Virtual Shipyard: Learn the Yard Before You Get Your Badge; Navy and Industry Invest in Training and Education

Introduction

The National Shipbuilding Research Program (NSRP) brings the Navy and the shipbuilding industry together in a cooperative effort to reduce the cost of Navy ship construction and repair through improved efficiency and economy in American shipbuilding.

According to Connie Bowling of the Naval Sea Systems Command and the Navy’s NSRP program manager, the program seeks to share and rapidly implement manufacturing best practices as well as take advantage of breakthrough technologies from across academia, small business, not-for-profit research and development companies, shipbuilders, Navy Program Executive Office platforms, naval shipyards, and the U.S.

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Coast Guard. Likewise, the results of the research are shared, so everyone wins. “The early thinking was that if the shipbuilding industry was willing to invest in a product or process improvement and therefore likely to implement, then so would the Navy be willing to invest,” she says. “The result has proven to be an effective model for research and development.”

NSRP projects cover the full spectrum of the shipbuilding industry, from engineering, planning, production, and facilities, to environmental concerns, education and training, technology, and regulatory compliance for shipbuilding. While many of these improvements are tangible, such as new welding machines, other successful efforts, such as online training programs are more virtual than tangible.

According to Jim House of SCRA Applied R&D and technical director for NSRP, an industry board decides which production, design, business process, or work force development projects will be undertaken. The focus on workforce development has shown great promise, he says.

Marinette Marine Corporation (MMC) in Wisconsin has been an early adopter of online courses and virtual training. The courses have proven to be valuable in training new workers, as well as for renewing and sustaining the existing workforce, House says.

The University of Wisconsin-Marinette has teamed up with MMC, along with other contributors, to develop a new Shipyard Orientation Program (SOP) course. The resulting course is targeted to newcomers and non-shipbuilders to get a basic understanding of shipyard layouts and functions—but with an important twist. Using an avatar, students “fly through” a virtual, 3D shipyard, following materials from receiving through production and onto a vessel, entering buildings, clicking on hot links and learning about materials, processes, and safety, among other things, in an interactive, self-paced, engaging environment.

The 3D virtual shipyard was built on Navisworks® Freedom, and the course is being delivered on the Desire2Learn® course delivery platform.

According to University of Wisconsin-Marinette Dean Paula Langteau, the SOP model is generic, representing various items seen in any shipyard, but it can also be customized to represent a specific yard.

Chancellor Ray Cross, of the University of Wisconsin Colleges/University of Wisconsin-Extension, calls the program “engaging,” especially for the generation that has grown up with video games and social media.

“It brings you right down into the shipyard, in the midst of the vessel construction, and lets you see and experience the processes on the ground, as if you are a new employee,” Cross said. “But it also allows for exploration, enabling you to delve deeper and examine processes and outputs more closely, according to your interest and at your own pace. It is very interactive, drawing you in and making you want to learn and explore more.”

“Marinette Marine has had a leading role for the shipyard orientation program and other innovative training programs for shipyards, owing to proximity to UW-Marinette,” House says. “It’s proven to be a good synergy.”

It all started with course design using state-of-the-market software. “The continuing education course was taught at UW-Marinette in cooperation with MMC,” says House. “It has now expanded to

FIGURE 1. The University of Wisconsin-Marinette is completing an R&D project funded by the National Shipbuilding Research Program (NSRP) to create a self-paced, avatar-driven, 3D virtual shipyard orientation program. (Graphic captured by Graham Chamberlain.)
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other aspects, available online and in person. And it has been exported to other institutions.

Gearing Up for Growth

Scott A. Wellens, director of facility and process improvement for MMC, a Fincantieri company, says his shipyard is busy with several projects, including the Navy’s Littoral Combat Ship. That means both updating the infrastructure and bringing in new workers.

“We had to grow,” says Wellens, who is a member of the NSRP executive board. “We will essentially double the size of our physical plant in just a few short years. We knew we would be hiring a number of people because our existing work force was about 600 to 700 people, and we have to grow to between 1,300 and 1,400 people.”

According to Langteau, UW-Marinette has been working with MMC for the past five years to help the shipyard meet its growing need for qualified shipbuilding designers, thanks to funding from NSRP to develop the curriculum. In 2007, we developed a classroom continuing-education course called Applications of Modern Shipbuilding Design for Marinette Marine,” Langteau says. “We also started offering the course online for the rest of the industry.”

Training people for professional positions was a good project for NSRP because what works at Marinette could be applied to the shipbuilding business as a whole, she says.

Based on the initial success of that first course, UW-Marinette developed four follow-on classes in specific disciplines, such as structure, electrical, piping and HVAC, and design for production. All five courses are now offered online in a certificate program which is available to the entire industry.

“This package of courses made UW-Marinette the first institution in North America to offer fast-track, distance-delivered courses in a full certificate program in modern shipbuilding design,” she says.

Today MMC is not just sending designers to this course. Langteau says the company has begun to put all their production people through it. “We have been told they are more productive in their production roles if they have an understanding of the full design concept.”

Langteau says yards that seek NSRP funding are looking for some process or some problem they have to solve. “They’re often not focused on the training or the tech transfer piece. That’s where the university comes in. We’re step two. So when they solve the problem, we’re there for the training and tech transfer.”

“The courses that we have developed have been for Tier 1 and Tier 2 yards. There are smaller yards and yacht builders and so forth who have expressed interest in our courses. Our primary focus is to serve our community, which started at Marinette Marine, and then has rippled out from there,” she says.

Langteau says her university wouldn’t be involved in shipbuilding at all if MMC wasn’t a neighbor. “Marinette Marine is in my community. But as part of the UW system, we can bring the resources of the UW to serve the whole industry. If what we can do for Marinette Marine is applicable to the larger industry, we’ll do it. My goal at this point is to find out what else is needed and to try to develop it.”

Her next step is to make all of the courses more accessible by migrating the design courses into a comparable self-paced, instructorless...
environment like the shipyard orientation program, Langteau says. Someone could go online, sign up for the course, plug in their credit card, and it would immediately spit back to them a user name and password so they could go to the site and they could start taking the course.

“We have created this incredible certificate program in shipbuilding design,” Langteau says. “We need to share that with the industry.”

**Spot-on Welding Training**
Training qualified welders is critical for shipyard production. Welding is a high-demand hands-on skill that relies on experience. But one NSRP research project examined a realistic, low-cost welding training system based on virtual reality technology.

According to a report on the NSRP-funded project called “Virtual Welding – A Low Cost Virtual Reality Welder Training System,” improvements in the training process and any reduction in the time required to train and qualify welders will provide a cost benefit to the shipbuilding industry.

The report was prepared by Kenneth Fast of Electric Boat Corporation, Jerry Jones, and Valerie Rhoades of Native American Technologies.

The key words are “realistic” and “low cost.” The goal is to give the user the same impression as real welding. “The weld simulation algorithm is known to produce very accurate results for the specific measured input from the user. Additional work will be required to improve the realistic welding feel of the system,” the report says.

The project team believes there is a substantial market for such a trainer. “It is expected that the current design will be further developed and enhanced into a marketable commercial product. We believe that if a low-cost virtual welder product were available, that it would find an eager market among equipment manufacturers, trade schools, and technical colleges, in addition to the initial focus of shipyards and the shipbuilding community.”

**Taking Ownership of Cost Control**
NSRP is focused on more than just controlling acquisition costs, but reducing Total Ownership Costs (TOC) as well. The program complements, and has proven successful in leveraging, other programs such as Office of Naval Research (ONR), Manufacturing Technology (ManTech), and SBIR (Small Business Innovative Research), the latter providing smaller companies and organizations the opportunity to contribute and benefit. In addition, each of the Program Executive Officers (PEOs) responsible for acquisition has a research and development program that is coordinated with NSRP activities.

NSRP projects are targeted at engineering planning, production, environmental issues, education and training, facilities, technology, and regulatory compliance for shipbuilding, including new construction and repair, and more. “We’re focused on the critical factors that impact acquisition and TOC, so we can make the most out of our investment,” Bowling says.

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**UW-Marinette is the first institution in North America to develop fast-track, distance-delivered courses in a full certificate program in modern shipbuilding design. Courses include:**

- Introduction to Modern Shipbuilding
- Introduction to Modern Shipbuilding Design
- Basics of Structural Modeling
- Basics of Pipe System and HVAC Modeling
- Basics of Electrical Design
- Introduction to Design for Production
- Shipyard Orientation Program

*Course information can be found at [http://www.marinette.uwc.edu/continuing-ed/shipbuilding/].*

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