Newport News Shipyard Leveraging ManTech Tool to Connecting the Digital Thread

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REDUCING THE COST AND TIME TO BUILD & REPAIR NAVY PLATFORMS
Newport News Shipyard Leveraging ManTech Tool to Connecting the Digital Thread

Acquisition of shipboard components is entirely based on ‘paper’ purchase order documents. Newport News Shipbuilding (NNS) provides suppliers with 2D fabrication drawings that are developed from 3D component models. Suppliers use the 2D drawings to create their own 3D component models to support producing parts using Computer Numerical Control (CNC) machines. Design and manufacturing collaboration during supplier contract execution is based on traditional spreadsheets, emails, and conference calls.

The Digital Thread Shipbuilding – Supplier Interface effort will incorporate NNS’s supply base into the company’s digital shipbuilding strategy by connecting the ‘digital thread’ from design through production/fabrication, assembly, test, inspection, integration, and installation/operation. In addition, the digital information produced by NNS will need to be consumable downstream by fleet provisioning and sustainment activities. The focus of this project will be on helping the supply base improve first-time quality, cycle-times, schedule performance, and supplier readiness, which will lead to cost savings for the company and the Navy. Through this project NNS intends to simplify Technical Data Packages, produce 3D design disclosures, and establish a secure exchange medium to enable efficient two-way transfer of data with suppliers. When a part number is created in the Parts Catalog System, Engineering will use computer-aided logic to assign requirements to help avoid human error and reduce the learning curve. The requirements applied will be clear, concise, and specific to the item, component, or assembly being purchased.

Once proven, NNS will replace 2D fabrication drawings with 3D design disclosures that can be used by suppliers to efficiently estimate, plan, manufacture, test, and inspect. The design disclosures will be generated directly from 3D component models. The component models will include the Production Manufacturing Information (PMI) and other design content needed for manufacturing. Replacing 2D fabrication drawings with 3D design disclosures will help NNS better convey design intent and position the company to exploit advancements in technology such as automated manufacturing, 3D printing, virtual inspections, etc. A secure environment will be established to enable the efficient two-way exchange of digital data between NNS and suppliers during the material procurement process. NNS plans to deploy the solution in its target environment after initial acceptance tests are complete and engage affected individuals/groups/organizations to ensure the solution satisfies documented needs and expectations. The Digital Thread Shipbuilding – Supplier Interface technology has an estimate savings of $10.6M per FORD Class Aircraft carrier.

Improving suppliers first-time quality, cycle-times, schedule performance and readiness by providing 3D design disclosures

Photo Courtesy of Newport News Shipbuilding
GDEB Modernizing Piping Inspection Systems

The recently ONR-awarded and NSAM-managed ‘Virtual Reality Inspection of Piping Systems’ project with General Dynamics Electric Boat will introduce a new process and innovative tool set into the business of inspecting ship’s piping systems. VipeR will supplement paper piping schematics and engineering drawings (manually colored after issue) with a model-based Virtual Reality (VR) component. The final system will provide a virtual interactive mock-up in which supervisors can assign work and new inspectors can learn about the product in the course of their business. The VR will highlight planned inspection work in a full-scale immersive session that mocks up the piping system itself and all its immediate surroundings on the ship.

When the user selects an inspection work order, the system will decide what ambient objects to display. The designated work items will be highlighted. The installation status of prerequisite components will be displayed. The supervisor will indicate to the inspector the extent of the work assignment. The supervisor will be able to fine-tune the assignment by selecting components on the fly. The resulting work assignment will be captured and made available to the inspector in a 3D lean tablet-based work instruction or Interactive Work Instruction (IWI). The inspector will take the tablet with IWI to the job site, perform the inspection and sign off via the tablet when done.

Inspectors are assigned work not from the 2D test section schematic but from the 3D model from the system engineering drawings. In order to convey the work assignment to the inspector, inspection planners currently take the system diagram and manually color (with markers) the extent of each inspection assignment. This process is laborious and is not only repeated for each ship but has to be adjusted whenever installation status does not support the inspection plan. This project also addresses the problem in which the workforce at GDEB consists of a majority of inexperienced workers as the experienced workforce continue to retire at a fast pace. The submarine is a complicated platform and new workers need not only to be familiar with inspection processes, but to work efficiently in an ever changing layout/environment of a submarine. The ‘Virtual Reality Inspection and Search’ project’s objectives are:

- Leverages the new model based approach for system build/inspect/test status.
- Enable inexperienced inspectors to more quickly familiarize themselves with the submarine and its inspection requirements.
- Improve and reduce the time for pre-job briefs and shorten inspection time as a result of better informed work force.

The VipeR system is estimated to have a 2.2% reduction of inspection labor resulting in $1.32M in total savings over a 5-year period.

High Deposition Advanced Submerged Arc Welding Leads to Savings Opportunities for FORD Class Aircraft Carriers

Compared to the NIMITZ-class, the FORD-class aircraft carriers have changed the thickness of plating resulting in increased welding hours for CVN 78. To meet CVN 79/80 cost reduction goals, Huntington Ingalls Industries—Newport News Shipbuilding (NNS) is actively modernizing its welding infrastructure with the intent of transitioning to new equipment that is more capable and shifting to more efficient welding processes. This NNS-led project worked to identify and implement an ultra-high deposition submerged arc welding (SAW) variant and expand the use of SAW to increase productivity. The objective of this project supports the technical feasibility of implementing new SAW technology in FORD-class aircraft carrier fabrication at NNS. The preferred SAW process targeted for implementation at NNS is Twin Wire Variable Wave-AC. This technology, once implemented, can potentially save an estimated $2.2M per FORD Class hull.

Submerged Welding Process
Ingalls Shipbuilding Promoting Digital Automation & Optimization with New Non-Destructive Testing Processes

Ships constructed for the U.S. Navy must meet rigorous survivability, quality, and durability requirements. To ensure the structural fabrications meet these requirements, these assemblies are tested using non-destructive methods throughout the construction process. Non-Destructive Testing (NDT) methods on structural members are used to validate two or more structural components have been joined properly. These welded connections will endure loads and fatigue during the ship's life, which can result in a break or failure if the weld is defective.

Huntington Ingalls Industries-Ingalls Shipbuilding’s (Ingalls) process for requesting and accomplishing NDT required multiple paper request and report forms, some of which were completed in quadruplicate. Shot locations were identified and physically marked on the test articles and expected to match the contents of the key plan, which was not always the case. Deviations required modifications to the key plan which proved to cause severe disruption and be problematic for tracking in the paper-centric process. If reconciliation between the NDT being requested and the key plan was not done, it could have resulted in incorrect testing, inability to test, testing ‘out of position’, or other harmful cost drivers.

The recently completed NSAM-managed ‘Increased Automation of NDT Tracking’ project with Ingalls developed a new electronic process to enhance and replace the prior paper-centric process for requesting, executing, processing, and archiving of Non-destructive Testing (NDT) for ship structures. Through piloting and testing Ingalls proved that with this new electronic tool and process in place, many manual touchpoints can be eliminated.

The ‘Increased Automation of NDT Tracking’ project performed a thorough study and modernization of the current NDT process utilizing the latest proven techniques and technologies. The primary focus was to develop parameters, identify best-fit technologies, and best-practice concepts then incorporate them into a the electronic process to enhance and replace the paper-centric process for request, execution, processing, and archiving of Non-Destructive Testing for structure. The new process and tooling focuses on addressing areas to achieve maximum cost reduction and process efficiency benefit. This process is enabled through digital automation and optimization. This symmetry of process and technology is helping to streamline the NDT process. This technology and process, is estimated to result in per hull savings of $228K for DDG, $484K for LHA and $369K for LPD.

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