

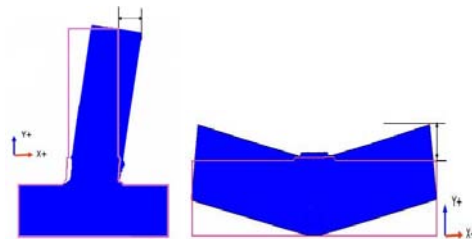
Predictive Distortion Tool Yields Significant Results; Technology Implemented in Production

This Northrop Grumman Shipbuilding (NGSB)-led project, funded by the Office of Naval Research and sponsored by Navy ManTech's Center for Naval Shipbuilding Technology (CNST) was completed in July 2007. The project's objective was to reduce ship construction costs by developing a tool capable of predicting weld distortion in thick steel structures, specifically focused on NIMITZ/FORD-Class aircraft carrier structures. This effort focused on evaluating commercially available, off-the-shelf software capable of performing predictive weld distortion analyses of processes to fabricate thick plate, multiple bead weld joints. This manufacturing process modeling and simulation tool uses process parameters to analyze alternative scenarios until the desired level of optimization is achieved. Optimization through simulation, rather than experimentation and experience, results in a cost reduction in construction of Navy ships by eliminating rework and mock-ups.



To effectively manage the program, the team used a four-phase approach. Phase I procured material, established subcontractor purchase orders, and developed welding process parameters. Test articles were fabricated in Phase II from the Phase I process parameters and consisted of four tee and four butt joints. During fabrication, pertinent modeling data was collected to create process simulations by the code developers. The code assessments were completed and one code was selected for Phase III. It was determined that the codes were capable of performing in a production environment and that ESI North America's SYSWELD® best met NGSB needs for accuracy, speed and implementation. SYSWELD® produced accuracies of 90%, faster computation speeds, and employs a more intuitive Graphical-User-

Interface. In Phase III, a baseline and a series of alternative models for heavy weldment problems were completed, leading to developing joints with less or equivalent weld distortion while drastically reducing the required backside manual welding, thereby, reducing cost. Phase III was to conclude the program; however, a request was made to extend the program into a Phase IV. In this phase, the project team modeled and analyzed additional weld joint designs to further improve construction efficiency.



Numerical Tee
Weld Distortion

Numerical Butt
Weld Distortion

The program has identified and implemented a tool for optimizing thick plate, multi-pass weld joints and their associated weld processes. As an example, one new joint design reduces the amount of distortion by 35%, uses a mechanized process that deposits 50% more material per pass and reduces the number of structural flips by 50%. The end result is a production welding process that has 43% less weld volume, is fully mechanized, and reduces process time. It is currently being implemented into shipyard construction practices.

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.

