

NMC Leads Effort to Improve Quality and Reduce Cost of Waterjet Inlet Tunnel Entry Edge

Status: Implemented

PROBLEM / OBJECTIVE

During production of the first Littoral Combat Ship (LCS) hull at Marinette Marine Corporation (MMC), the leading edge of the waterjet inlet tunnel (WjIT) was made by welding 13 formed steel plates into the ship hull. Due to the production challenges of correctly positioning each plate while accounting for welding distortion, installation of the WjIT entry edge became costly and required significantly more production time than expected. Many hours of grinding were needed to achieve an acceptable hydrodynamic shape of the welded structure. A cast solution was developed and found to reduce the production time and cost for future LCS hulls, while also improving the accuracy of the complex curvature required of the entry edge.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The Navy Metalworking Center (NMC) evaluated several potential production methods; the project team agreed that the best option was to cast the component in three separate segments. To ensure timely integration of the cast solution, molds were designed using casting simulation, which assured that porosity, distortion, and cracking were minimized or eliminated from the finished castings. Sand molds were printed by team member ProMetal® using direct digital manufacturing. Fitted chills were produced from the computer solid model. All mold segments were printed in two days, shipped to the foundry, assembled and were ready for pouring within two weeks from the date the mold design was finalized in the casting simulation. This approach allowed the team to produce a superior quality casting, while maintaining a tight schedule and at a cost significantly lower than traditional sand casting methods. Casting, heat treatment and weld repair processing and LCS fit-up trials demonstrated the viability of the solution.

Implementation and Technology Transfer:

The solution identified and demonstrated by this project is now MMC's preferred production method for the four WjIT entry edges required per hull. The casting method was certified by the American Bureau of Shipping (ABS) for use on future LCS platforms. MMC committed to using the cast solution starting with LCS-3. Sand mold printing technology—coupled with numerical simulation—offers opportunities for rapid, high-quality production of many other components.



Three-piece WjIT casting has saved many production labor hours.

Expected Benefits and Warfighter Impact:

The following benefits were achieved:

- 75% reduction in construction labor hours
- 23% reduction in weld length
- 30% reduction in weight
- Increased accuracy of the complex contoured shape, resulting in improved hydrodynamic performance leading to:
 - reduced turbulence
 - reduced ship power requirements
 - minimal cavitation erosion
- Reduced production cycle time

TIME LINE / MILESTONE

Start Date: March 2009
End Date: December 2010

FUNDING

Navy ManTech Investment: \$1.1M

PARTICIPANTS

PMS 501	ProMetal
MMC	International Casting Corp.
Bollinger Shipyards, Inc.	Gibbs & Cox, Inc.
Lockheed Martin	NMC
ABS	

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