

# Reducing Distortion in DDG 51 Class Thin Plates Will Avoid Costs and Significant Rework

**Status:** Partially Implemented

## PROBLEM / OBJECTIVE

Significant distortion is associated with the fit-up and welding of inserts into thin steel plates used in DDG 51 class production. Currently, a high percentage of plate openings does not match the required insert shape, resulting in substantial fit-up issues. Extensive rework to the insert profile and/or plate opening is needed to enable panel assembly. The rework results in weld joints with poor fit-up and/or excessive weld root gaps that require large welds and a high heat input, which causes further panel distortion. Working with Ingalls Shipbuilding (Ingalls) and the Integrated Project Team (IPT), the Navy Metalworking Center (NMC) developed improved weld sequencing procedures for circular and rectangular inserts to minimize distortion during the welding process. NMC also developed several prototype tools to improve the trimming process for the fitter and to help provide a consistent weld root gap between the panel and the opening for welding.

## ACCOMPLISHMENTS / PAYOFF

### **Process Improvement:**

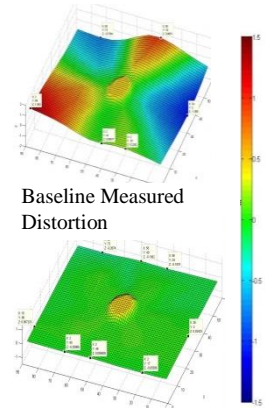
The IPT documented baseline insert fit-up and welding procedures at Ingalls. The IPT also conducted subscale trials to document the baseline process and resulting distortion. Several welding process improvements were developed using weld analysis tools. The down-selected improvements were demonstrated with additional subscale trials. Baseline plates were compared to the improved process plates to determine the most effective, implementable solutions for both circular and rectangular inserts. Several of the IPT's recommendations were implemented on the panel line.

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

Improved weld sequencing procedures were developed, demonstrated with subscale testing, and integrated into the panel line at Ingalls in the second quarter of FY14. In addition, the lessons learned regarding the factors that impact distortion during thin panel insert welding can be used on future ship designs or redesigns. Prototype trimming tools were developed for use at Ingalls to help provide a consistent weld root gap for panel insert fit-up and welding. Full implementation of these tools is expected by the fourth quarter of FY16 at Ingalls.



Circle Trimming Tool for Inserts and Openings



Baseline Measured Distortion

Recommended Process Measured Distortion

Improved weld sequencing procedures and new trimming tools will reduce costs at Ingalls for DDG 51 and other platforms. NMC photo

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

Implementation of the project results will reduce fit-up time, improve quality, and avoid costs associated with mitigating distortion in thin panels on DDG 51 class ships and other ships built at Ingalls, including LPD/LX(R), LHA, and NSC. Ingalls estimates that more than 40,500 labor-hour savings (across all platforms) will be realized over the next five years, resulting in a cost savings estimate of \$2.63M.

## TIME LINE / MILESTONE

Start Date:	February 2012
End Date:	May 2014

## FUNDING

Navy ManTech Investment:	\$1.42M
Cost Leverage (Ingalls):	\$7K

## PARTICIPANTS

PMS 400D (DDG 51 Program Office)  
 Naval Surface Warfare Center, Carderock Division  
 Ingalls  
 University of New Orleans  
 NMC

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