Navy Metalworking Center

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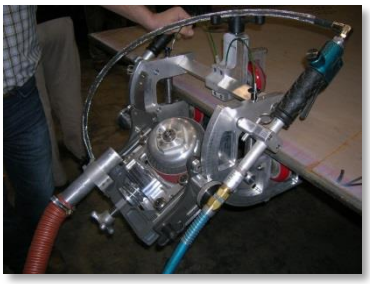
Background / Mission

Established in 1988, the Navy Metalworking Center (NMC) is a Manufacturing Technology Program Center of Excellence sponsored by the Office of Naval Research. To support the Navy's mission to reduce total ownership cost, NMC works with government and industry to develop and optimize metalworking and manufacturing processes and implement the solutions in the U.S. industrial base.

Capabilities

NMC has advanced and applied a vast range of technologies to defense-related manufacturing issues. NMC's current capabilities include:

Advanced Metalworking: Projects address challenges with manufacturing processes such as forming, joining and cutting. For example, after evaluating several potential production methods, NMC developed a net-shape casting solution for the entry edge of the Freedom Class variant LCS waterjet inlet tunnel, which had been constructed by welding and blending 13 formed steel plates into the hull. In FY10, Marinette Marine Corporation implemented the cast inlet edges on LCS 3, which reduced construction labor hours for this component by 75%.



A new, mechanized tool has replaced manual grinding of steel plate edges and surfaces in preparation for welding on DDG 51 and DDG 1000.

Shipyard Processes: NMC develops mechanized process solutions that save labor and provide ergonomic and environmental benefits to the shipyard workforce. NMC recently developed two new, mechanized tools – one for plate edges and one for plate surfaces – to replace manual grinding of large plates for weld preparation. The tools were implemented on DDG 51 and DDG 1000 and are expected to save $2M - $4M on the cost of a future combatant.

Coatings Application and Removal: NMC develops processes for both coatings application and removal that improve life-cycle costs. NMC modified a remotely operated crawler to perform a wide variety of inspection, de-coating, and preservation tasks in hazardous or inaccessible shipyard areas. Norfolk Naval Shipyard intends to implement the project results for coating removal during a Moored Training Ship conversion starting in late 2014 and for a Moored Training Ship overhaul beginning in spring 2017. The Navy will realize a cost avoidance of almost $2.6M from reduced labor associated with bilge maintenance and preparation for human bilge maintenance.

Design for Manufacturability (DFM): By concurrently addressing design and manufacturing considerations, the manufacturability and cost of ship components can be improved. NMC and Newport News Shipbuilding (NNS) employed DFM principles to save costs and labor in the construction of weapons elevator doors on CVN 79. NNS implemented an interim door design on CVN 79 in March 2013 and will use a permanent door solution on CVN 80 in 2018. Reduced labor and on-time delivery will reduce costs significantly.

Advanced Metrology and Inspection Technologies: NMC is leading several projects that improve measurement (metrology) and inspection accuracy during manufacturing, which significantly enhances the inspection fidelity and reduces weapon system production cost. NMC improved the accuracy of detecting debonded special hull treatment (SHT) on the Virginia Class Submarine (VCS) by developing an impulse hammer system that can be used during the construction process. A cost avoidance of approximately $350K/hull may be realized. General Dynamics Electric Boat (EB) first used the system on SSN 789 in May 2014 and plans to use it next on SSN 784.

An impulse hammer will improve SHT quality inspections.

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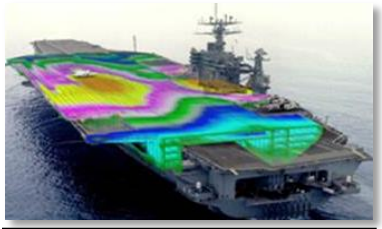
Selected Project Highlights



HSLA-115 plate provides top-side weight reduction on CVN 78.

HSLA-115 Evaluation and Implementation (CVN) – NMC tailored a high strength, low alloy (HSLA) steel variant using innovative material processing parameters to meet the Navy's need to significantly reduce weight on the CVN 78 Class carriers. NMC increased the performance and strength of HSLA-100 steel through improved thermal processing, resulting in a higher strength material designated as HSLA-115. This permitted the use of steel plate at reduced thickness, and thus, reduced weight. HSLA-115 steel is being used on the flight deck of CVN 78, resulting in more than 100 long ton weight savings.

Hull Fabrication Improvements Phase III (VCS) – NMC leveraged robotic welding technology developed in a Navy Joining Center project to create a portable, production-hardened, track-based plasma arc backgouging system for VCS hull butt joints. These project results will save 910 labor-hours per hull. The prototype was used on SSN 789 in April 2014; EB also plans to procure two backgouging systems for use in its Groton assembly plant to prepare VCS hull butt joints. The technology is also applicable to the Ohio Replacement Program.

Cold Forming of Alloy 625 Fittings (CVN/VCS) – NMC scaled up and demonstrated an innovative cold forming process initially developed to form small diameter elbows for manufacturing large-bore, seamless pipe elbows made of Alloy 625. The closed-die, cold forming technique creates minimal thinning of the pipe elbow walls, which allows thinner raw material to be used. Based on this project work, the vendor won a separate, competitive bid to form large-bore elbows on CVN 78. In addition, the vendor has quoted the main seawater fittings for Block IV of VCS. Material costs will affect savings, which range from $150K to $660K per VCS shipset.

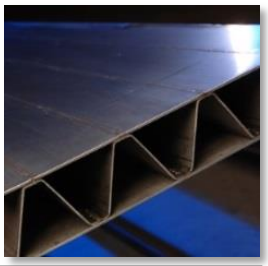
Awards and Commendations

Ingalls Shipbuilding used the weld shaver tool on DDG 1000 and BIW used it on DDG 1001, saving labor and production costs.

2013 – Defense Manufacturing Technology Achievement Award for developing, implementing, and commercializing mechanized plate edge and surface preparation tools that significantly reduce the time required to prepare large plates for welding, as well as worker injuries associated with conventional grinding tools. The tools were used in the production of DDG 51 and DDG 1000 and will save up to $4M per hull.

2012 – Defense Manufacturing Technology Achievement Award (*Finalist*) for developing a mechanized system that is being used to braze CVN 78 pipe fittings shipboard. The tool replaces a hand-held torch and is expected to save $2.6M in the construction of 3 CVN and 9 VCS hulls and in the overhaul of 7 CVN hulls at NNS.

2010 – Defense Manufacturing Technology Achievement Award for leading the development and implementation of a mechanized tool that removes weld reinforcement on DDG 1000 Class ships, substantially reducing the amount of hand grinding and associated injury claims, labor costs and production costs. The weld shaver tool and a modified version that performs weld back gouging will save $4.1M on 3 DDG 1000 hulls.



NMC-developed LASCOR technology was implemented on DDG 1000.

2010 – Special Commendation from Joint Defense Manufacturing Technology Panel Metals Subpanel for an outstanding track record transitioning projects to industry.

2008 – Defense Manufacturing Technology Achievement Award for advancing the state of Laser-welded corrugated-CORe (LASCOR) metallic sandwich panel technology to reduce weight and improve performance of naval applications. Leveraging this project's work, a team led by General Dynamics Bath Iron Works (BIW) won a competitive multi-million dollar bid to develop, test, and manufacture ship sets of Deck Edge Safety Berms and Personnel Safety Barrier Panels for the DDG 1000 Class using LASCOR technology.

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