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# theSIGNAL

A Publication of the Center for Naval Shipbuilding Technology

- Improving the Planning and Scheduling Processes for Construction of the VIRGINIA-Class Submarine
- Revitalizing Pipe Manufacturing Processes
- Improving the Outfitting Process with OneStop


# REDUCING THE COST AND TIME TO BUILD NAVY SHIPS

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## PHOTO CREDITS:

**Cover**
*USS Michael Murphy bow shot*
**Photo courtesy of U.S. Navy**

**Page 2**
*The Virginia-class attack submarine Pre-Commissioning Unit (PCU) Missouri (SSN 780) conducts sea trials July 2, 2010 in the Atlantic Ocean.*
**Photo courtesy of U.S. Navy**

*Robotic Welder*

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*The Navy's newest and most advanced submarine, Pre-Commissioning Unit (PCU) Virginia (SSN 774) moved outdoors for the first time in preparation for her August 16, 2003 christening.*
**Photo courtesy Electric Boat**

*The Virginia-class attack submarine Pre-Commissioning Unit (PCU) Mississippi (SSN 782) conducts alpha trials in the Atlantic Ocean on April 7, 2012.*
**Photo courtesy of U.S. Navy**

**Back Cover**
*DMC 2012 Announcement.*
**Photo courtesy of DMC 2012**

# ONR Awards Project to Improve Welder Productivity

The Center for Naval Shipbuilding Technology (CNST) has awarded General Dynamics Electric Boat (GDEB) the Virginia-class submarine (VCS)-focused Improved Welder Productivity project. Welding at shipyards remains a large cost-driver in the construction of US Navy ships, particularly with Virginia-class attack submarine (VCS). Shipyard welders must complete a thorough series of checks at the start of their daily shifts prior to actually performing welds. This shift startup includes getting proper assignments from shop supervision, checking out the correct weld wire, and verifying qualifications and the work to be completed, each necessary though impacts welder productivity. Because these activities often require supervisor approval prior to starting work, and supervisors are responsible for several welders per work area, there are potentially significant delays for every welder in actually achieving arc time. The objective of this project is to identify inefficiencies, potential process improvements, and technologies that will reduce welder start-up time and ensure compliance with welding procedures, ultimately leading to improved efficiency.

This two year effort teams CNST, EB and the Institute for Manufacturing Sustainment Technologies (iMAST), executing a two-phased approach. The first phase is conducting a comprehensive investigation of the current welder startup process to identify the time drivers to get a welder fully prepared to execute welds at the start of their shifts. Upon completion of the investigation, improved processes will be studied and proposed to increase welder productivity. The second phase will focus on targeted, small scale pilot testing of process improvements identified during the Phase I investigation. This phase will involve the implementation of rapid response initiatives that aim to reduce inefficiencies in the current startup procedures; and the development of a pilot "Smart Welder" system that leverages state of the art technologies in welding equipment. The 'Smart Welder' system will include a weld machine and computing hardware capable of providing the necessary information to the welder to actually begin welding, as well as the required software and data interfaces to extract that data from existing systems at GDEB. It is estimated that this project will result in a savings of $1.28M per VCS hull, reduce start-up time and rework, and increase welder output (arc time).

# New Project: GDEB Evaluating Robotic Welding Technology

The Office of Naval Research has awarded the Virginia-class submarine (VCS) focused Robotic Welding of VCS Interim Products project to the Center for Naval Shipbuilding Technology (CNST-a Navy ManTech Center of Excellence). General Dynamics Electric Boat (GDEB) is the project lead teamed with Edison Welding Institute, with the objective to develop an engineered manufacturing cell specifically designed to robotically weld assemblies that cannot be accomplished using a mechanized process.

This project began in July 2012 and will be executed in two phases. The first phase is the procurement of a robotic welding cell and initial weld process development for part family and interim product assemblies. The second phase will complete the required welding process development, install the robot at GDEB Quonset Point facility (QP), and develop a roadmap to implement robotic manufacturing at GDEB QP. This technology, once implemented, could potentially save an estimated $551K per VCS Hull. These savings will result from enabling discrete planning of welding small assemblies within existing planning systems and increasing the percent of first time quality. While the project focuses specifically on improvements benefiting the VCS, the same benefits described here can accrue to all U.S. shipyards.

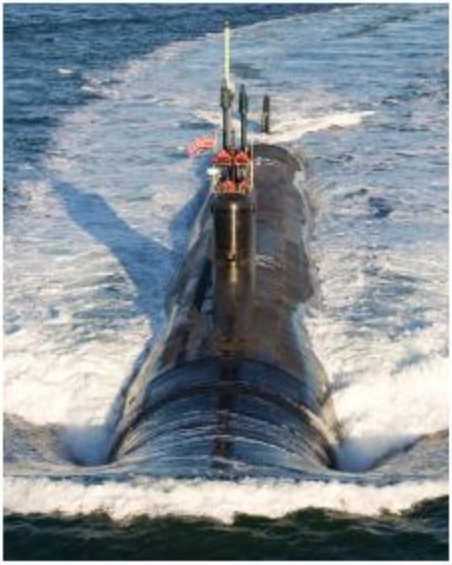
## Completed VCS Supply Chain Review Project Saves over $1M per VCS Hull

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. Using the ISSR (inherent, structural, systemic, and realized) analysis process, General Dynamics Electric Boat (GDEB) and Huntington Ingalls Industries - Newport News Shipbuilding (NNS) conducted a structured review of these 40 most costly contractor furnished components. The initial cost savings goal was a reduction of $1.46M in contractor furnished equipment (CFE) costs per VCS hull, based on previous studies and similar supply chain reviews.

The project teams evaluated the components during a series of reviews that encompassed every stage of the installation process, from initial design, procurement, and receipt inspection, all the way through delivery to the ship. Design engineers determined whether current component designs were 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 were challenged where practical. Design-for-Assembly (DFA) tasks affecting components or gaps where DFA should be employed were also considered. Vendors' existing infrastructures were evaluated for their ability to provide components for the increased two ships per year build rate. Once the components were reviewed, the project teams identified the top 9 vendors for whom any recommended changes in design, engineering, manufacturing, and delivery will provide the greatest cost savings and probability of implementation.

Overall, the project teams identified nearly 60 cost savings opportunities between the VCS co-build shipyards. GDEB began implementing improvements in early January 2011 using a phased approach, and initial savings of $1.04M/VCS hull were accomplished with no implementation costs. Once fully implemented, shipyards and vendors see the potential for the cost savings to increase by an additional $7.4 million per hull and will support Block IV reduction of total ownership cost initiative, making the total estimated potential cost savings as much as $8.5 million per VCS hull.

## GDEB Modernizing Lead Installation Processes



The Center for Naval Shipbuilding Technology (CNST) has awarded General Dynamics Electric Boat (GDEB) the Virginia-class submarine (VCS)-focused Lead Installation Process Improvement project. Lead installation processes have not changed in decades, resulting in higher non-recoverable cost expenditures through lead material waste, energy consumption, equipment wear and other costs. The purpose of the Lead Installation Process Improvement project is to identify, review and select processes to improve current lead installation procedures. GDEB is investigating three targeted lead installation areas to determine if more efficient processes exist and these can also improve safety. It is the goal of the project team to reduce man hours, improve lead installation efficiency, and minimize or eliminate hazardous work procedures for lead shielding installation.

This project is being executed in two phases over the next two years. The first phase of this project is focusing on the development of a current state map for lead installation practices, as some of these have remained unchanged for decades. GDEB is also investigating alternative methods, equipment and material used in that support the Virginia contractual requirements, and the development of the desired future state map. GDEB is using these maps to conduct the Gap Analysis review, comparing the "now" to the "future' to identify the most significant areas of opportunity to produce improvements in lead installation cost, cycle time performance and environmental compliance.

The project's Phase II will use the Phase I opportunities to execute an action plan, piloting processes and technologies that show promise for implementation. During Phase II, GDEB will identify alternative methods and equipment, evaluate the prototypes and pilot identified technologies, provide applicable NAVSEA qualification support and develop a training curriculum based on the new lead installation processes. The second phase includes developing a post-project implementation plan and validating the business case, as GDEB estimates a potential project savings of more than $270K and over 3,000 man-hours per VCS hull while minimizing or eliminating waste streams.

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