

## New CNST Project Will Investigate Welding Distortion in Thin Steel Structures

The Office of Naval Research recently authorized the Center for Naval Shipbuilding Technology to proceed with a \$1.1 million project to investigate a method for reducing weld distortion in thin steel structures. That method is described as “transient thermal tensioning” and has the potential to significantly reduce distortion due to buckling and eliminate the high rework costs associated with correcting that distortion.

At present, several U.S. Navy construction programs are experiencing high rates of distortion and buckling on thin steel structures. The standard shipyard practice of fabricating stiffened steel panels by arc welding causes heat-induced buckling and angular distortion. Correcting the distortion is a necessary but time-consuming operation that adds no value and ultimately tends to degrade the quality of the ship structure. Estimates of ship production costs for flame straightening, repainting, re-insulating and other rework associated with correcting distortion can exceed millions of dollar per vessel.

Northrop Grumman Ship Systems has teamed with Edison Welding Institute, Battelle Memorial Institute and the University of New Orleans on a project to develop transient thermal tensioning procedures to significantly reduce the distortions that develop during construction of the lightweight ship panels.

Thermal tensioning involves the application of a second heat source parallel to, but some distance away from, the welding torch during fabrication. This secondary heat source varies the thermal distribution around the weld joint, which alters the magnitude and distribution of the residual stress developed during welding. The positioning and amount of heating can be determined by numerical analysis of the ship panel using modeling techniques.

This two-phase, two-year project will begin by reviewing the results from previous experiments using transient thermal tensioning technology and determining the best panel construction to begin testing. In the second phase, the team will validate the results from Phase I and install and test prototype equipment on the Northrop Grumman Ship Systems panel line. The team will also address more complex panel geometries. Numerical models will be developed for complex panels including multiple inserts, transition thicknesses and penetrations.

### About CNST

CNST is a Navy ManTech Center of Excellence, chartered by the Office of Naval Research (ONR) to identify, develop and deploy, in U.S. shipyards, advanced manufacturing technologies that will reduce the cost and time to build and repair Navy ships. For additional information on this and other CNST projects, please visit [www.cnst.us](http://www.cnst.us).



**Heating during welding can help balance the welding-induced compressive stresses in thin plate structures.**