR, MARCOR, NAVSEA

S2176 – Effervescent Paint Application System

Objective

The application of maintenance coatings to ships, submarines, tanks and other weapon systems is performed almost exclusively using the airless paint spray process. The transfer efficiency of the airless paint spray process is dependent upon a variety of factors but is generally accepted as being within the range of 40%-60%. Transfer efficiency is the ratio of coating solids deposited on a substrate to the total weight of coatings solids used in the coating application step, expressed as a percentage. The primary source of material loss during the airless paint spray process is due to overspray. The goal of this project is to develop a paint application system to significantly reduce or eliminate overspray from industrial processes and thereby increase transfer efficiency to 95% or greater. The process developed will be a paint spray application system having transfer efficiency in excess of 95%. This technology has been proven feasible through work performed at Applied Research Laboratory (ARL) at Penn State University.

Payoff

Reducing or eliminating overspray from these industrial processes will have the following beneficial outcomes: reduce material usage and the associated (potentially hazardous) waste strears; reduce VOC usage and accidental release of copper particulates during hull-maintenance activities; and reduce cleanup costs associated with paint overspray. The cost benefit analysis based on a single medium-sized shipyard using approximately 30,000 gallons of paint per year in the building and repair of ships shows estimated cost avoidance (materials and car detailing) for this project will be $593.4K.

Implementation

The prototype industrial paint spray system will be developed in consultation with paint shop personnel at the Puget Sound Naval Shipyard in the 1st Quarter of FY08. Following successful demonstration the commercial paint system configuration will be finalized and a production unit will be fabricated. Once the final production unit has been tested, and validated, implementation will proceed. FY08 Pollution Abatement Ashore (PAA) funding is being sought for implementation in FY08. One or more production jobs will be identified for demonstration / implementation at the Puget Sound Naval Shipyard in the 3rd Quarter of FY08. Ample testing will be performed to identify reduction of overspray volume / improved material usage for various Mil-Spec coatings. This technology represents one of many similar methods that coatings and adhesives may be applied to DoD assets, as well as DOT and municipal structures. This spray system will operate and function in a similar manner to current airless spray systems. The only differences will be a reduction in overspray, improved material usage, reduction in cleanup costs and reduced environmental impact. This spray application technology does not modify or alter the chemistry or physical properties of the materials being processed. For these reasons, no changes to specifications, standards, process instructions, etc. will be required. Implementation of this technology at DoD maintenance facilities other than Puget Sound Naval Shipyard will be accomplished through the simple expedient of purchasing a spray system, and applying current Mil-Spec coatings to current weapon systems and support equipment.

Blade Repair Process Saves up to $2.4M / Year in Cost

A2177 – F402 Compressor Blade Repair

Objective

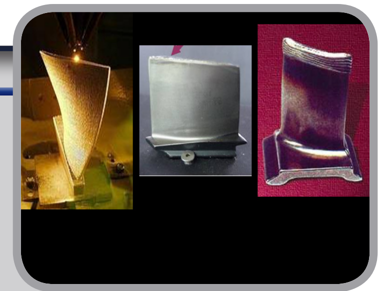
The project objective is to evaluate and implement a mature additive repair process and non-destructive inspection technique for the repair of high pressure compressor blade tips in the AV-8B harrier's F402 engine.

Payoff

The primary payoff is cost avoidance by repairing worn blade tips instead of replacing them. In addition, the original equipment manufacturer (OEM) of new blades has indicated that the Navy's demand for new blades will not be met due to manufacturing issues. The repair and inspection process will increase the operational fleet size and save up to $2.4M / year in operational costs associated with replacing blades. A successful repair process will impact other aero-engine systems such as the T700 and F-18.

Implementation

The outcome of this project will be a repair and inspection process for high HPC blade tips that provides flight assurance to the F402 Fleet Support Team (FST) and FRC-East, while reducing life-cycle maintenance costs and mitigating a future supply chain crisis. Implementation is achieved when (1) FRC-East acquires the equipment necessary to perform the repair and inspection process, (2) FRC-East produces qualification test samples according to the ManTech developed Pilot Qualification Plan, and (3) the F402-FST and PMA-257 qualify the repair and inspection process. Final implementation is expected to occur in early FY10.



Period of Performance:

March 2007 to
September 2009

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

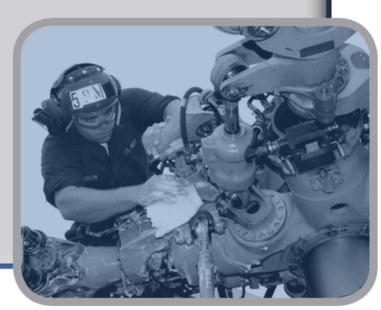
Mr. Tim Bair
(814) 863-3880
tbd14@psu.edu

Stakeholder:

NAVAIR

Total ManTech Investment:

$500,000



In-Situ Repair Process Has Potential Cost Avoidance of $1.28M per Year

MSW Valve

Period of Performance:

May 2007 to February 2009

Platform:

REPTECH

Affordability Focus Area:

Not Applicable

Center of Excellence:

iMAST

Point of Contact:

Mr. Tim Bair
(814) 863-3880
tbd14@psu.edu

Stakeholder:

Philadelphia Naval Shipyard (PHNSY) / Intermediate Navy Activity (IMA)

Total ManTech Investment:

$275,000

S2178 – In-Situ Strategic Repair Process

Objective

The primary tactical objective is to improve affordability life-cycle cost of submarines by developing a method to reduce cost of repair of auxiliary seawater / main seawater (ASW / MSW) valves by designing, building, testing, and implementing a flexible tool for in-situ repair. New alloys could further reduce costs by lengthening the time between repairs. The secondary strategic objective is to begin to develop a broad base of in-situ repair technologies using a cross-functional approach.

Payoff

ASW / MSW valves have been identified as requiring 3,390 man-hours per vessel, and were identified by the Executive Planning Sessions as being a "Top Priority Improvement Candidate". Based on a 30% reduction in repair cost, estimated cost avoidance for the Navy is $1.28M / yr.

Implementation

Implementation details will be developed during the first portion of the project as the Detailed Project Plan is assembled.

Other Projects

Other

BMPCOE Enables Best Practices and Enhances Technology Transfer

Period of Performance:

August 1993 to Present

Platform:

Other

Affordability Focus Area:

Not Applicable

Center of Excellence:

BMPCOE

Point of Contact:

Rebecca Clayton
(301) 405-9990

Stakeholder:

Office of Naval Research (ONR)

Total ManTech Investment:

$2,000,000

M0708 – Best Manufacturing Practices Center of Excellence

Objective

The Best Manufacturing Practices Center of Excellence (BMPCOE) is a national resource providing best practices, systems engineering, and web technologies that enable defense and commercial customers to operate at a higher level of efficiency and effectiveness. Located in College Park, Maryland, BMPCOE and its nine regional satellite centers have helped businesses identify, research, and promote exceptional manufacturing practices, methods, and procedures to support the U.S. industrial base.

Pay Off

BMPCOE provides a noncompetitive means to help improve the use of existing technologies and introduce enhanced technologies, reducing inefficiencies in manufacturing while promoting excellence in government, industry, and academia. BMPCOE serves as a free source of benchmarking and expert assistance to help the U.S. industrial base become more competitive, helping organizations to achieve both incremental improvements and major breakthroughs while avoiding costly mistakes. An independent validation by the Center for Naval Analyses confirmed a 67:1 return on the Navy's investment for technology transfer.

Implementation

By leveraging its core competencies (surveys, systems engineering, and web technologies), BMPCOE continues to support industry and the warfighter. In-depth, on-site voluntary surveys conducted by BMPCOE identify, validate, and document best practices. Findings are disseminated through published reports, online, and at conferences and exhibits. Since 1985, BMPCOE has conducted more than 150 surveys and documented more than 5,000 best practices. BMPCOE's Program Manager's WorkStation (PMWS) and its three components – Knowhow, the Technical Risk Identification & Mitigation System (TRIMS), and the Best Practices Database - provide timely risk identification, acquisition, and systems engineering information to users. PMWS provides knowledge, insight, and experience to its users through an extensive knowledge base, a powerful analytic and predictive capability, and a database of validated industry best practices. The BMPCOE-developed Collaborative Work Environment (CWE) is an integrated digital environment that provides a solution to Department of Defense (DoD) Program Executive Offices and other geographically dispersed organizations faced with coordinating and communicating program information among large numbers of contractors, suppliers, and government personnel. CWE has evolved to a fifth-generation architecture and provides increased efficiency to government organizations by leveraging the ONR technology resident in BMPCOE to minimize document staffing and simplify dispersed communications requirements.

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