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REDUCING THE COST AND TIME TO BUILD & REPAIR **NAVY** PLATFORMS

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Gerald R. Ford (CVN 78)
Photo courtesy of Huntington Ingalls Industries

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Photo courtesy of GDEB

3D scanning systems
Photo courtesy of Harris Pye Group Ltd

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Flame Straightening
Photos courtesy of Ingalls Shipbuilding

USS Nassau (LHA_4) and USS Bulkeley (DDG_84)
Photo courtesy of U.S. Navy

3D model of ship configuration
Photo courtesy NSRP

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FMMS
Photos courtesy of FMMS 2015

GDEB 'CAD/CAM' Effort Advances Manufacturing Technologies for Shipbuilders

Steel Shapes Processing Machine

he Office of Naval Research has awarded the VIRGINIA Class Submarine (VCS) and OHIO Replacement Submarine (OR) focused CAD/CAM Interface for Steel Shape Processing project to the Naval Shipbuilding and Advanced Manufacturing Center. General Dynamics-Electric Boat (GDEB) has made significant investments in new manufacturing technologies and processes in order to support the schedule demands for VA and OR Class submarines. One such improvement is the automated processing of steel shapes, including cutting, footprint marking and coping. This technology has matured among construction industries and has proved well-suited to ship construction. Shape processing machines such as the Voortman® utilize a standardized format (DSTV) for model input, though the first generation usage of the Voortman® at GDEB requires the manual input of program instructions, a significant labor cost. The objective of this project is to develop the interface to feed the shape processing machine directly from the Computer Aided Design (CAD) product model without manual intervention. The CAD/CAM interface tool will be adaptable, using standards-based format, automating the currently manual process and will result in fewer errors—ultimately reducing costs. GDEB expects that this tool will also advance the state of manufacturing technologies for shipbuilders, as it automates CAD to Computer Aided Manufacturing (CAM) interface for structural steel shapes, a baseline product line is any shipyard. Though the basic technology exists elsewhere, this project will adapt it to shipbuilding requirements.

This project started in December 2014 and will be executed in 12 months. The first task defines the detailed design requirements; the subsequent five tasks will develop and test various capabilities of the software followed by a task to demonstrate the tool capabilities for all Stakeholders. This technology, once implemented, could potentially save an estimated $2.1M per OR hull. These projected saving estimates are primarily based on increased installation efficiency.

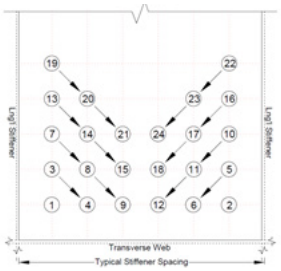
3D Scanner "Captures" Cost Savings from Improved Ship Check Process

3D scanning systems provide highly accurate 3D representations of complex shipboard spaces that can be utilized for modernization and repair planning.

Huntington Ingalls Industries – Newport News Shipbuilding (NNS) has utilized a 3D laser scanning system to improve accuracy while significantly reducing the cost of frequent ship check evolutions. The 3D scanning system facilitates necessary shipboard modernization and repair work planning for a fraction of the previous labor and associated costs. Traditional ship check evolutions require the assembly of large teams and a great deal of dedicated labor to measure numerous spaces using conventional tools such as rulers, plumb bobs and measuring tapes. In addition to the considerable labor investment, traditional ship check methods are susceptible to human error which can lead to costly rework resulting in further impact of production schedules.

The utilization of 3D laser scanning technology by NNS has emerged from the necessity to mitigate the inefficiencies of traditional ship check evolutions. Providing the ability to minimize the size of the ship check team to a limited number personnel while also improving the accuracy beyond the capabilities of traditional methods, 3D laser scanning has proven to be implemented today. With this project successfully transitioning at NNS, a nearly 50 percent reduction of laser scan capture time and data processing time has already been verified and an anticipated expanded use of the 3D laser scanning system on upcoming ship check evolutions forecasts greater reductions and savings. Once fully implemented, this technology is expected to reduce the total travel cost associated with CVN repair planning evolutions on-board forward deployed carriers by over 30 percent, resulting in an estimated $533K per evolution. The projected labor savings resulting from a fully implemented 3D scanning system are in excess of $1.4M per evolution contributing to an overall savings per ship check evolution in excess of $1.8M. In addition to the anticipated savings captured by the dedicated team at NNS, this technology possesses the potential to generate comparable savings in other DoD communities.

Ingalls Shipbuilding Finds Cost Savings through Improved Flame Straightening Processes



Flame Straightening Spot Heating V Pattern

The Office of Naval Research awarded the Structural Fairing Process Improvement project to the Naval Shipbuilding and Advanced Manufacturing Center (NSAM-a Navy ManTech Center of Excellence). The practice of 'Flame straightening' is synonymous with re-work, and a significant cost driver throughout the shipbuilding industry. The objective of the Structural Fairing Process Improvement project was to investigate the current procedures used to straighten deck plate, gain an understanding of the limits to which distortion can be safely brought into tolerance without compromising material strength, and revise the guidance procedures used by fairing personnel.

Through vigilant data collection and analysis, the project was able to identify procedural issues of a complex production process and execute testing to bring a consistent, controlled, and efficient procedure to flame straightening. This project isolated key factors causing process delays, structural damage, and cost overruns that the team evaluated and improved. The improvements led to revised procedures and improved personnel training. The new procedures are expected to reduce flame straightening process time by up to 75% and bring consistency and repeatability, addressing ineffective legacy processes. During the project's execution, it became evident to the flame straightening supervisors that the new process was working, and the team observed the trades' personnel trying the new processes immediately. Ingalls developed a handbook simple enough to follow while on the job, though detailed enough to allow an inexperienced operator to fully execute the correct procedures. With the new "less is best" philosophy to flame straightening and the implementation of the new procedures, it is expected that secondary damage to structural members due to overheating will be eliminated.

The improved process, once fully implemented, potentially saves an estimated $453K per DDG 51 Hull. The flame straightening labor cost savings associated with this project are estimated strictly based on the process time improvement. Another benefit, while difficult to quantify, is the savings from early compartment completion and reduced paint rework.

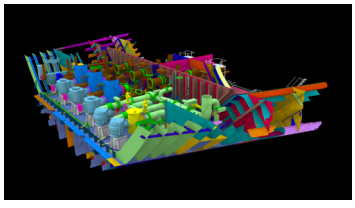
EB Using 3D CAD Modeling Processes to Develop OR/VCS Cable Lay and Sequencing Tool

General Dynamics-Electric Boat Corporation (GDEB) is developing a reliable, cost effective CAD tool to provide design engineers a 3D modeling processes that support cable lay and sequencing efforts. There are between 15,000- 20,000 cables on a nuclear submarine and the process of designing, planning and installing each of these cables is complex, exacting, and inefficient. This inefficiency typically leads to large amounts of cable being ordered and warehoused, only to sit idly coiled until the next module is ready. GDEB's goal is to re-engineer processes to assist the planner in the selection of smaller work packages that will result in savings in material ordering, warehousing of cable, reduction of clutter in outfitting areas and more timely installation of cables in modules and on board the ship.

The current process has six steps: logical design, component physical design, cableway design, cable routing, cable lay, and cable sequencing—GDEB's VCS Improved Cable Lay and Sequencing Tool project is focused on re-engineering the cable lay and sequencing processes. Once implemented, this tool will allow electrical designers to create a 3D CAD model of designated cable lay for a cable through its shipboard route. The tool will include a function to verify that Electro-Magnetic Interference (EMI) rules have not been violated, a key technical challenge. Additionally, the tool will provide the capability to sequence cable installation based on construction schedule of a particular hull. The current process typically begins in the early stage of design where functionally related equipment, systems, tanks, etc. are located to reduce the distributed system footage and maximize standardization potential, though not always optimizing cable installation work packaging. Once fully implemented, GDEB anticipates this tool will provide the best method for reducing cable lay and cable sequencing costs and also reduce cable lay design labor and cable sequencing costs by 10%. The combined improvements created by the improved tool show a potential savings of $2.7M per OR hull and $274K per VCS hull.

Ingalls Pursuing 'Digitally Agile' Data Strategy with Work Flow Tracking System Technology

Huntington Ingalls Industries - Ingalls Shipbuilding (Ingalls) is developing a reliable, cost effective tool that will assist in identifying opportunities and savings for alternate build strategies. There is a significant opportunity to pre-package/test large portions of the ship during outfitting processes but often the projected cost of these changes precludes change consideration. The LHA build strategy (includes build sequence, configurations, make/buy, testing etc.) for these spaces could be modified using a modular outfitting approach, with the potential for significant cost savings. Legacy LHA designs date back several decades and have not seized the opportunity to invest in an optimized build strategy. The current build approach for congested spaces is cumbersome; often these spaces are 'outfitted' very late in the build schedule, where accessibility is limited and demand on support services is much higher. These constraints make outfitting activities of those spaces more difficult and costly.



3D model of ship configuration

The 'Modular Outfitting' project is developing a build strategy assessment tool/process that will be demonstrated using actual ship construction space examples. This modular outfitting approach is based on the principle of outfitting as much as possible as soon as possible, in a sequence that makes sense for follow-on activities. It typically begins in the early stage of design where functionally-related equipment such as piping systems, tanks, etc. are located to reduce the distributed system footage and maximize design and component standardization. The project team is working to standardize the methodology for evaluating and changing the current build strategy approach for the LHA ship program, with the goal of extending the use of this design tool to other Ingalls' platforms. The outfitting activities build sequences are being examined in detail to identify possible changes that could lead to cost savings, identifying the largest possible assembly of the equipment and outfitting components that can be completed in the workshop, assembled concurrently with hull construction and easily lifted without exceeding crane-lifting capacities and workload during the installation. Once fully implemented the project team expects to reduce labor hours for current outfitting activities by as much as 10 percent, an estimated cost savings of $1.8M per LHA hull.

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