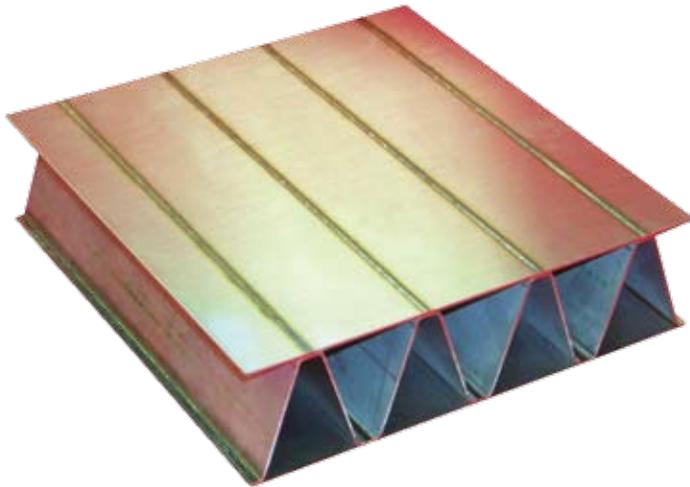


Naval Applications of Laser-Welded Metallic Sandwich Panels

Lightweight, Strong, and Adaptable



Stiff, lightweight metallic sandwich panels offer the potential for significant weight and cost reductions.

Future naval vessels must reduce weight to improve combat effectiveness and maneuverability, while remaining affordable. Improvements in manufacturing and process technology have made the use of laser-welded metallic sandwich panels more feasible and economical for naval applications.

Background

Laser-welded metallic sandwich panels are stiff, lightweight structures that offer the Navy corrosion resistance, reduced weight, less distortion and cost-effectiveness. The design is similar to corrugated cardboard and consists of two sheets of metal that are joined to a corrugated metal core via laser welding.

Efforts involving the panels have spanned more than 20 years, including work by the Naval Surface Warfare Center Carderock Division (NSWCCD) and ARL-Penn State under the Office of Naval Research's (ONR) Manufacturing Technology Program. Today the technology is geared

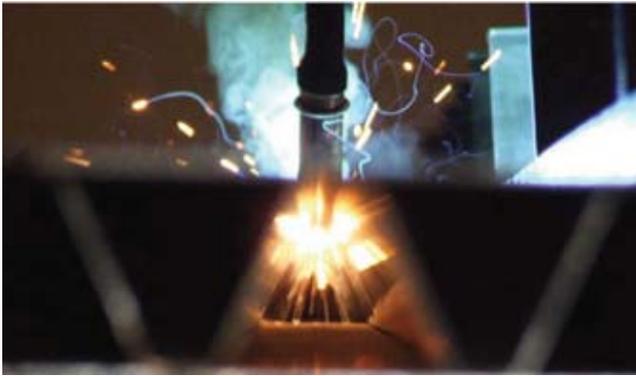
toward Navy implementation and manufacturing efficiency. Sandwich panels have seen limited use on various applications for the U.S. Navy, including DD-981, CV-41, LC 19/20, and DDG-51 as well as antenna platforms for the USS Mt. Whitney (LCC 20). Even after extensive development work, issues such as uniform design parameters; joining techniques; attachment practices, materials, repair and modification methods; and availability have prevented opportunistic growth in the use of laser-welded metallic sandwich panels for naval and other defense and commercial applications.

Benefits

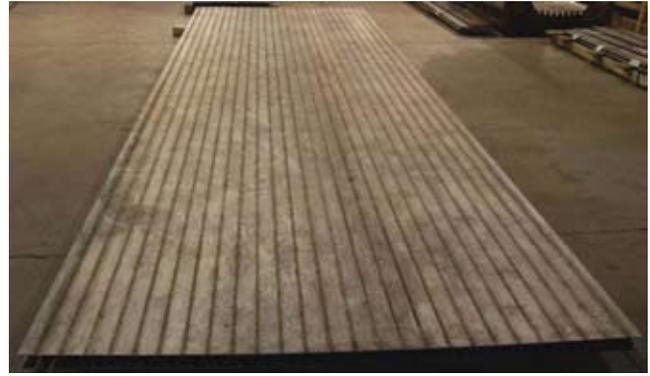
Laser-welded metallic sandwich panels combine the features of low-density materials with the advantages of traditional steel superstructures.

By properly addressing the current barriers to use, this technology can be more readily implemented in modular fashion to improve opportunities for weight reduction and other benefits in military and commercial applications. Preliminary studies have shown that for typical deck applications, a 15 - 35% weight savings can be attained over traditional plate and stiffener structural systems. In addition to weight reduction, laser-welded metallic sandwich panels can provide:

- Modular panel design for assembly
- Lower center of gravity for ship construction when used for topside applications
- Better life-cycle maintenance cost
- Enhanced corrosion resistance when constructed of duplex stainless steel
- Elimination of stiffeners and reduced understructure
- Improved flatness



Detailed view of stake welding with hybrid filler.



Final assembled laser-welded metallic sandwich panel.

Application

Laser-welded metallic sandwich panels continue to be developed and improved for naval shipbuilding applications. The Navy Metalworking Center (NMC), working with Applied Thermal Sciences, Inc., (ATS); NSWCCD; Northrop Grumman Shipbuilding; the Institute for Manufacturing and Sustainment Technologies; and the Navy Joining Center, was able to advance the state of the technology under the sponsorship of ONR. Application development, design, material selection, vendor qualification and the fabrication of prototype 80-by-240-inch panels (with the ability to increase panel size) are among the project team's accomplishments.

Implementation Success

The advancements made from the ONR-funded project enabled ATS and Concurrent Technologies Corporation (CTC) to transition the sandwich panel technology to an application on the DDG 1000 class of guided-missile destroyers. CTC is the principal subcontractor to ATS, which was awarded a contract from General Dynamics Bath Iron Works to develop, test and manufacture Deck Edge Safety Berms and Personnel Safety Barrier (PSB) Panels using laser-welded metallic sandwich panels. The BIW solicitation requested technical solutions for the Berms and PSBs that are made from lightweight, corrosion-resistant materials that also meet structural, heat and other

requirements. The ATS/CTC team was able to propose laser-welded metallic sandwich panel technology, which offered a unique technology for this application.

Laser-welded metallic sandwich panels provide an opportunity for shipyards to reduce weight while enhancing performance in applications where an economical metallic solution is needed. By optimizing thickness, materials, geometry, and joint designs, the flexible sandwich panel designs can be tailored to a wide variety of shipyard applications that meet various performance requirements. As more applications for this technology are successfully implemented, additional opportunities will follow.



*Closeouts can be incorporated into panel designs.
All photos courtesy of Applied Thermal Sciences, Inc.*



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