

# Portable System to Mitigate Aluminum Cracking to Provide Significant Cost Avoidance

**Status:** Implemented

## PROBLEM / OBJECTIVE

Cracks in the aluminum superstructure of the CG 47 class cruisers require extensive repairs or replacement (i.e., removing and replacing the affected plate as well as all of the outfitting obstructing the area). The Navy Metalworking Center (NMC) led a project to address the major contributor to the cracking – the sensitized microstructure in the 5456 aluminum-magnesium alloy used in the construction of the structure. An Integrated Project Team (IPT) developed and demonstrated a portable heat treatment system that reverses the sensitization in 5456 aluminum alloy, thereby restoring the affected material in the ship's superstructure to a stabilized condition, which greatly reduces the propensity for cracking.

## ACCOMPLISHMENTS / PAYOFF

### **Process Improvement:**

NMC conducted laboratory tests and finite element simulations to derive the optimized parameters for the reverse sensitization process. Using this data, NMC designed and fabricated a prototype reverse sensitization unit (RSU), which imparts the necessary heat treatment to the aluminum plate in the CG class cruiser superstructure to mitigate the sensitization. The RSU was tested on laboratory sensitized panels, and a mockup of a CG superstructure was designed by NMC. The RSU was then demonstrated onboard two cruisers (one decommissioned, one active duty).

### **Implementation and Technology Transfer:**

The final RSU prototype system was transitioned to PMS 407 for additional evaluation and use during maintenance intervals. A procurement specification was also developed by NMC, so that additional units may be built after successful implementation. Implementation of the new process was initiated in September 2016 with the transition of the equipment to Ingalls Shipbuilding, the planning yard for CG repairs.

This article was prepared by the Navy Metalworking Center, operated by Concurrent Technologies Corporation, under Contract N00014-10-D-0062 (CDRL A002/Task Order 0006) to the Office of Naval Research as part of the Navy ManTech Program. Approved for public release; distribution is unlimited.



Application of a device to mitigate sensitization in aluminum structures will be less labor intensive than the current remove and replace process.

### **Expected Benefits and Warfighter Impact:**

Reverse sensitization will give the Navy a low-cost alternative to the current process of cutting out and replacing the sensitized plate.

- The reverse sensitization repair process can save as much as \$2.4M per CG 47 ship availability, resulting in a cost avoidance of as much as \$43.2M for 18 ships.
- The Littoral Combat Ship (LCS) program will also benefit from this improved technology at a conservative estimate of \$500K avoidance per hull, resulting in an additional \$4M in cost avoidance for the LCS hulls in service over the next five years.

## TIME LINE / MILESTONE

Start Date: September 2013  
End Date: August 2016

## FUNDING

Navy ManTech Investment: \$797K  
Cost Share: (PMS 407) \$1,084K

## PARTICIPANTS

PMS 407 Serco Inc.  
PMS 501 NMC  
SEA 05P2 ONR Navy ManTech  
SEA 05D  
Naval Surface Warfare Center, Carderock Division  
ElectraWatch  
DDL OMNI Engineering