

Stirred, not shaken: Bond for future ships, iMacs has ONR roots

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A state-of-the-art welding process refined for use in naval shipbuilding by the Office of Naval Research (ONR) has crossed over to the world of computing.

Known for creating the alternative to PC computing, Apple credits friction-stir [welding](#) for the design of its new iMac computers, which went on sale last week. The [welding process](#), which uses heat and pressure to join metals and alloys, has long been a research investment for ONR.

"We recognized early the potential benefits that friction-stir welding could bring to the shipbuilding process," said Dr. Thomas Killion, director of transition at ONR. "The importance of our continued investment in this area has paid off in advances in this technology, which is being used by a variety of industries today."

Friction-stir welding softens—but does not melt or distort—the materials being joined. Apple reports using the process to conjoin the front and back aluminum parts of its product to create an extra-thin computer. For the Navy, it could provide an affordable, efficient way to create [ship hulls](#) from stronger and lighter materials that are resistant to corrosion, such as titanium.

In addition to applications in the aerospace, automotive and railway industries, friction-stir welding's clean precision has the potential to open new avenues for ship design.

"One of the main attributes of friction-stir welding is that you can do unconventional welds," said Kelly Cooper, a program officer in ONR's [Sea Warfare](#) and Weapons Department. "You could essentially write your name in it."

Cooper manages a program to build a demonstration section of a ship hull out of titanium. Sponsored by her ONR program, researchers from the University of New Orleans and Textron Marine and Land Systems have completed record-length titanium friction-stir welds as they near completion of an entire mid-ship hull structure.

The section is planned for completion by the end of the year, after which it will undergo a series of structural tests and validations.

The Welding Institute in the United Kingdom invented friction-stir welding in 1991. Since then, ONR has invested heavily in modeling, tools and specifications for the process and has focused its research on adapting it for use in conventional shipyards. Along the way, researchers have used the process to fuse everything from steel and aluminum to nickel and bronze.

The Navy Metalworking Center (NMC), a center of excellence under the Navy Manufacturing Technology (ManTech) program overseen by ONR, developed a friction-stir welding machine that could be used in future ship construction.

"Over the past 12 years, NMC has advanced friction-stir welding tooling and technologies for aluminum and steel," said Robert E. Akans, NMC senior technical director. "Since adoption of friction-stir welding has been slow in the United States due to its high cost, we developed a transportable, low-cost friction-stir machine that can be located at the shipyard. It takes advantage of new welding techniques and design approaches to dramatically reduce the cost of the equipment."

Provided by Office of Naval Research

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