

# UP PERISCO

## New Finish for a Legendary Sub

### Solvent-free epoxy system plays a key role in preservation project

**I**n the summer of 1958, the USS Nautilus undertook a journey that once only seemed possible in a Jules Verne novel. And even in the famed author's imagination, the feats of this legendary submarine would be improbable.

The Nautilus was no ordinary submarine, after all. It was the world's first nuclear-powered submarine, and it was undertaking a journey that challenges the imagination even today. The Nautilus, with 116-men aboard,

was travelling a path directly underneath the geographic North Pole and the surrounding Arctic ice cap. Once it popped above the surface on the far side of the ice pack after being submerged for nearly three weeks and word of the accomplishment spread, the nation feted the crew and Commander W. R. Anderson with the ultimate star treatment of the day — a New York ticker-tape parade.

The Nautilus went on to provide a valuable service life for the Navy, but the life span of a nuclear-powered submarine is short, and in 1980 at the age of 26, the Nautilus was decommissioned. It returned to Groton, Conn., where it had been originally constructed by Electric Boat-General Dynamics. Groton, also the home of a Navy submarine base, figured to be the logical location for a museum dedicated to the sub, as well as a mooring spot where tourists could visit the craft.

While the Nautilus would no longer face the challenges of the Arctic Ocean, maintenance remained an issue as the sub would remain partially submerged in the Thames River. Given its proximity to the mouth of the river and the Atlantic Ocean, the hull and the two free-flood ballast tanks would constantly face the corrosive effects of brackish water. Other corrosive elements, such as birds that had been making nests in the nooks and crannies of the sub's superstructure, had made spot painting a frequent necessity.

These were among the factors that prompted the Navy to undertake a \$4.7 million preservation project, including a repaint, that began in January, 2002, and finished in May. And in order to ensure that future gen-

**Lt. Cmdr. Ben Howard, officer in charge of the HS Nautilus, and Ship's Manager Bruce Falcone stand by the bow of the ship.**



# PE marine



The HS Nautilus is moored in Groton, Conn., along the Thames River, where tourists can board the legendary submarine.

erations have an opportunity to enjoy and study this historic landmark, the Navy used the same tank preservation protocol used by their active fleet.

## ENGINEERING FOR REDUCED MAINTENANCE

The Navy, like any other American military organization, is on a constant lookout to bring improved efficiency to practically everything it does, and its Engineering for Reduced Maintenance (ERM) initiative is evidence of that. As part of the program, the Navy essentially challenged all of its suppliers to find ways to extend life cycles and reduce long-term maintenance requirements, and the paint systems used in submarine ballast tanks received particular scrutiny.

Solvent-based epoxy coating systems had been a standard, and they typically offered five to seven years of protection. Naval Sea Systems Command (NAVSEA) wanted a longer maintenance interval, and Mark Toscano, an Electric Boat Materials Engineer, and Scott DeVinney, a Sherwin-Williams corrosion specification specialist selected the Sherwin-Williams DuraPlate UHS solvent-free edge-retentive system in response to NAVSEA's challenge.

The DuraPlate UHS system is qualified to Mil-PRF-23236 and offers several features sure to appeal to the Navy's reduced maintenance initiative. First is that it offers a significantly longer life cycle than the five to seven years previous solvent-based systems offered. Its edge-retentive characteristics allow for better film retention on the sharp edges found in tanks. It also reduced the risk of solvent entrapment in the film, a circumstance that can lead to premature coating failure in immersion service.

The challenge came in finding a practical application means, a project that largely became an Electric Boat initiative. For this purpose, Electric Boat used a National Shipbuilding Research Program (NSRP) document "Guidance Manual for the Application of High-Solids Paints" which focused on high solids coating characteristics and application techniques. The end result was that DuraPlate UHS system was selected to preserve the aft and forward free-flood tanks as well as the chain locker of the HS Nautilus.

"We decided to 'hot-pot' it," says DeVinney, referring to the exothermic reaction that generates heat when the two-component product is mixed. "It would be very

## At a Glance

### PROJECT

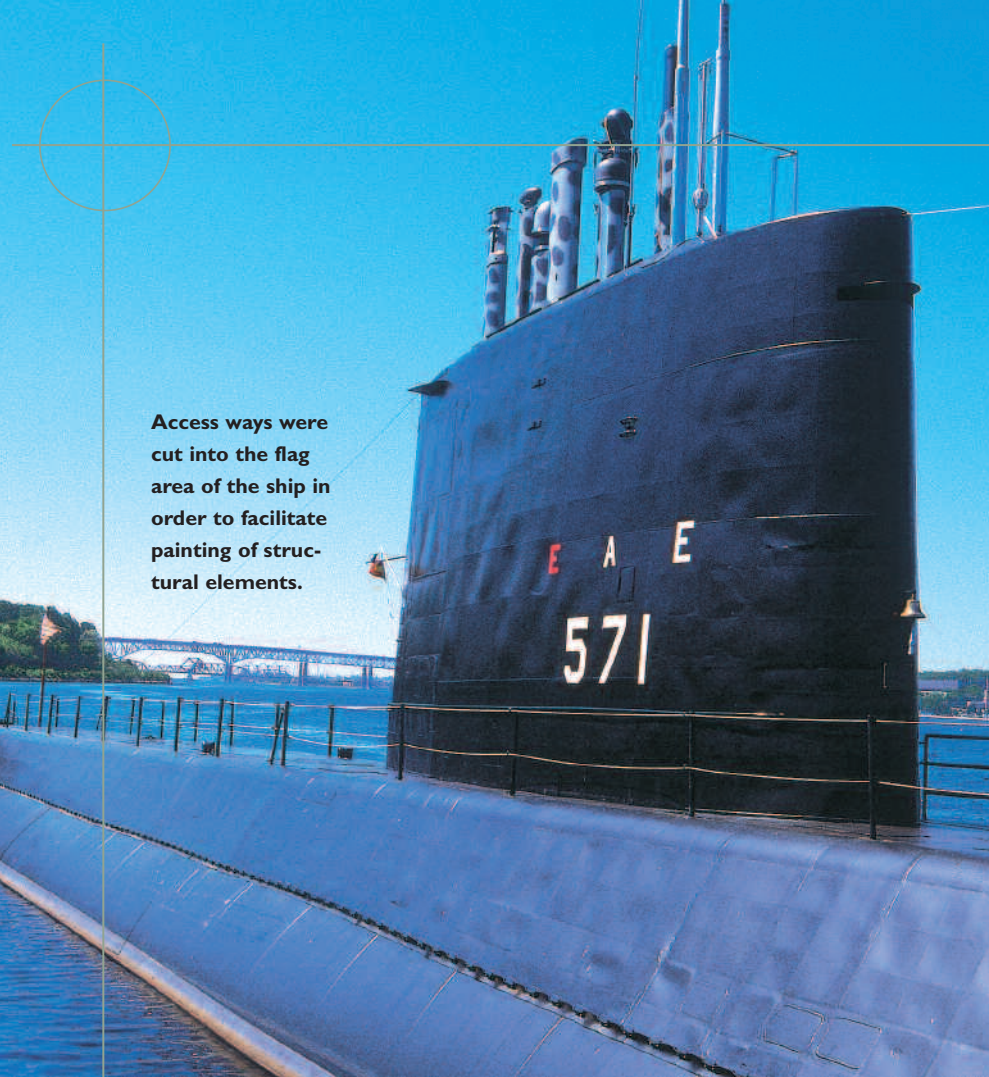
Preservation of the HS Nautilus

### PAINTED BY

Electric Boat—  
General Dynamics

### HIGHLIGHTS

Coating system provides longer maintenance interval



Access ways were cut into the flag area of the ship in order to facilitate painting of structural elements.

important that the application be very well choreographed in terms of temperature control and time monitoring. If the product started to set up in the can, you'd know it would be setting up in the pump, too. That could be expensive."

Toscano conducted calculations that showed a single-component pump has advantages over the plural-component system for the Nautilus application.

"The issue with solvent-free epoxies is that they have such a short pot life," says DeVinney. "In developing an application methodology, it was obvious that it would have to be applied very quickly."

"Since it only took one applicator about 40 minutes to apply one coat per tank, we could apply the coating before pot life was a problem," adds Toscano.

#### FOUR MONTHS

With a coatings system and application method in hand, Electric Boat personnel led the ship to an enclosed drydock in January, 2002, with the goal of having it back at the dock in mid-May for the tourist season. Bruce Falcone, the Ship's Manager, oversaw the preservation project that would include some rebuilding of the superstructure as well as deck replacement.

"It turned out not to be the 'little project' we thought it

would be, but it's gone remarkably well," says Falcone. "That's a testament to the people we have working here."

Sandblasting to near-white metal (SSPC-SP 10) gave the once-black ship a distinctly different appearance. In the ballast tanks, the by-hand removal of several tons of mud and grit that had accumulated over the years preceded sandblasting. Other areas of the superstructure had never seen a maintenance repaint simply because they were inaccessible. For this project, holes were cut into the structure to allow entrance for blasting, cleaning and painting.

"It wasn't a matter of neglect that some of these areas hadn't ever been repainted," says Falcone. "It was a matter of accessibility. You simply couldn't get at them."

With access ways cut into the sub, workers could get in and out, but spaces were extremely tight.

"That was the hard part," says Falcone. "We really had people on top of each other in here, but we had

no injuries. We didn't issue so much as a band-aid."

Painting also went smoothly, a fact that left an impression on Falcone.

"We had painters who were able to paint in tight spots and run the sprayer at 6,000 psi without leaving runs and sags. That's impressive, especially as inexperienced as we were. This was our first major production project using a high-solids product."

By finishing both under budget and ahead of schedule with the innovative system, Electric Boat and the Navy reinforced the message that the Nautilus remains a jewel worthy of serious preservation efforts.

"Sometimes the biggest challenge you face on a project is the unknown, and we went through a lot of 'firsts' on this project," says Falcone. "It's a credit to all the people involved that the job went as smoothly as it did." ▣



The USS Nautilus at sea.