

Improved Construction Method Incorporated into the Design of Submarine Deck Structures

Status: Implemented

PROBLEM / OBJECTIVE

The Navy Metalworking Center (NMC) led a project that devised a more efficient way of fabricating submarine deck structures, which have been traditionally constructed of many short, fitted pieces (intercostals) between continuous beams. The project team developed the manufacturing process for a new concept – the self-locating, self-fixtured (SLSF) method – for fitting and joining the deck structures for COLUMBIA Class submarines and the Virginia Payload Module (VPM). SLSF will enable construction with notched beams that interlock and are continuous in both directions. The team investigated manufacturing processes and requirements to determine the most efficient means of building these structures and produced several test structures and a final demonstration deck.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The details of the special notched joint and welding were refined with initial single cruciform trials, then applied to larger structures completed on a reconfigurable fixture. Finite element analysis of the test structure, the fixture, and the welding process informed the camber plan. All elements were combined and refined through several iterations of multi-beam trial structures, culminating with the large-scale trial – a 3 X 4 beam grid representative of ship structure. A final, heavy beam tee-on-plate structure was also produced at General Dynamics Electric Boat (EB).

Implementation and Technology Transfer:

Implementation is expected on COLUMBIA Class and on the first VPM in the third quarter of FY19 at EB's facility in Quonset Point. Current detail design has incorporated SLSF in both programs. Pre-Commissioning Unit COLUMBIA (SSBN 826) will utilize SLSF on 16 decks; the following ships of the COLUMBIA Class will incorporate SLSF on 26-31 decks. Both decks of the VPM utilize SLSF in their current design.

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S2633 Self-Locating/Self-Fixtured Structure
Rev A (JUL17)



An advanced shape-cutting capability at EB is enabling a new structural grid construction of submarine deck structures, which will simplify fitup and reduce the skill and time needed for assembly.

Expected Benefits and Warfighter Impact:

- \$2.19M estimated savings per CLB hull; \$107K savings for VPM
- \$5.23M estimated five-year savings; \$28.34M life-of-program savings for both systems
- Reduced or eliminated post-weld processes for weld distortion remediation
- Enables parallel construction of mating structures, reducing overall span time
- Reduced part count, distortion and shrinkage variation; simplified fitup and inspection; lower skill level required; reduced labor hours for setup, fitting, and fabrication.

TIME LINE / MILESTONE

Start Date:	June 2015
End Date:	June 2017

FUNDING

Navy ManTech Investment:	\$1.5M
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PARTICIPANTS

PMS 397
PMS 450
DDL OMNI
EB
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NMC
ONR Navy ManTech