Paint-Dispensing Cartridges Improve Quality, Reduce Waste on Navy Ship Applications

By Gretchen Jacobson

The U.S. Navy has made significant strides in recent years to improve the fleet's corrosion control systems and reduce costs through better business practices and advanced technologies. With 25 percent of its maintenance budget spent on corrosion prevention, control, and remediation, the Navy is continuously testing new products and systems to reduce maintenance hours and achieve longer-lasting protection on ships, while also complying with today's strict environmental and safety regulations.

One of the most critical and costly components of the fleet's corrosion maintenance efforts is the use of anti-corrosion coatings. Coatings are a proven, effective method for protecting fleet assets and equipment—from ship decks, ballast tanks, and large structures such as jet blast deflectors (JBDs) to preserving weld seams and smaller items of equipment.

However, the use of anti-corrosion coatings presents many challenges. The most prevalent occurs when the coating fails prematurely because users improperly mix and dispose of unused material as hazardous waste. Coating applicators also have difficulty when handling newer paint systems, adjusting to some paints' shorter pot life, and working within shorter windows of time. They also encounter challenges as they work to comply with regulations that minimize paint waste streams, volatile organic compound solvent emissions, and human exposure to hazardous chemicals.

Problems in Packaging

In 2006, a team of Navy corrosion and coatings experts initiated an Office of the Secretary of Defense (OSD) project to address and solve problems related to using effective coating systems on ships. The project is focused on packaging and mixing paints to enable easier and higher-quality application and performance.

"Marine paints have traditionally been supplied in five-gallon containers," said project team leader Angela Ross of the Naval Surface Warfare Center (NSWC). "This type of packaging is not conducive to the accurate mixing of two-component epoxy coatings and can result in the application of off-ratio material."

The large, heavy paint cans (approximately 40 pounds each when full) are cumbersome to transport, work with, and dispose of. In addition, estimating the amount of paint that should be mixed for each application can be difficult. "It is not uncommon to mix too much paint for touch-up repairs, creating product waste and expense," said Ross. "We needed to find and test a paint packaging system that could be sized to meet specific job requirements."

Paint-Dispensing Cartridges—A New Technology

The OSD project team identified plural-component disposable paint-dispensing cartridge technology as a promising system to solve the problems of inaccurate mixing, waste, disposal, and handling. Developed in the private sector, the cartridge delivery system consists of two independent barrels, or chambers. For a single-component paint system, each chamber is filled with the same coating. For dual-component systems, paint component A is in one chamber, and paint...
component B is in the other chamber. A plunger seal is installed in the back of each chamber. A plug securely seals the tip openings during storage periods. The system is designed to dispense the paint components using a manual dispensing gun (similar to a caulking gun), which applies pressure to the plunger seals to force the two coating components toward the tip of the cartridge. Upon exiting the cartridge tip, the components are combined as they pass through a disposable static mixer to blend the material and activate the paint system.

"By using the disposable paint cartridges and dispensing system, paint can be manually dispensed, sprayed, or rolled onto a surface directly from the cartridge without excess waste," said project team member Rich Hays of NSWC. "It eliminates staging, handling, opening, and mixing two-component paints, simplifies cleanup and disposal, and improves application time."

Comparing Standard Methods to Prepackaged Cartridge Applications

To test the new paint cartridge technology, members of the Naval Sea Systems Command (NAVSEA) Preservation Team and NSWC performed side-by-side shipboard coating applications using traditionally packaged paint and paint packaged in cartridges. Metrics measured included cost per square foot, schedule enhancement (i.e., time saved in paint application), and amount of waste generated.

In one evaluation, the NAVSEA Preservation Team conducted two coatings demonstrations on JBD pits on the USS Theodore Roosevelt, a Nimitz-class aircraft carrier. One demonstration, performed on the entire area of JBD pit no. 3, was the application of a two-component coating system packaged in five-gallon cans using NAVSEA's standard preservation methodologies. The second demonstration, performed inside six smaller areas of pit no. 1, was the application of the same anticorrosion coating system, this time packaged in 300-milliliter (mL)-by-75-mL paint cartridges and applied using manual paint-dispensing guns with static mixers. In both instances, the two-component system was applied in three coats—a primer coat, stripe coat, and topcoat.

NSWC, meanwhile, performed two similar demonstrations on the batter boards of the USS Oak Hill. The two-component system packaged in the five-gallon cans was applied on the port side of the ship; the same coatings were applied on the starboard side batter boards via 300-mL by 300-mL paint-dispensing cartridges.

Evaluation Results

The demonstrations revealed that there are many advantages to using paint-dispensing cartridges—they are lightweight and easy to transport; the quality of the paint job is better because of enhanced mixing; there is a reduction in cost and waste because the quantity of paint is sized for the job; and exposure to hazardous materials is reduced.

The investigators noted some disadvantages as well when they compared the paint-dispensing cartridges to the standard coating method of using paint packaged in five-gallon cans; for example, dispensing the paint from the cartridges manually was time-consuming because it required frequent trigger pumping action. Also, cartridges in the dispensing gun have to be changed often. Investigators also noted that maintenance personnel may need training in order to learn how to use the paint cartridges effectively.

"We found that the cartridge systems are best suited for smaller and horizontal surface areas. It is faster and more convenient to coat larger areas such as JBD pits using paint packaged in five-gallon containers," said Ross. "We also concluded that for our purposes, the cartridges should be used for packaging two-component paints only."

"The bottom line is that this new technology will save the Navy time and expenses, reduce waste, and improve safety in many applications," said Hays.