

## Automating the Install of Studs

### *Reducing Labor Hours and Span Times*

The process of locating and installing attachments and structural penetrations is very time intensive and has a substantial impact on the cost and schedule of the outfitting of Navy warships, particularly in submarines. Each attachment or penetration may involve only a modest effort in its own right, but there are thousands of such attachments on each submarine, so the overall cost is substantial. In November 2008, the Center for Naval Shipbuilding Technology and General Dynamics Electric Boat (EB) kicked-off a project to determine if metrology technologies can be used to further automate the layout process for welded studs and automate the installation/welding of the stud itself.

This project, *Automating the Install of Studs*, is a follow-on effort to the previously completed and very successful CNST/ManTech project, *Laser Image Projection*. The EB team discovered that image projection technology could automate layout processes for attachments, thus significantly reducing the labor hours and span times and eliminating the use of paper templates and string measurements. This project will continue to focus on hull attachments by seeking means of automating the actual install of the studs themselves.



Metris iGPS Transmitter and Receiver

The EB team is investigating the use of metrology technologies such as internal GPS (iGPS) and laser tracking to determine stud placement and orientation and allow the user to immediately install the stud. It is believed that iGPS and/or laser tracking technologies can be integrated with various hand tools (stud gun, hand punch machine and/or fixture) to reduce the number of hours it takes to locate points of attachments and then shoot the studs. This project will investigate the necessary integration of metrology technologies with chosen mechanical hand tools and or fixtures. For stud mounted attachments, this use of automated stud welding equipment is attractive because it would eliminate the need for layout/marketing altogether and would also allow the installations to occur earlier in the outfitting process. This 12-month effort will also begin a preliminary evaluation of the feasibility of integrating robotics technologies with metrology capabilities so that studs can ultimately be installed robotically, further reducing outfitting time and costs.



Leica Laser Tracker and T-probe

### About CNST

CNST is a Navy ManTech Center of Excellence, chartered by the Office of Naval Research (ONR) to identify, develop and deploy, in U.S. shipyards, advanced manufacturing technologies that will reduce the cost and time to build and repair Navy ships. For additional information on this and other CNST projects, please visit [www.cnst.us](http://www.cnst.us).

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