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Featured Projects

Maintenance Costs Plummet After NAVSEA Introduces Composite Boxes

By Gretchen Jacobson

Researchers from the Naval Sea Systems Command (NAVSEA) are turning a widespread corrosion problem—identified in 1998 as "the biggest topside maintenance problem on carriers"—into a success story that involves saving the taxpayer millions of dollars a year.

In 2001 the Navy began replacing the metallic boxes that house an aircraft carrier's electrical equipment, indicator lights, and connectors with composite electrical boxes that do not corrode or require repainting. Use of the new boxes also eliminates structural corrosion on the ship. (See ["NAVSEA Looks to Composite Technology to Improve Warship Components,"](#) *CorrDefense*, Spring 2006.)

Currently, there are approximately 477 topside electrical boxes on each carrier. This type of box is also used on smaller Navy ships, Army watercraft, and Military Sealift Command vessels. The Navy reports that it costs more than \$1 million over 10 years to repair, paint, and rewire brass, aluminum, and steel electrical boxes on a single aircraft carrier. The old metal boxes have to be repainted and repaired every three years, and half of these must be replaced every six years. In addition, the brass boxes cause galvanic corrosion of the ship's adjoining steel superstructure and mounting hardware, which requires further repair.

"We estimate that the DoD has spent more than \$13 million per year, and nearly \$400 million over 30 years, to resolve corrosion problems in the fleet related to metal boxes," said Mark Ingle, a Program Manager at NAVSEA. "In addition to the maintenance required, failure of these boxes causes operational and communications problems that must be resolved in the short term with extension cords, hand signals, and other undesirable means."

To solve the problem, researchers are leveraging technology used for Air Force cargo aircraft to develop the new composite boxes. The technology is based on a fire-retardant, tough Ultem resin system that is inherently stable in ultraviolet light (i.e., the boxes will not become brittle or degrade in sunlight). The composite boxes also use stainless steel for all fasteners, hinge pins, and springs to ensure that the metal parts of the composite boxes do not degrade overall box performance.



The aircraft carrier USS Nimitz passes under the Golden Gate Bridge while entering San Francisco Bay during San Francisco Fleet Week 2006. NAVSEA is solving one of the most serious aircraft carrier corrosion problems that exists today. U.S. Navy photo by Mass Communication Specialist 2nd Class Charlemagne Obana.

"Our composite electrical boxes with stainless steel hardware do not corrode, do not need to be painted, do not degrade in the sun, and require virtually no maintenance for the life of the ship," said Ingle. "In fact, our cost/benefit analysis shows a return on investment of more than eleven to one by implementing these composite boxes as repair items for the brass boxes as they fail."

Ingle acknowledged that the composite boxes are more expensive than the metal boxes, but their corrosion- and wear-resistant properties allow them to far outlast their metal counterparts.

"Composite boxes cost about 2 1/2 times more than brass boxes, but the total job cost is only 8 to 12 percent higher when all paint and installation labor cost savings are included," Ingle said. "Composite boxes on a single carrier can save more than \$3 million over 30 years because of the reduced need to repair electrical equipment, repair and repaint boxes and adjoining structures, and replace nonfunctioning metallic boxes."

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NAVSEA has already completed a Navy standard drawing on composite boxes that includes some designs that are direct replacements for existing box configurations. As such, a ship can simply order a composite box to replace a corroded metal box with no need to modify the ship's electrical wiring. Using the NAVSEA standard drawing as a starting point, the system has started assigning stock numbers to boxes to allow a ship's force to obtain them through the normal Navy supply system. NAVSEA will work with the supply system to include procurement codes of the metal boxes that advise the user to consider the composite items. The goal of these efforts is to ensure that the fleet implements composite boxes to realize the projected benefits.

"If composite boxes don't make it onto our ships, we will have lost an opportunity to reduce corrosion maintenance and life-cycle costs," said Ingle.

"This is a prime example of how implementing best practices and best value decisions are significantly reducing corrosion costs and freeing up resources for other crucial needs in the military," said Dan Dunmire, head of the DoD Office of Corrosion Policy and Oversight. "We are also sharing information among and between the services and industry to leverage our technologies to the greatest extent."