

# Dual Hot Wire/Cold Wire Gas Tungsten Arc Cladding Procedure Can Increase Shipyard Cladding Deposition Rate by 72%

Status: Implemented

## PROBLEM / OBJECTIVE

In VCS ship production, General Dynamics Electric Boat (EB) used hot wire gas tungsten arc welding. With that process, the cladding rate of nickel-based materials onto HY-80 and HY-100 components is restricted by heat input, dilution rate and interpass temperature limits. An NMC project was developed to evaluate arc cladding processes, down select a candidate process and demonstrate the ability to qualify the cladding procedure based on NAVSEA Tech Pub 248 requirements. The developed procedure was expected to increase the deposition rate to a target level of approximately 10 lbs/hour (~40% improvement) without degrading the clad quality and while maintaining appropriate final weld layer chemical composition.

## ACCOMPLISHMENTS / PAYOFF

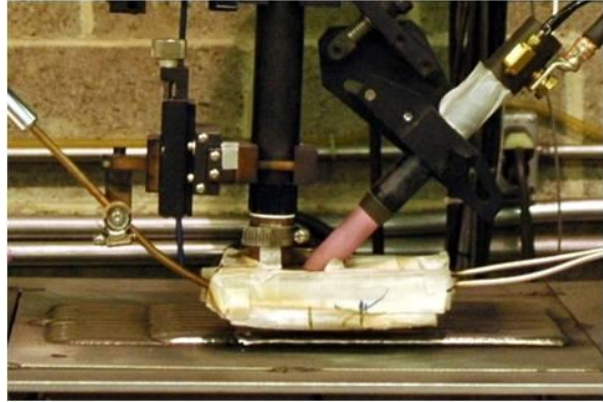
### Process Improvement:

NMC evaluated state-of-the-art cladding solutions that used submerged arc, plasma transferred arc, pulsed gas metal arc, and hot wire gas tungsten arc welding (GTAW) processes. Based on weld test evaluations of deposition rate, deposit quality and chemical composition, the Integrated Project Team down selected the GTAW process for additional cladding optimization. NMC developed a cladding procedure to optimize hot wire GTAW at a deposition rate of 10.9 lbs/hour, which is 47% above the baseline process. Further development of a variant process with a supplemental cold wire addition increased the deposition rate to 12.8 lbs/hour, which is 72% above the 7.4 lbs/hour baseline.

### Implementation and Technology Transfer:

EB has purchased, installed and began operating the new hot wire GTAW welding equipment, as recommended in the project. Qualification of the NMC-developed, enhanced hot wire (HW) deposition rate practice is scheduled to begin this year in the EB weld lab. Once that occurs, the next planned activity is to purchase a cold wire (CW) feeder and begin to test HW/CW GTAW welding in the EB weld lab.

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*A modified cladding process increases the deposition rate with equal or superior weld quality and low capital cost. NMC photo*

### Expected Benefits:

- Significant reduction in weld cycle time due to increased deposition rate from 7.4 lbs/hour to 12.8 lbs/hour
- Equivalent or superior weld quality and mechanical performance to that of the current welding procedure
- If integrated with current production cladding equipment, low (<\$15K) capital cost needed per weld cell to realize the benefits of the increased deposition rate.

## TIME LINE / MILESTONE

Start Date: November 2007  
End Date: April 2009

## FUNDING

Total ManTech Investment: \$400K

## PARTICIPANTS

Virginia Class Submarine (VCS) Program Office  
General Dynamics Electric Boat (GDEB)  
Institute for Manufacturing and Sustainment  
Technologies (iMAST)  
Navy Metalworking Center (NMC)  
Arc Applications, Inc.  
Jetline Engineering  
Arc Machines, Inc.  
Lincoln Electric  
Deloro Stellite  
Special Metals Welding Products