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Building Design and Construction

Simulator puts sailors under fire at Battle Stations

Jeff Yoders -- 10/1/2006



PHOTO: U.S. Navy

The USS Trayer has been attacked at night. A deck has collapsed, depositing the wreckage of the battleship's galley onto a crew barracks. As water and fire sprays into the ship's hull, sailors have to scramble to crawl through twisted metal and plastic and pull a wounded shipmate out of the debris and smoke and carry him up a ladder to safety.

This is just one of several battlefield scenarios new U.S. Navy recruits will be tested on at Battle Stations 21, an \$82.5-million facility now under construction at Naval Station Great Lakes in Great Lakes, Ill. The Trayer is a ship-shaped building-within-a-building that uses the latest in simulation and monitoring technology, plus state-of-the-art theme park-quality special effects, to produce training scenarios to give new recruits realistic situations as part of their training.

Each year 42,000 recruits are trained at Great Lakes; soon, all of them will go through Battle Stations 21 training. Recruits will spend 12 hours inside the ship facility and experience 16 different simulated crises, from battling floods and fires to assisting the wounded in mass-casualty situations. Most of the scenarios are based on historical Navy battles or crisis situation. The collapsed deck scenario is based on the bombing of the USS Cole in 2000, when 17 sailors were killed and another 39 were injured by a small boat bomb. Another scenario is based on a deck fire on the USS Forrestal during the Vietnam War.

Once the recruits' performance is evaluated and they have passed the exam, they will officially make the transition from civilian to sailor.

Building a safer ship

The USS Trayer is being constructed inside a 156,869-sf steel-framed administrative building complete with a dock and an "ocean" with realistic water and scent thanks to 90,000 gallons of pumped-in water and an ozone and ionization scent filter.



This compartment contains the scene of a collapsed deck. Training on how to handle fires, explosions, floods, and casualties will

To create such a

realistic training environment, two separate Naval Commands—Naval Facilities Engineering Command (NAVFAC) and Naval Air

take place in Battle Stations 21. The project is part of a nearly \$800 million training recapitalization program taking place at Naval Station Great Lakes.

PHOTO: Jeffrey Yoders

Command (NAVAIR)—hired a contractor-led design-build team of architects, engineers, entertainment and special effects consultants, and military personnel, led by James McHugh Construction, Chicago.

The team includes SmithGroup, Detroit (architecture and structural and MEP engineering); Wight & Co., Darien, Ill. (administrative building design and civil engineering); and GlobalSim of Salt Lake City (lead integrator).

The special effects firms include Scenic View, Morton Grove, Ill. (set fabrication); Bob Weis Design Island, Orlando, Fla. (media and art direction); Advanced Entertainment Technologies, Monrovia, Calif. (action equipment and effects); Edwards Technology, El Segundo, Calif. (audio-visual effects); Yaeger Design, Lake Oswego, Ore. (lighting design); and Kidde Fire Trainers, Montvale, N.J. (fire effects).

Having such a diverse team working on such a complicated project was a prescription for design chaos early in the process.

"We've had to merge worlds," said Brian Anson, project manager for McHugh, which was selected by the Navy in April 2004. "We all have different names for the same things. Eventually we all got used to the entertainment and military terms so we knew we were talking about the same thing."

Major subcontractors were required to experience the current Battle Stations training. Key team members also sailed on destroyers to gain a better grasp of ship design.

The Building Team also had to clear their minds of rules-of-thumb that did not apply to this project. The design team had to get used to breaking the ADA code, since the Trayer would only be staffed with able-bodied recruits. Electrical and lighting subcontractors had to get used to the idea that ships like the Trayer have exposed overhead wiring and unevenly spaced safety lights.

The biggest challenge, though, was squeezing a 500-foot-long destroyer into a half-scale structure such that it would fit into a three-story building horizontally without changing the scale vertically.

"We basically took out the pieces that weren't necessary," said Roxanne Knapp, an architect with Wight & Co. The forward part of the destroyer had to have the basic look for the bridge and deck scenarios. "We were able to keep that entirely in the proper scale and shorten it elsewhere," said Knapp.

What makes it work

The design team validated that 352 recruits could go through the simulations in 12 hours. They plotted a spreadsheet using all 16 scenario compartments and plotted virtual recruits' movements until they were assured the recruits would be able to finish each station in the required time.

The floors in the Trayer are epoxy-coated concrete; some are tilted to emulate battle damage. The walls are made of epoxy-coated plywood over metal studs or concrete block. The exterior hull is clad in fiberglass panels attached to a strut system held up by steel studs. The superstructure is a combination of aluminum-composite and foam panels. Hatches, watertight doors, lifeboats, muster bells, and other naval details are either replicated

or salvaged from decommissioned ships.

All video-screen "lookouts," mission briefing rooms, and scenario compartments on the ship will be equipped with a closed-circuit TV system. Commercial computer hardware running on proprietary Navy software and logic was used for the control center. PDAs with time clocks will allow military police facilitators to communicate with each other over voice-over IP while supervising the training.

After further testing, the first recruits are expected to start going through the training scenarios next month.

[Click here for a detailed PowerPoint presentation on Battle Stations 21](#) (4MB).

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