



# METALWORKING TECHNOLOGY UPDATE

Summer 2003

## **NCEMT's Growing Success with Shipbuilding Technologies Information Exchange**

Before 1998, an established forum did not exist that formally enabled the exchange of ideas of innovative technologies in the shipbuilding industry. In July 1998, that all changed when the NCEMT, under the direction of Program Director, Richard J. Henry, developed such a venue for the exchange of information on modern metalworking technologies related to shipbuilding and to present its technology contributions to the shipbuilding industry. The program would highlight successful technology developments and implementations, promote discussion on current and future technology needs of Navy/DoD Program Offices, and identify opportunities to jointly implement new technologies. Its name would be *Modern Shipbuilding Technologies: Demonstration & Information Exchange*.

*Modern Shipbuilding Technologies* was created for management and technical personnel involved in shipbuilding processes and technologies. Participants were solicited from DoD technical organizations, industry, and academia. Logistically, meetings were planned for the Washington, D.C. area. The first meeting, which took place in July 1998 in Arlington, Virginia, drew 70 attendees. Opening remarks were delivered by Francois Mollard (ret.), Concurrent Technologies Corporation (CTC). This meeting attracted 18 presenters representing 14 organizations. The second meeting took place in September 1999, again in Arlington, drawing 84 attendees. Mr. Henry gave opening remarks. This meeting featured 22 presenters from 15 organizations.

During this same period, there was a desire on the part of the Navy MANTECH Centers of Excellence (COEs) for greater interaction with the shipyards. Beginning in September 1998, the U.S. shipbuilding industry, acting through a collaboration then known as MARITECH Advanced Shipbuilding Enterprise, began meeting with COEs to better understand their activities and capabilities and to convey the industry's research and development priorities. This increase in industry/COE

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### ***In 1998, the NCEMT developed the first-of-its-kind forum for the shipbuilding industry.***

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interaction evolved to include greater shipbuilding industry participation in these meetings. In September 2000, the shipyards—operating through a collaboration now known as National Shipbuilding Research Program, Advanced Shipbuilding Enterprise (NSRP ASE)—supplied keynote speakers, panelists, and technical track co-chairs for the event. The name changed to *Shipbuilding Technologies 2000: A Shipbuilding Technologies Information Exchange*, with the Navy MANTECH Program as the sponsor. Attendance at this third meeting, held in New Orleans, Louisiana, grew significantly to 145. As part of the forum, concurrent technical sessions were developed in three categories—Metals Fabrication and Processing, Emerging Processes and Materials, and Business and Design Processes. Opening remarks were delivered by Steven M. Linder,

Director, Navy MANTECH, Office of Naval Research (ONR). Here, 33 presenters represented 17 organizations.

Plans were quickly underway for the fourth meeting in September 2001 in Biloxi, Mississippi, for which NSRP ASE officially joined MANTECH ONR as a sponsor. *Shipbuilding Technologies 2001* drew its largest crowd yet with 205 attendees. Concurrent technical sessions were held in Materials, Standards and Design Technologies; Production Processes; and Business Processes. Mr. Linder gave opening remarks. A total of 62 presenters represented 24 organizations. In 2003, the name was shortened to simply *ShipTech 2003*. MANTECH ONR and NSRP ASE returned as sponsors. Concurrent technical sessions included the three categories of Materials and Production Processes, Shipboard Propulsion and Auxiliary Systems, and Business Processes. This meeting, held in January 2003, surpassed previous years' attendance with 210. Mr. Linder delivered opening remarks. A total of 48 presenters represented 11 organizations. (See back page.)

Now, the NCEMT is anticipating another exciting and successful meeting with *ShipTech 2004*, scheduled for January 27–28, at the Beau Rivage Resort in Biloxi, Mississippi. The NCEMT is working with ONR and the NSRP program administration staff to develop the agenda and identify speakers. Interested members of the shipbuilding industry are encouraged to attend this ever-growing venue for the exchange of information on modern manufacturing technologies related to shipbuilding. Updated information will be posted at [www.ncemt.ctc.com](http://www.ncemt.ctc.com) as it develops. *See you in Biloxi.* ■

## NCEMT's Efforts Focused on Navy Certification of MP98T

The Naval Sea Systems Command (NAVSEA) is interested in identifying corrosion-resistant materials that possess good combinations of strength and ductility for use in future submarine and surface ship systems. Of primary concern is the desire to remove the cost and downtime associated with the periodic inspections and maintenance that are currently required of select components. A leading material candidate, and the focus of the current High-Strength Marine-Grade Fasteners (HSMGF) project, is a cobalt-nickel-chromium-based alloy called MP98T. This material is produced with less mechanical deformation than its predecessor, MP159, resulting in a desirable balance of mechanical properties while conserving the inherent corrosion resistance of the alloy.

Early HSMGF work was conducted on fasteners with diameters less than 2 inches, in cooperation with the Naval Surface Warfare Center (NSWC). The success of those

investigations led to the current work on MP98T fasteners (see Figure 1) with larger, approximately 3.5-inch diameters. The NCEMT is working with SPS Technologies of Jenkintown, Pennsylvania to develop technologies to overcome the substantial challenges of manufacturing larger MP98T bolts. Concurrently, the NCEMT is evaluating the mechanical behavior of the MP98T stock material as a function of sample location. If these MP98T development efforts are successful, it is anticipated that the substitution of that alloy for more corrosion-prone materials that are currently in use will lead to significant life-cycle cost reductions for NAVSEA.

In a related effort, the NCEMT is focused on investigating several other corrosion-resistant materials. This project, termed Metallic Materials Advanced Development and Certification (MMADCP) is examining Aerex 350, Ti-5111, and Alloy 59, in addition to MP98T. In collaboration with the manufacturer of each alloy and NSWC, the NCEMT is working to fully characterize those materials. ■



Figure 1. MP98T Fastener

## New Marine Material Property Database Designed to Facilitate Shipbuilders to Adopt New Materials and Technologies

Recent advances within metallic materials hold great potential to improve performance and/or affordability of naval ship structures and machinery components. New materials and technologies will provide naval ship structures with improved performance and/or increased affordability. Additionally, a goal of this program is to remain flexible to take advantage of emerging materials that may reduce component weight, cost, and/or improve performance, and to address generic material problems encountered by NAVSEA.

The full service contract concept for procurement of naval ships such as the DD(X) Destroyer (see Figure 2), has specified the shipbuilders as the principal design agent responsible for material decisions. Without materials that are pre-certified for use in critical structural or machinery applications, it is likely that only pre-approved materials will be utilized for future combatant ships, and new materials and technologies will not be adopted by the shipbuilders.

The objective of the Metallic Materials Advanced Development Certification Project (MMADCP) is to establish and maintain a Navy Material Property Database (NMPDb) for structural and machinery applications and to provide a front-end tool for searching on and viewing data contained within the database. The database will be able to include newly approved materials to allow the shipbuilders the flexibility to implement latest material technology improvements within their design processes. The database is focused to support and facilitate a design agent's use of NAVSEA's Material Selection Requirements (MSR) by providing easily accessible Material Selection Information (MSI). Furthermore, the database will support and facilitate use of NAVSEA's Fracture Toughness Review Process (FTRP) and shock extension methodologies by providing accessible fracture toughness properties for analyses. The task includes the development of a relational database and

definition of the appropriate schema to store and retrieve the data. Database and data requirements will be established by a working group including the NCEMT, the Naval Surface Warfare Center, Carderock Division (NSWC-CD), NAVSEA, and representatives from the shipbuilding industry.

To accomplish the proposed task, the initial work will focus on database planning to develop the appropriate definition and technical approach. The NCEMT, with input from NSWC-CD, will develop a list of relevant material properties to be incorporated into the database, recommend any additional properties, and define how these properties will be stored and presented. In addition, a definition of data quality levels and data entry protocol will be provided as well as an establishment of material qualification and quality assurance procedures for database population in conjunction with NSWC-CD and NAVSEA.

The NCEMT will develop software programs to interface with raw test floor data at NSWC-CD and the NCEMT. A standard format for output from the interfaces will be developed to facilitate ease of maintenance of these interfaces from many different systems. In addition, front-end software will be developed for use at the testing sites to simplify data entry to the interface.

The completed NMPDb will provide shipbuilder designers an easy-to-use computer interface with the capability to search for unique material property characteristics, critical for a specific design, and obtain a recommendation of a material that meets those specific design requirements. The database will also allow complete access to the supporting material property test data for the chosen certified NAVSEA material. ■



Figure 2. DD(X) Destroyer

# NCEMT Teams Up to Fulfill Navy's Request to Improve on Costs, Production, Quality, and Reliability of Thermal Batteries

The Navy's PMA-264, 259, and 201 Program Offices and the Naval Surface Warfare Center, Carderock Division (NSWC-CD) recently requested the NCEMT's assistance to reduce manufacturing costs, increase production, and improve the quality and reliability of thermal batteries. Current manufacturing practices do not meet cost and production requirements for sonobuoys and other battery applications, in particular bombs that were outfitted with Joint Direct Attack Munitions (JDAM) conversion kits. The JDAM is a guidance tail kit that converts unguided free-falling bombs into accurately guided weapons (See Figure 3 for JDAM bomb preparation and Figure 4 for JDAM deployment). These "smart" bombs were heavily used to support the wars in Afghanistan and Iraq. Under the Advanced Thermal Battery Production Project, the NCEMT met the Navy's objectives by implementing and demonstrating process improvements into the overall production of thermal batteries.

Through the entire life cycle of the project, the NCEMT, PMA Program Offices, NSWC-CD, and the thermal battery manufacturers worked as a team to identify the cost drivers. The primary issues were with the manufacture and assembly of the electrochemical components that make up the battery cells. Jenike & Johanson

designed and manufactured a powder feed system to reduce potential segregation and funnel flow. National Carbide Die and the NCEMT designed and manufactured a new tool set to improve the tooling life and operation. The NCEMT designed and manufactured a powder feed shoe to improve the die-fill volume consistency and press cycle time. In order to reduce powder leakage and press set-up time, the NCEMT also designed and manufactured a wear plate. The NCEMT specified features for new and rebuilt presses that are conducive to improving the die fill and reducing powder leakage. To remove the pellets from the press for weighing convenience and continuous press operation to increase production, the NCEMT designed a new system. In addition, the NCEMT supplied a press and tooling set-up procedure for installing and checking the tooling alignment. Press parameters were also recommended by the NCEMT to improve pellet quality, production, and tooling life and reduce press repair costs. The NCEMT provided compaction pressure versus density curves for improved press and tooling utilization. In addition, the NCEMT designed and implemented a



Figure 4. JDAM deployment from an F/A-18C Hornet

system to automatically place the cell components in the correct assembly sequence.

The NCEMT worked with Eagle-Picher Technologies to implement and demonstrate the process improvements on one of Eagle-Picher's presses that is typical of those used to compress the powders used to form the components of the battery cell. As a result, the part's weight and thickness consistency and strength were improved, which increased part yield and contributed to improved battery performance and reliability. The powder loss was also reduced by approximately 85%, which improved material utilization and reduced fire potential during the pressing of a pyrophoric powder. The fire would not only be a safety hazard, but the fumes would be harmful to the environment. The tooling life was increased, which reduced press down-time and tooling maintenance costs. The production was also increased as a result of the part removal system, allowing the press to operate during breaks and in between shifts. In addition, the cell component stacking system reduced the number of reworks and the learning curve of a new employee who is required to assemble a battery stack.

The team's effort made it possible to successfully implement and demonstrate improvements that will contribute to reduced manufacturing costs, increased production, and improved quality and reliability of thermal batteries. ■



Figure 3. JDAM Bomb preparation

*The DD(X) Destroyer photo is courtesy of Northrop Grumman Corporation.*

*The JDAM Bomb photos are courtesy of the U.S. Navy.*

## Program News/Events

### ShipTech 2003 Held January 16-17

*ShipTech 2003: A Shipbuilding Technologies Information Exchange* took place January 16-17 at the Beau Rivage Resort & Casino in Biloxi, Mississippi. A total of 210 attendees represented the Navy and industry. The information exchange was sponsored by the Navy MANTECH Program, ONR, and the NSRP and facilitated by the NCEMT. Steven M. Linder, Director, Navy MANTECH Program, ONR served as Conference Chair/Moderator and gave the opening remarks. Keynote addresses were delivered by VADM Phillip M.



Figure 5. Steven M. Linder, Director, Navy MANTECH Program, ONR delivers opening remarks.

Balisle, Commander, NAVSEA; RADM Jay M. Cohen, Chief of Naval Research; and George R. Yount, Vice President, Northrop Grumman Ship Systems, Avondale Operations. The Plenary Panel Discussion on Shipbuilding Technology Development Needs was moderated by Michael L. Powell, Director, Technology Development, Northrop Grumman Newport News and the Chair of the Executive Control Board of the NSRP. This year's Plenary Panelists were from NSRP. They included David Brannon, Bender Shipbuilding & Repair/Assistant Team Leader, Shipyard Production Process Technologies; Barry Espeseth, Electric Boat/Team Leader, Product Design & Materials Technologies; Lee G. Kvidahl, Northrop Grumman Ship Systems-Pascagoula Operations/Panel Chair, Welding Technology; Greg Morea, Electric Boat Corporation/Assistant Team Leader, Systems Technologies;

and Jennifer C. Parker, Bath Iron Works/Panel Chair, Environmental Technology. A total of 48 presenters represented 11 organizations. *ShipTech 2004* is planned for January 27-28, 2004, at the Beau Rivage Resort in Biloxi, Mississippi. **Mark Your Calendars!** ■

### Low-Cost Titanium Workshop: Applications for Ship and Ground Vehicle Structures Set for December 10-11, 2003

The NCEMT is hosting a Low-Cost Titanium Workshop: Applications for Ship and Ground Vehicle Structures to be held December 10-11, 2003 at the Sheraton Inner Harbor Hotel in Baltimore. Speakers from industry and government will discuss low-cost titanium applications for ship and ground vehicle structures. The workshop will feature keynote addresses, group discussions, and presentations describing end-user requirements and producer initiatives. ■

### Second Workshop on Friction Stir Welding Technology for Defense Applications Scheduled for October 14-15, 2003

The NCEMT and the Navy Joining Center (NJC) have jointly organized the second workshop on Friction Stir Welding Technology for Defense Applications, scheduled for October 14-15, 2003 at the Living/Learning Center at the University of Pittsburgh at Johnstown, Johnstown, Pennsylvania. As a follow-up to the first workshop held May 2002 at Edison Welding Institute (EWI), Columbus, Ohio, the major objective is to bring industry and DoD organizations up-to-date on progress made in developing/implementing friction stir welding (FSW) technology. An additional objective is to obtain the participants' input on the direction to be taken in further developing this technology and removing the barriers to its full-scale implementation for defense applications. The overall format includes keynote addresses by representatives of the DoD community, technical presentations on ongoing/planned projects, technology demonstrations, including large-scale FSW unit; and concluding discussion to generate and record participants' comments/input on current activities and suggested directions for further developments. The event should be attended by Navy, Marine Corps, Army, and Air Force weapons acquisition program managers; DoD manufacturing experts responsible for generating/approving new process specifications; manufacturers of ships, aircraft, missiles, and combat vehicles; and FSW equipment suppliers. Navy MANTECH Program, ONR will sponsor the event. ■

For more information, contact

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Additional information and updates can be found at  
[www.ncemt.ctc.com/Events/dsp\\_events.cfm](http://www.ncemt.ctc.com/Events/dsp_events.cfm).



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Concurrent Technologies Corporation (CTC) operates the National Center for Excellence in Metalworking Technology (NCEMT) for the U.S. Navy Manufacturing Technology (MANTECH) Program. The NCEMT serves as a national resource for developing and disseminating advanced technologies for metalworking products and processes. The NCEMT applies these technologies to solve productivity problems in support of the Navy and Department of Defense needs.

CTC is committed to assisting industry and government achieve world-class competitiveness. Through a unique concurrent engineering framework, CTC provides comprehensive solutions that improve our clients' product quality, productivity, and cost effectiveness. The professional staff of CTC has the requisite experience, knowledge, and resources to rapidly and effectively meet the diverse needs of our clients by transitioning appropriate science, technology, and management applications.

For further information about topics in this publication or about Concurrent Technologies Corporation, please contact Information Services at (814) 269-2809.

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