

Printed Sand Mold Technology Investigated to Improve Producibility of Submarine HY Steel Castings

Status: Technical Success

PROBLEM / OBJECTIVE

The Navy Metalworking Center conducted a Navy ManTech project that investigated the use of printed sand mold technology to produce complex high yield (HY) strength steel castings for the COLUMBIA class submarine (CLB) and VIRGINIA class submarine (VCS) programs. These components are currently produced as steel weldments, which are challenging and expensive to manufacture. Printed sand mold technology offers the ability to rapidly design and produce molds and cast complex geometries that would be difficult, if not impossible, to achieve as weldments or conventional castings.

ACCOMPLISHMENTS / PAYOFF

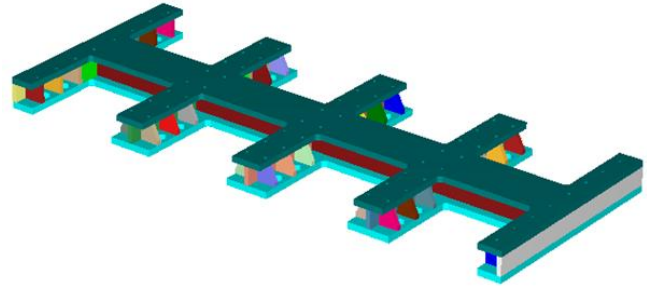
Process Improvement:

Design of experiments (DOE) was used to quantify the effects of eight critical production variables on casting quality, mechanical properties, and surface chemistry relative to Naval Sea Systems Command Technical Publication T9074-BD-GIB-010/0300 Revision 2. The DOE findings were verified by comparing the results of a demonstration casting to its production counterparts made by conventional mold production methods. Results of the work, including a draft requirements document, will be useful in completing future qualification efforts for use of the technology.

Implementation and Technology Transfer:

Implementation is on hold due to an IPT decision to discontinue the project since the business case was supported by an insufficient number of applications, resulting in an inadequate return on investment. The NMC project manager will continue ongoing dialogue with project Technical Assistant to discuss how the Navy can further benefit from implementing the technology.

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Use of 3-D printed sand molds to cast complex HY parts is expected to provide producibility improvements. EB illustration

Expected Benefits and Warfighter Impact:

- Reduced rework and material handling
- Improved part quality and consistency
- Rapid changes to casting shapes during component development
- Casting single-piece parts in place of multi-piece assemblies

TIME LINE / MILESTONE

Start Date: July 2015
End Date: November 2017

FUNDING

Navy ManTech Investment: \$1.0M

PARTICIPANTS

PMS 397
PMS 450
Naval Surface Warfare Center, Carderock Division
General Dynamics Electric Boat
The ExOne Company
Naval Undersea Warfare Center, Keyport
University of Northern Iowa
Bradken Tacoma
NMC
ONR Navy ManTech