

Small Diameter Pipe Fitting Prototype Tools and Fixtures Being Implemented at VCS Shipyards

Status: Implemented

PROBLEM / OBJECTIVE

Welding of smaller diameter piping assemblies (<3”) on Virginia Class Submarines (VCS) involve complex configurations for set-up, fit-up, fixturing and actual welding. These assemblies require manual welding and significant labor for set-up and handling. This Navy Metalworking Center (NMC) project applied improved pipe preparation methods and automated technologies to decrease construction costs through the reduction of man-hours by 20 to 30% in General Dynamics Electric Boat (EB) and Newport News Shipbuilding (NNS) pipe shop welding processes. To do this, NMC and the Integrated Project Team (IPT) developed prototype pipe fitting tools – a modified Accu-fit tool and a ball pivot tool – which reduce the amount of manual fitting needed on small diameter pipe details. NMC also developed a mobile weld fixture to weld pipe bosses, which was designed to reduce manual welding pass times.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

NMC examined and evaluated several aspects of VCS small diameter piping assembly operations, including preparation, fitting, and welding, at both VCS shipyards. Process improvements centered on development of pipe fixturing and tooling to enhance the pipe fitters’ ability to fit and stage pipe details in advance of the welder. The IPT analyzed labor-intensive pipe boss manual welding processes and developed a mobile welding fixture to effectively utilize the automated welders, increasing productivity and reducing manual welding times by 50%.

Implementation and Technology Transfer:

The pipe fitting tools and automation methods developed in this project were evaluated for performance improvements at EB and NNS pipe shops. They underwent demonstration testing at those shipyards and were used in the construction of VCS hull 786 in December 2010. Several inspection and welding tools identified by NMC have been transitioned and are being used at the EB Quonset Point facility, and NNS implemented one of the tools in 2012. The results of this project can also be applied to CVN, DDG 1000 and commercial shipyard pipe shops.



Pictured is one of the hands-free clamps that NNS is using to help reduce labor costs for manual pipe preparation and fitting processes. NMC photo

Expected Benefits:

- Prototype pipe fitting tool evaluations demonstrate a potential reduction of 6,250 labor-hours/hull (\$400K)
- Pipe boss automation fixturing demonstrates a 1,500 labor-hours/hull reduction (\$100K)
- Reduced fatigue for pipe welders through fitting and tacking pipe details in optimum ergonomic positions demonstrates a 1,180 labor-hours /hull reduction (\$75K)
- Pipe fitting tools are being transitioned to VCS shipyards with low capital cost investments

TIME LINE / MILESTONE

Start Date: October 2007
End Date: September 2009

FUNDING

Total ManTech Investment: \$844K

PARTICIPANTS

PMS 450 VCS Program Office
General Dynamics Electric Boat
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