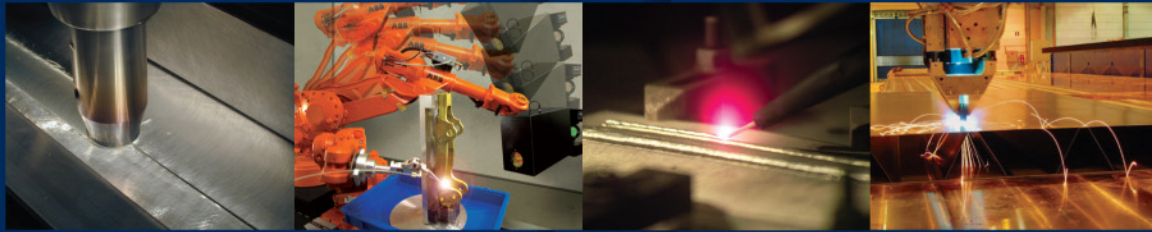


Advanced Metalworking Solutions



2 0 0 7 A N N U A L R E P O R T



For Naval Systems That Go in Harm's Way



Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2007		2. REPORT TYPE		3. DATES COVERED 00-00-2007 to 00-00-2007	
4. TITLE AND SUBTITLE NMC 2007 Annual Report. Advanced Metalworking Solutions for Naval Systems That Go in Harm's Way.				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Concurrent Technologies Corporation,NMC Information Services,441 Friendship Road Suite 103,Harrisburg,PA,17111-1204				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 16	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

DIRECTORS' LETTERS



The Navy has an ambitious goal to construct several new ship classes that execute missions in a variety of environments using advanced technologies and greater automation. By focusing on projects that reduce manufacturing costs and optimize the performance of Navy weapon systems, the ManTech Program plays a significant role in improving the affordability of these platforms, and ultimately, helps the Navy achieve its goal.

The Navy Metalworking Center (NMC) is the Navy's resource for advanced metalworking and manufacturing processes. Its current project portfolio addresses both ManTech's shipbuilding affordability initiative and its platform-centric investment strategy to support CVN-21, DDG 1000, Virginia Class Submarines, and Littoral Combat Ship.

Greg Woods, NMC Program Officer; Dan Winterscheidt, NMC Program Director; and NMC staff are working with industry and weapon system Program Offices, and managing 24 projects—the majority of which focus on the needs of shipbuilding affordability.

I hope this annual report provides you with a better understanding of NMC and its role in achieving the Navy's goal of reducing ship acquisition costs. The leadership and staff of the Navy Metalworking Center are meeting the challenges of the ManTech Program head on. I am confident that NMC will continue to deliver technical excellence and transition projects that enable the Navy to fund the fleet it needs.

A handwritten signature in black ink that reads "John U. Carney".

John U. Carney
Director, Manufacturing Technology Program
Office of Naval Research



"It is not the critic who counts; not the man who points out how the strong man stumbles or where the doer of deeds could have done better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood, who strives valiantly, who errs and comes up short again and again, because there is no effort without error or shortcoming, but who knows the great enthusiasms, the great devotions, who spends himself for a worthy cause; who,

at the best, knows, in the end, the triumph of high achievement, and who, at the worst, if he fails, at least he fails while daring greatly, so that his place shall never be with those cold and timid souls who knew neither victory nor defeat." – Theodore Roosevelt, April 23, 1910

Like Theodore Roosevelt's "man in the arena," the Navy ManTech Program has taken on a formidable challenge — to meet RADM Landay's request to support the Navy's goal to reduce shipbuilding costs. Last year, the Navy Metalworking Center spent considerable effort identifying projects and structuring the Program to support shipbuilding affordability.

Our current project portfolio supports the weapon systems comprising ManTech's Integrated Systems Investment Strategy — Virginia Class Submarines, DDG 1000, CVN 78, and Littoral Combat Ship — and their need to reduce acquisition costs. In this annual report, you will read about our progress and successes, including recent

transitions in the areas of distortion reduction and manufacturing process optimization for shipbuilding, as well as projects for the Navy Unmanned Combat Air System, M777 Lightweight Howitzer, MH-60R Air Vehicle, and CH-53E Sea Stallion.

Our successes have not always come easy, but as Roosevelt notes, "there is no effort without error or shortcoming." Take, for example, LASCOR (LASer-welded corrugated CORE), stiff, lightweight, metallic-sandwich structures. LASCOR has been around the Navy for decades with very limited implementation. Through persistence and commitment to the technology, the NMC Integrated Project Team was able to make significant technical advancements to LASCOR — such progress that General Dynamics Bath Iron Works (BIW) competitively selected LASCOR on a separate initiative to manufacture Deck Edge Safety Berms and Personnel Safety Barrier Panels for DDG 1000.

It took many years of determination, teamwork and just plain hard work to transition LASCOR. But in the end, ManTech delivered not only a superior technical solution but one that potentially will save BIW and the Navy millions of dollars. Frequently, the worthy causes are the ones worth fighting for. Like the man in the arena, the Navy Metalworking Center will continue to strive for a worthy cause: implementing advanced metalworking solutions for naval systems that go in harm's way.

A handwritten signature in black ink that reads "Daniel L. Winterscheidt".

Daniel L. Winterscheidt, Ph.D.
Program Director, Navy Metalworking Center



SUBMARINES



“The Virginia Class Program...was originally designed with cost effectiveness in mind. In order to reduce costs on this program, we have to change the way we build submarines, and that’s what we’re doing with the program. I have every confidence that we can meet this goal.”

– Admiral William Hilarides (PEO Submarines)
Undersea Warfare, The Official Magazine of the U.S. Submarine Force, Winter 2007

The Navy Metalworking Center (NMC) has been a key player in cost-reduction efforts for Virginia (SSN 774) Class Submarines (VCS) and has developed several projects in the past year that will optimize manufacturing processes for VCS.

Time-Saving Techniques Translate to Reduced Costs

The first new project involves innovative electron beam welding technology that would replace the current welding process on a VCS component. The manufacture of VCS first reduction gears requires multiple passes using complex sequencing, with some joints requiring double-sided welding to ensure full penetration. NMC is developing a solution that would simplify joining and reduce schedule time. In addition to improving the manufacturing process of the first reduction gears, the team working on this effort will seek other potential VCS applications and other naval weapon systems during the execution of this project.

Another recently initiated project is investigating and developing a solution for defects that occur in steel during the casting process. NMC is analyzing the source of recurring problems such as foreign particle inclusions and entrapped gas. NMC will then prepare test castings using identified clean steel practices, which are expected to reduce costs and casting delivery time. The technology developed will be applicable to other VCS components and marine structures.



NMC worked to improve the casting process of a stainless steel saddle for Virginia Class Submarines. CTC photo

NMC is working on a project that is identifying a solution to manufacturing schedule delays that have resulted from high radiographic rejection rates on large-diameter alloy 625 pipe welds. NMC and an Integrated Project Team (IPT) consisting of shipyards General Dynamics Electric Boat (GDEB) and Northrop Grumman Newport News (NGNN), the Virginia Class Submarine Program Office, Naval Sea System Command (NAVSEA), Navy Joining Center (NJC), and Naval Surface Warfare Center Carderock Division (NSWCCD) investigated cost-effective methods for reducing or eliminating root-weld defects in large-diameter alloy 625 consumable insert pipe welds. These new techniques and alloy 625 processes are intended to decrease fabrication time and costs due to minimized schedule delays.

Reduced labor time, and therefore, cost, is also the aim of a project that will simplify preparation, installation, and inspection for pipe joining and fitting on VCS. These goals will be accomplished by replacing butt- and socket-welded joints with options that require less preparation time and simplified inspection procedures, such as mechanically attached fittings and belled-end fittings. For this project, NMC is managing a project team consisting of GDEB, NAVSEA, NGNN, and the Virginia Class Submarine Program Office.

Decreasing man-hours is the main goal of another VCS project involving damping materials, which reduce vibration. Damping tiles must meet military requirements on damping characteristics, adhesion strengths in peel and shock,



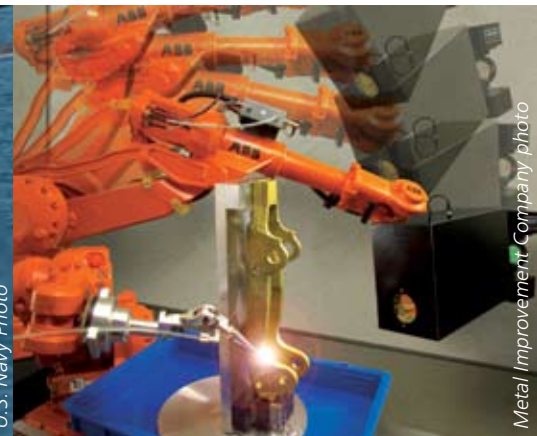
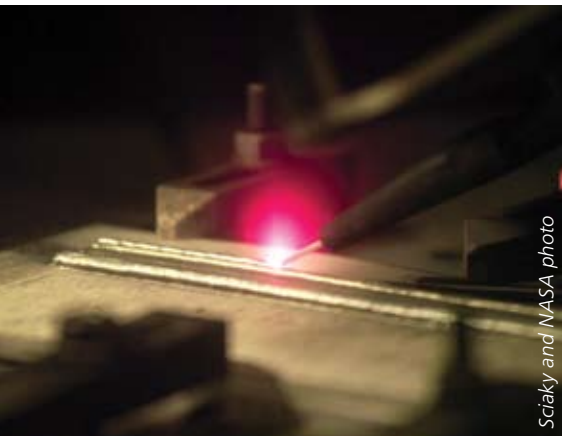
NMC has a number of new projects aimed at reducing labor hours and subsequent costs in the construction of the Virginia Class Submarine. General Dynamics Electric Boat photo

toxicity, flame retardancy, and others. The application process for the tiles is labor-intensive and has significant potential for improvement. Along with the Virginia Class Submarine Program Office, shipyards GDEB and NGNN, and NSWCCD, NMC will identify and qualify alternative damping materials that can be applied more efficiently and reduce the total cost of damping material for VCS.

These new and ongoing efforts to improve processes, and ultimately reduce manufacturing costs of VCS, are meeting the critical Navy need to improve the cost-effectiveness of the submarine program.



AIRCRAFT



“The Department of the Navy requires a robust aviation capacity including attack, utility, and lift capabilities.”

– Honorable Donald C. Winter
Secretary of the Navy
before the House Armed Services Committee, 1 March 2007

In times of war or peace, the ability of U.S. Navy aircraft to strike and project the threat of sustained attack from a mobile platform on the seas gives United States leaders significant crisis management and diplomatic options. In addition, aircraft provide logistics support to maintain the Navy’s readiness and, through helicopters, supply platforms for search and rescue, special operations, anti-submarine warfare, and anti-surface warfare. NMC is engaged in several projects to bolster the Navy’s performance in the air.

Improving Affordability and Performance of Unmanned Aircraft

From rotary-winged to unmanned aircraft, NMC is helping to keep our Navy capabilities in the air strong. The Navy-Unmanned Combat Air System (N-UCAS) Advanced Development Program is developing a high-performance, weaponized, unmanned aircraft for the 21st century combat missions.

In an effort to meet the Navy’s need for a lighter, more affordable N-UCAS, NMC is managing a project that leverages advanced High-Speed Machining (HSM) and Electron Beam Free Form Fabrication (EBFFF) to reduce both costs and weight. This project will demonstrate the applicability of these advanced metalworking technologies on a full-scale significant structural component consisting of both metal and composite parts. HSM will be used to manufacture ultra-thin aluminum spars, and EBFFF technology will be used to produce lower-cost titanium components. The potential benefits are up to 35% weight reduction and 35% acquisition cost avoidance for the affected parts. In addition to the reduced fuel cost, the weight savings may lead to performance enhancements such as increased payload and endurance. This project is being coordinated with a Systems Design and Manufacturing Development effort managed by the Composites Manufacturing Technology Center. IPT members for this

project are N-UCAS Advanced Development Program Office, The Boeing Company, and Naval Air Systems Command (NAVAIR).

Enhancing Mission Availability and Reducing Operating Costs of Helicopters

The three-engined CH-53E is the most powerful helicopter in the U.S. military inventory. It can lift aircraft as heavy as itself. NMC is working as part of an IPT to improve the H-53 transmission housing acquisition cost, life-cycle cost, and corrosion resistance, all without adding weight to the component. The team, consisting of H-53 prime contractor Sikorsky Aircraft Corporation (SAC) and key engineers from Naval Air Systems Command (NAVAIR); Patuxent River; and Fleet Readiness Center East, Cherry Point, will optimize the transmission housings to substantially reduce maintenance and replacement costs. The technology on this project can also be transitioned to other H-53 components, later variants, and similar components in the MH-60R, MH60S, and other helicopters.

The MH-60R is the U.S. Navy's new primary maritime-dominance helicopter, replacing SH-60B and SH-60F aircraft. Greatly enhanced over its predecessors, MH-60R features a glass cockpit and significant mission system improvements that give it unmatched capability as an airborne multi-mission naval platform. The Air Vehicle Systems Analysis (AVSA) project is addressing various components / mission kit design enhancements for the MH-60R for NAVAIR, with SAC, Cherry Point In-Service Support Team, and North Island, Mayport, and Norfolk Naval Air Stations. NMC is currently providing design and manufacturing engineering, material expertise, structural analysis, and Computer-Aided Design improvements for the MH-60R's Antenna systems, tail section stabilator bushings, Forward Looking Infrared / Hand-Control Unit and shimming updates of the production drawings. The technology on this project will result in improved maintenance, reduced fleet support cost, and higher mission availability.

The use of advanced manufacturing processes will reduce the weight and cost of the Navy-Unmanned Combat Air System. Northrop Grumman photo

Laser Peening Improves Strength, Extends Aircraft Life

The technology started with the ball peen hammer, advanced to shot peening, and now includes both ultrasonic and laser peening methods. Laser peening is capable of generating compressive residual stresses in the surface of metal parts at greater intensities and at least four times greater depth than conventional shot peening. This improves the fatigue and stress corrosion cracking resistance of fracture critical components and extends their service life by three to five times over conventional shot peening.

NMC is managing a project to evaluate and demonstrate the potential benefits of laser peening for naval aircraft applications. Other IPT members for this project include Metal Improvement Company, a subsidiary of Curtiss-Wright Corporation, which is performing the technical work, and NAVAIR. The team will assess and utilize the benefits of laser peening to improve the strength and extend the life of fracture critical airframe, turbine engine and drive train components. Specifically, this project will develop models to predict the internal stress distribution profiles of selected components at design load limits, develop laser peening procedures and parameters to reduce excessive tensile stresses in critical areas, and demonstrate the benefits of laser peening using geometrically representative samples and/or full-scale components.

Innovative and leading-edge technologies are being advanced and applied to Navy aircraft through these projects. By working with industry leaders in the various manufacturing areas, NMC is ensuring that the U.S. Navy benefits from the very latest knowledge available to improve weapon system performance and cost-effectiveness.



SHIPS



“The Littoral Combat Ship Program remains of critical importance to our Navy. With its great speed and interchangeable war-fighting modules, the ship will provide unprecedented flexibility.”

– Admiral Mike Mullen
Chief of Naval Operations
12 January 2007

Because of its size, weapons technology, and ability to project force far from American shores, today’s U.S. Navy continues to protect American interests. Enhancing its current fleet and planning the next generation of vessels remains a constant focus of the U.S. Navy.

Lowering Costs of Navy’s Newest Class of Surface Warships

Among the new ships under development is the Littoral Combat Ship (LCS), the first of the U.S. Navy’s next-generation surface combatants. Its design allows the ship to be reconfigured for the mission at hand, e.g., anti-submarine warfare, mine warfare, surface warfare, and humanitarian relief.

LCS owes much of its agility at advanced speeds to the use of aluminum alloys in large structural components. A joining process ideally suited for aluminum, friction stir welding yields decreased distortion, improved joint properties, and reduced production costs. Until now, the high cost of multifunction FSW machines had limited the use of this technology in the shipyards. NMC, along with an IPT including the LCS Program Office, Lockheed Martin, Marinette Marine Corporation, Bollinger Shipyards, NAVSEA, and American Bureau of Shipping, is creating a prototype FSW machine that reduces machine functionality to that specifically needed for shipyard production, making it less expensive and providing a faster return on investment. In addition, because the



NMC is leading an effort to bring friction stir welding on site to the shipyard, allowing the Littoral Combat Ship to benefit from this process on a large scale for the first time. Lockheed Martin Corporation photo

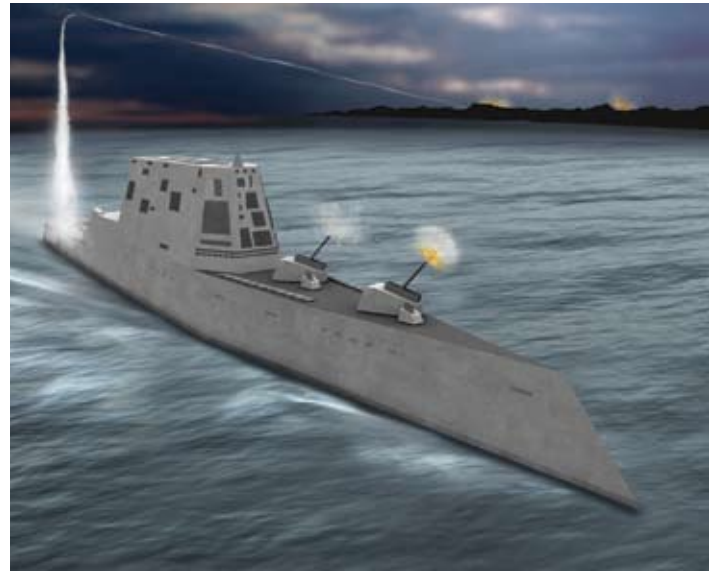
FSW operation will be located at the construction yard, the metal panels can be built to size rather than limited to a size that can be transported.

In another project that brings manufacturing processes to the shipyards, an NMC project successfully transitioned a prototype abrasive waterjet cutting system that is located dockside or in dry dock. Until now, this technology has been used only sparingly in shipbuilding because the components that could benefit from abrasive waterjet cutting could not be accommodated by the off-site workstations. Abrasive waterjet cutting offers excellent after-cut properties such as near-net shape, low distortion, and no heat-affected zone. NMC worked with Spiritech Incorporated, ONR, NAVSEA, Penn State University/Applied Research Laboratory, Norfolk Naval Shipyard, Puget Sound Naval Shipyard, Portsmouth Naval Shipyard, and Pearl Harbor Naval Shipyard.

Construction Process Improvements for DDG 1000

DDG 1000 is the lead ship in the Zumwalt Class of destroyers developed under the DD(X) Program. The Zumwalt Class destroyer will triple both current naval surface fire coverage and capability against anti-ship cruise missiles. DDG 1000 will provide forward presence and deterrence and operate as an integral part of joint and combined expeditionary forces. Two new projects are underway that will improve manufacturing processes and subsequently reduce the cost of construction.

In the first project, NMC is working with the DDG 1000 Program Office; Naval Technical Authorities; Naval Surface Warfare Center Carderock Division (NSWCCD); Northrop Grumman Ship Systems (NGSS); and Bath Iron Works (BIW) to mechanize the process of weld grinding on hull and deck panels. DDG 1000 class ships require that hull plating butt welds be ground flush with the hull. Mechanizing the grinding process will reduce the potential of damaging the surfaces adjacent to the welds, as well as diminish workforce hazards, such as ergonomic strain, eye injuries, particulate and gaseous emissions, and high-decibel noise levels. Mechanized grinding is expected to substantially increase productivity and decrease production costs, including a reduction in lost-time injuries. Mechanizing weld seam facing is applicable to other Navy ship construction projects as well.



NMC continues to make advances on several projects that will improve manufacturing processes, thereby reducing construction costs and improving functionality of the DDG 1000 destroyer. Northrop Grumman photo

Reliability of a DDG 1000 peripheral vertical launch system (PVLS) structure is the focus of a project undertaken by NMC along with NGSS, BIW, NSWCCD, and Southwest Research Institute. The team is studying cast HY-100 tee sections as a potential replacement for welded joints. Currently, the joint design consists of HSLA-100 steel plates that are fabricated by welding lengthwise. Distortion, quality/rework, and production costs of lengthwise-welded sections are of concern along with fracturing that occurred during explosion testing. A one-piece alternative to welded tee sections may improve the reliability of the PVLS structure in explosive conditions and may also reduce procurement and weld fabrication costs.

In another project supporting DDG 1000, NMC is working with a project team to reduce the cost and weight of the MK 100 Advanced Gun System (AGS). The AGS pallet is used to package, handle, store, and transport the Long-Range Land Attack Projectiles and associated propellant charges through the logistic channels and within the AGS magazine. A projected 20% cost and weight reduction of the AGS pallet system will allow for potential safety and survivability improvements, as well as enhance the ability to handle the pallet throughout the logistic channels. The IPT, which includes Naval Surface Warfare Center Dahlgren and Port Hueneme Divisions, and BAE Systems, is reviewing the manufacturing approach and identifying opportunities

for reduced cycle time, enhanced material selections, and alternate manufacturing approaches such as injection molding and near-net-shape casting. Proposed production methods focus on decreasing the time and cost to manufacture the pallets while maintaining the tight tolerances needed for the pallets to function properly.

Materials and Process Improvements to Benefit the Entire Fleet

NMC continues to support research and development efforts to identify and evaluate many advanced materials and processes that will enhance the entire U.S. Navy fleet. Past successes through the Metallic Materials Advanced Development and Certification Project (MMADCP) include HSLA-65 testing for certification and procurement on CVN 78 and production methods and testing of large high-strength, marine-grade fasteners, including procurement specifications for Ti-5111, MP98T, alloy 59, and others. These fasteners offer significant reductions in life-cycle costs for current and future applications. MMADCP also established the Navy Materials Properties Database (NMATDB), which compiles more than 1,200 Navy material test reports as well as the test

results of all MMADCP tasks. NMATDB will support design agents making materials selections for critical ship system applications.

In another effort to research and develop advanced materials and processes for Navy platforms and subsystems, NMC is working with experienced ship design firms, NAVSEA, and NSWCCD. The project will investigate the use of low-cost titanium alloys, review composite-to-metal joining technologies, and advance technologies developed under related Navy efforts. Emerging steel alloys are being closely examined to determine whether pricing and shipyard manufacturing criteria are suitable for introduction into shipyard applications. This project is also documenting innovative material and manufacturing technologies that can improve the performance and/or reduce cost on various naval platforms. University and industry experts will be engaged to develop ways of optimizing friction stir welding practices for shipbuilding.

Through a wide range of manufacturing processes and solutions, NMC and its partners are leading the way to make certain that the U.S. Navy maintains its dominance on the sea today and in the future.



AIRCRAFT CARRIERS



“I know how relieved I am each time when I turn to my operations officer and say, ‘Hey, where’s the nearest carrier?’ and he can say to me, ‘It’s right there on the spot.’ For United States’ interests, that means everything.”

– General John Shalikashvili
former Chairman of the Joint Chiefs of Staff
during a visit to USS Dwight D. Eisenhower

By using the oceans – more than 70% of the earth’s surface – both as a means of access and a base, forward-deployed Navy aircraft carrier battle groups are a powerful instrument of diplomacy, strengthening alliances or responding to crisis. Production has begun on the first ship in the next generation of carrier, CVN 21. That first ship is the Gerald R. Ford (CVN 78), which is slated to be commissioned in 2014.

NMC’s work with the Future Aircraft Carriers Program has led to improvements being implemented now and is paving the way toward innovative solutions that will reduce weight, save costs, and improve manufacturing processes in future aircraft carriers.

Successes Already Achieved for CVN 78 Production

An NMC project that avoids costly rework usually associated with the huge structures used in shipbuilding has been incorporated early in the manufacture of CVN 78. Weld distortion in heavy plates used in the fabrication of aircraft carriers requires significant rework to achieve flatness requirements. Under this project, software that predicts distortion in welding structures was assessed, fabrication parameters for innerbottoms were established, and a sub-scale innerbottom was constructed. The successes achieved in this

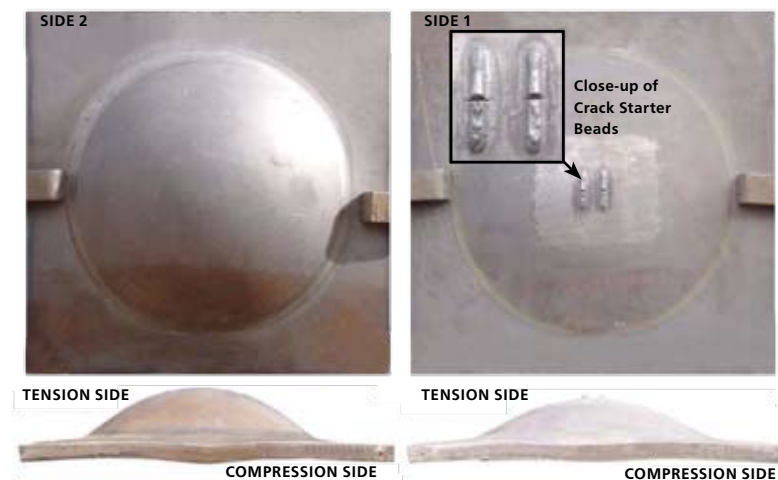


NMC recently transitioned improved manufacturing technology to CVN 21 and is involved with several other projects that will enhance performance and reduce manufacturing costs.
Northrop Grumman photo

project translate to simplified construction methods, reduced schedule impact, and cost savings, e.g., a 22% reduction in the thick plate weld joint volume. The project's IPT consisted of the Future Aircraft Carriers Program Office, NGNN, Battelle Memorial Institute, ESI North America, and Optimal, Inc.

Another manufacturing process improvement on CVN 78 has been implemented as a result of an NMC project; this one involving the work of IPT members Future Aircraft Carriers Program Office, NAVSEA, NSWCCD, NGNN, GDEB, ESAB, and Lincoln Electric. To maintain ballistic performance, a certain type of electrode that conforms to MIL-10718-M must be used for all shielded metal arc welding (SMAW) of HSLA-100 and HY-100 steels on Navy ships. However, the MIL-10718-M electrode tended to yield an unacceptable rejection rate during testing and had been available only in a 1/8-inch diameter. This project improved the manufacture of the 1/8-inch diameter electrode and developed a 3/32-inch diameter electrode. Further, the project qualified two suppliers for each diameter of electrode, increasing flexibility, providing competition in pricing, and ensuring consistent availability of the two diameter sizes of MIL-10718-M electrodes. ESAB and Lincoln Electric each produced lots of electrodes and provided them to GDEB and NGNN, who verified the operating characteristics, weld metal mechanical properties, and electrode usability. The 1/8-inch electrodes were implemented on CVN 78 as well as VCS. The 3/32 electrode has been approved for use on CVN 78 and VCS.

NMC successfully completed a project addressing an immediate need to determine the strength and toughness of HSLA-65 and DH-36 steel plates that have been hot formed. The goal was to help define shipyard hot forming practices for these materials. The project determined limitations on hot forming of HSLA-65 and DH-36 and transferred the mechanical property data to NAVSEA.



HSLA-115 has demonstrated excellent explosion performance even at reduced thicknesses for CVN 21 applications. Puget Sound Naval Shipyard photo

Designing Tomorrow's CVN 21 Class Ships

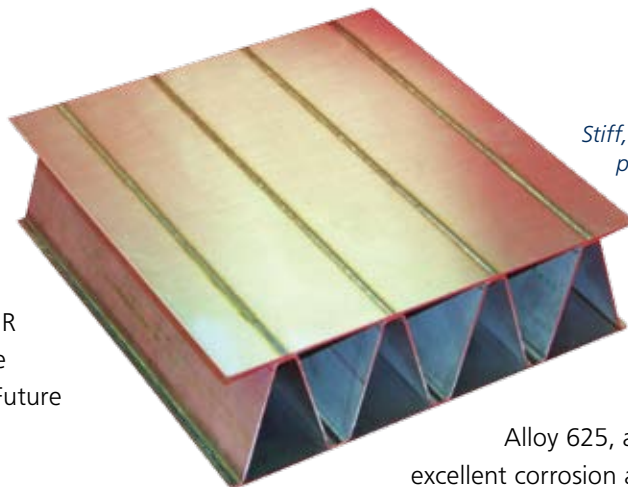
New steel alloys are being developed in a project that is evaluating and testing the replacement of HSLA-100 steel with HSLA-115, an improved version of HSLA-100. HSLA-115, named for its 115 ksi minimum yield strength, allows for reduced weight, a critical goal on CVN 78. To date, the multifaceted project team, led by NMC and consisting of the Future Aircraft Carriers Program Office, NSWCCD, Mittal Steel USA, NJC, NAVSEA, Puget Sound Naval Shipyard, Aberdeen Test Center, and NGNN, has demonstrated successful production plate manufacturing, acceptable explosion and under-matched welding performance at reduced thickness, as well as acceptable impact toughness values for CVN applications of HSLA-115. Efforts are now focusing on evaluating HSLA-115 for production plate performance and manufacturability, welding optimization and performance, as well as shipyard practices so that NGNN can incorporate HSLA-115 into the baseline design and implement it into the CVN 78 construction schedule. A cost-neutral implementation is estimated compared to the baseline design. Pending successful completion of this project, NAVSEA has approved the use of HSLA-115 for the CVN 21 design, noting that ManTech projects supporting the research and testing of this material have been critical to its approval. HSLA-115 may now be considered to reduce weight and improve performance for additional CVN 21 or surface ship applications where HSLA-100 is currently used.

Another option for reducing weight is the use of LASCOR (LASer-welded corrugated-CORe), which are stiff, lightweight, metallic sandwich panels. Structural, corrosion, and material testing of LASCOR is being conducted by NMC and an IPT consisting of the Future Aircraft Carriers Program Office, Applied Thermal Sciences (ATS), NSWCCD, NAVSEA, NJC, the Institute for Manufacturing and Sustainment Technologies,

and NGNN. The results of their efforts will be an approved LASCOR Engineering Manual as well as supporting Material Selection Information data that will help streamline future LASCOR implementation efforts, which are currently being evaluated by the Future Aircraft Carriers Program Office.

As a result of the commitment of the IPT to advance LASCOR technology, a successful transition of this project has been achieved with the DDG 1000 Program and has generated interest from other ship platforms as well. Bath Iron Works has awarded ATS and its principal subcontractor, Concurrent Technologies Corporation, a contract to develop, test, and produce six ship sets of Berms and Personnel Safety Barrier Panels for the DDG 1000 Program. The LASCOR solution to this application meets all technical requirements at a much lower overall cost.

During construction of CVN 21 and other Navy platforms, the steel surfaces of critical areas must meet stringent surface specifications to ensure proper coating adhesion. In addition, specific environmental conditions must be met from the start of blasting until final paint cure. Currently, excessive rework is required to meet the surface specifications, and the existing process only controls the environment in a limited number of tanks and voids. An NMC project is optimizing the preparation methods and environmental controls for preservation of tanks and voids on CVN 78 and subsequent aircraft carriers in order to reduce cost and schedule risk. To date, the project has obtained baseline information regarding the causes of the rework and is evaluating potential improvements. Conceptual designs for increasing the capability to control a larger number of tanks and voids are also in progress. IPT members



Stiff, lightweight, metallic sandwich LASCOR panels offer the potential for significant weight and cost reductions. Applied Thermal Sciences Inc. photo

include the Future Aircraft Carriers Program Office, NAVSEA, and NGNN.

Alloy 625, a nickel-based super alloy, offers excellent corrosion and oxidation resistance as well as strength and toughness at extremely high temperatures. However, the alloy also has a reputation for being difficult to form and weld. NMC is leading a project to develop practical experience and procedures for the forming of alloy 625 for CVN 78 applications. IPT members include NGNN, the Future Aircraft Carriers Program Office, and NSWCCD.

NMC and its integrated project team members have achieved many successes in implementing construction improvements and advanced new materials for the Future Aircraft Carriers Program, and they continue to meet the challenges involved with meeting performance and cost goals.



U.S. Navy photo

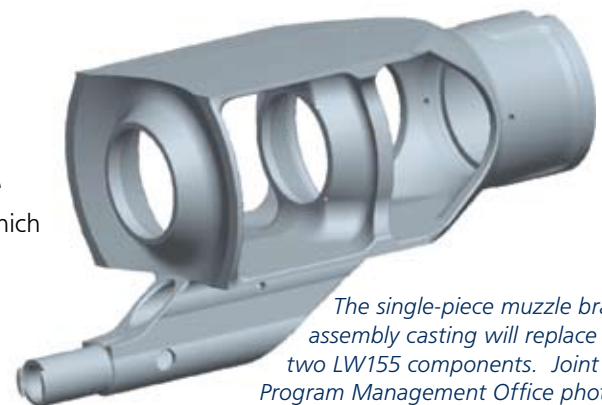
Ground Weapon Systems



“Lying offshore, ready to act, the presence of ships and Marines sometimes means much more than just having air power or ship’s fire, when it comes to deterring a crisis. And the ships and Marines may not have to do anything but lie offshore. It is hard to lie offshore with a C-141 or C-130 full of airborne troops.

– Gen. Colin Powell, Former Chairman of the Joint Chiefs of Staff during a visit to USS Dwight D. Eisenhower

In addition to enhancing the U.S. Navy fleet in the air and the sea, NMC is engaged in efforts to improve military ground weapon systems. With the aim of reducing manufacturing costs and improving reliability of the M777 Lightweight 155mm Howitzer, an NMC project is developing a single-piece casting of the 300-pound muzzle break and the 66-pound tow bracket, which previously had been welded together and had experienced weld failures. NMC is providing casting simulation and qualification, as well as managing the IPT comprised of the LW 155MM Howitzer Program Office, Benet Laboratory, MetalTek International, and Wollaston Alloys. In addition to the anticipated cost savings -- \$8 million plus cost avoidance from the retrofitting of replacement parts over the weapon’s lifetime – this project qualified two foundries capable of manufacturing this casting, mitigating supplier risk. In another project, NMC has been working with the U.S. Army Tank Automotive Research, Development and Engineering Center, vehicle program managers and manufacturers to transition advanced lightweight materials, novel designs, and innovative processing technologies to existing and future military vehicles. Specifically, high-strength Al-Li alloys in ballistic tempers, affordable titanium alloys, friction stir welding technology, and novel lightweight hybrid armor are being transitioned to higher technology readiness levels for various vehicle applications.



The single-piece muzzle brake assembly casting will replace two LW155 components. Joint Program Management Office photo

Improving the manufacturing processes of current and future U.S. Navy weapon systems – on the ground, in the air, on the sea and below it – is the essence of the Navy Metalworking Center’s work. Advanced manufacturing technologies, materials, and structures are making weapon systems more affordable and stretching the imagination of what the Navy is capable of. Leveraging the combined strengths of industry and government partners, NMC is transitioning affordable solutions into reality for our naval systems that go in harm’s way.

Concurrent Technologies Corporation (CTC) operates the Navy Metalworking Center (NMC) for the U.S. Navy Manufacturing Technology (ManTech) Program. NMC serves as a national resource in developing and implementing advanced technologies for metalworking products and processes. NMC applies these technologies to improve cost and performance in support of Navy and Department of Defense needs.

NMC offers extensive expertise in metalworking technologies, materials, and related processes, including:

- Metals and advanced metallic materials
- Metal-based composites
- Ceramics
- Metal/non-metal interface issues
- Shape-making processes
- Joining techniques
- Surface and heat treatment
- Primary metal materials manufacturing processes
- Materials characterization and testing
- Process design and control
- Product design and structural performance
- Environmental issues and recycling
- Information and data handling and transfer



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This report was prepared by the Navy Metalworking Center, operated by Concurrent Technologies Corporation (CTC), under Contract No. N00014-06-D-0048 to the Office of Naval Research as part of the Navy ManTech Program. Approved for public release; distribution is unlimited.

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