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the SIGNAL

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More Efficient Product Flow in the Pipe Shop

Reducing Costs by Streamlining the Material Flow Process

Nationally Recognized Standards for Computed Radiography

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Pipe Shop Work Bench
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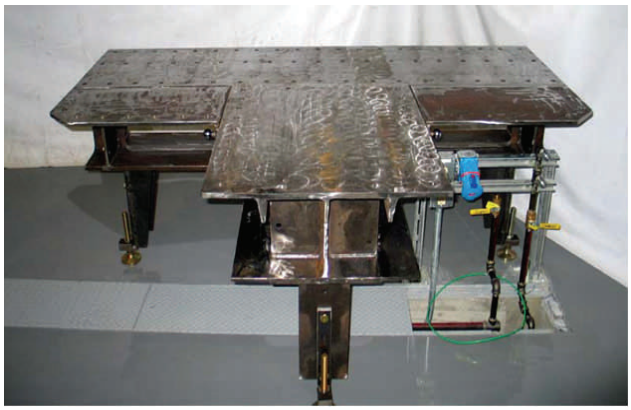
Pipe Shop Process Reengineering

Expected Savings of $1.2M per VCS Hull

This General Dynamics Electric Boat (EB) project, now half-way through its second phase, is well on its way to achieving its goal of developing self-sufficient, cellular work centers and process lanes that support a more efficient product flow through the pipe shop. At the outset of the project, EB identified a number of process improvement initiatives to streamline the planning and manufacturing practices supporting the delivery of pipe details in construction of VIRGINIA-Class Submarines (VCS). These processes and technologies were investigated during Phase I of the project, continue to be further developed in Phase II, and some implementation has begun. Approval for full implementation is expected at the completion of the second phase.

Early in Phase II, the team received prototype tools and fixtures, and piloting began for selected items and new processes. As of January 2011, a reengineered prototype work center for large diameter pipe was fully functioning, including new work benches. The renovated center design provides each bench with all necessary services (electrical, gas, and compressed air) routed through covered trenches. Concurrent with Phase II, EB is leveraging non-project funding to complete other pipe shop renovations, including cleaning, abatement of lead paint, and re-painting of ceiling and walls throughout the front-shop area. The team is also developing plans to renovate the Small Diameter Pipe Socket Welding Process Lane. Additionally, the team is working to provide fitters and welders with clear, understandable, and automated joint-by-joint weld sequence and assembly instructions.



Newly Designed Large Diameter Pipe Shop Work Bench with Services (Gas, Power, Compressed Air) Routed via Covered Trenches

When fully implemented, this CNST led project is expected to result in a cost savings of approximately $1.2M per VCS hull.

Digital Radiography Transition—Task Group

In a previous CNST project, Northrop Grumman Shipbuilding-Newport News (NGSB-NN) identified and acquired state-of-the-art computed radiography capabilities, knowledge and supporting technical resources that are being tested in a practical shipyard environment to assess overall potential benefit. NGSB-NN kicked off a new project, *Digital Radiography Transition for Inspection of Welds and Castings*, in November 2010 to further develop these technologies. The team is working to ascertain inspection confidence with isotopes and high energy applications in addition to resolving technical and implementation issues that will lead to full implementation.

In support of this effort, the project team is establishing a Task Group to ensure the greatest level of success and achievement possible in the implementation of this technology. The Task Group is made up of key individuals from both private and public shipyards, Supervisor of Shipbuilding (SUPSHIP), and representatives of NAVSEA 05 and 08. The Task Group members will provide input to the continue developing Digital Radiography standards and gain early awareness of progress that is being made. They will meet periodically and be involved in two major workshops hosted by NGSB-NN. The Task Group's involvement will ultimately help to ensure that Navy requirements are being met throughout the project thus improving the rate of acceptance and implementation of this technology for the Navy's use.

Once fully implemented it is estimated that this project will result in a cost savings of approximately $1M per CVN. Additionally, findings from this project and the standards developed will be widely applicable and beneficial to construction and repair activities at other major shipyards. Improvements in this area are applicable to all U.S. Navy platforms.

VCS Supply Chain Manufacturing Technology Review

Contractor furnished components make up nearly 30% of the overall cost for a VIRGINIA-Class Submarine (VCS), roughly $600M. Of that, $270M is attributable to the 40 most costly components. The General Dynamics Electric Boat (GDEB) and Northrop Grumman Shipbuilding-Newport News (NGSB-NN) shipyards have identified an opportunity to reduce cost from the VCS program by identifying key cost drivers for these 40 vendor furnished components, and will leverage in-house expertise in the areas of design, engineering, procurement, and operations to work with vendors to reduce costs where possible.

The project team is currently evaluating each of these 40 components during a series of reviews, encompassing every stage of the installation process, from initial design, procurement, and receipt inspection, all the way through delivery to the ship. Design engineers are determining whether current component designs have been optimized to reduce cost and schedule and if the most effective and efficient techniques are being used to manufacture them. Dimensional accuracy requirements that drive costs are being challenged where practical. Design-for-assembly (DFA) tasks affecting components or gaps where DFA should be employed are also being considered. Vendors' existing infrastructures are also being evaluated for their ability to provide components for the soon to be increased two ships per year build rate.

Once all 40 components have been reviewed, the project team will identify the top 10 vendors for whom any recommended changes in design, engineering, manufacturing, and delivery will provide the greatest cost savings and probability of implementation. Working with the component vendors, both shipyards will lead a series of meetings at each vendor site to discuss the proposed actions that will bring down the cost of their respective components, and an implementation plan will be developed so that all stakeholders can agree upon a clear transition strategy.

With 22 of the 40 most costly components completed in GDEB's internal review (Phase I), the project has realized over $185K/per hull in current savings to the VIRGINIA Class submarine program, with additional potential savings of over $256K/hull soon to be validated (over $440K in savings before NGSB-NN completes Phase I and prior to vendor activity in Phase II).

Based on the success of Phase I, the Office of Naval Research has authorized GDEB to begin Phase II to substantiate supply chain material cost reduction for future VIRGINIA Class submarine procurements with five selected vendors. The GDEB vendor visits will focus on the areas EB determined to have the most opportunity for cost saving at the vendors' manufacturing facility and evaluate vendor recommendations to continue to reduce cost. It is anticipated that the combined results of GDEB's and NGSB-NN's Phase I and II efforts will achieve the potential savings goal of $1.46M per hull.

VCS Material Flow Processes & Technology

Streamlining the Material Flow Process

Material availability in a shipyard can have an enormous impact on both the cost and schedule of ship construction. The advent of Lean Six Sigma and other process improvement methodologies is evidence that companies are constantly striving to streamline processes, cutting out activities that add minimal value and reducing overall labor and material "waste." A cross-functional team of Operations, Material Control, Transportation, Material Planning and Process Engineering personnel at General Dynamics Electric Boat (GDEB) are currently executing an effort to drive down the costs associated with material flow for VIRGINIA Class Submarine (VCS) construction at its Groton and Quonset Point facilities.

Phase I of the project completed in January 2011. Phase I activities included "process walks" and development of detailed current state Value Stream Maps (VSMs). These current state VSMs were focused on documenting the flow of material from storage to the trade shops, from storage to the submarine outfitting or final assembly area, and material movement within trade shops. They were reviewed with the area operations personnel to identify top inhibitors to flow that result in increased cycle time, wait time, transaction errors and reduced material availability performance. This analysis led to future state VSMs for each targeted area to identify the desired material flow scenario that will lead to improved performance given existing constraints of capital equipment and space. These ideal scenarios, along with additional market sector research, were captured in an Improvement Action Plan that will be executed in the project's second phase.

Phase II activities began in February 2011. They will focus on "proof of concept" demonstration of wireless tracking (RFID) of material in shops, outfitting, final assembly and test; wireless 'picking' to reduce material touches and expedite material issue, point-of-use technologies that can issue material at the worksite, innovative material delivery including 'milk run' distribution, and improvements in outfitting material delivery and staging.

Once these technology pilots have been tested and evaluated, GDEB will develop the metric improvement and savings summary that will document both the expected and realized savings from each of the various technology applications. The savings summary will provide the critical information that will be used when determining the plan for implementation in the Groton and Quonset Point VCS construction facilities. The potential savings are estimated at $2.72M/hull.

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