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Featured Projects

## Army Receives Patent for a New Self-Healing Coating

### *Overcoat for Lead-Based Paint Creates Safer Environment on Bases*

By Cynthia Greenwood

The Army has developed a new coating that repairs itself when it is damaged. Besides lowering maintenance costs for the DoD, the technology makes life safer for Army personnel and their families.



*A deluge tank at Fort Campbell, situated across the Tennessee/Kentucky border and home to the 101st Airborne Division, has benefited from the Corps of Engineers' patented self-healing coating. Photo courtesy of Army Corps of Engineers (CERL).*

In 1997 materials experts at the Army Corps of Engineers Construction Engineering Research Laboratory (CERL) began developing the new coating. The product has an unusual ability to heal itself immediately after being dinged, cut, or otherwise damaged. The inventors of the self-healing coating have envisioned a wide range of uses for the technology on steel structures and buildings covered with lead-based paint. (See ["Army Protects Hangars, Towers, and Tanks at Fort Campbell,"](#) *CorrDefense*, Spring 2006.)

On March 20, 2007, the U.S. government awarded a patent to the Army for the version of the technology now used on steel structures. "We see a widespread application of this coating on any steel structure, including automobiles, bridges, oil rigs and platforms, and outdoor air-conditioning units," said Ashok Kumar, a program manager at CERL and one of the technology inventors. Kumar noted that Vinod Agarwala, a NAVAIR materials expert, originally started developing a similar self-healing coating technology to protect aluminum alloy exteriors of aircraft.

The patented technology consists of a liquid coating with microcapsules containing specific repair formulations that allow the coating to fix itself immediately after it is compromised in any way. "If something bangs against the coating and cuts it, the pressure will cut open the microcapsules and cause them to release liquids—known as "film formers"—and restore the cut area," said Dave Stephenson, a materials expert at CERL and co-inventor. "At the same time, the microcapsules also release a corrosion inhibitor, which prevents corrosion, while the restored coating is curing."

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For steel structures, the applicator can take a commercially available paint primer and mix it with a pre-specified amount of the microcapsules. After the coating has cured, any physical damage to the cured coating will trigger the microcapsules to burst and release a liquid that "fills and seals the compromised volume of the coating," according to the U.S. Patent abstract. For other applications, engineers must purchase microcapsules that are custom-designed to work well for their specific paint formulation.

Lead-based paint poses a serious health risk to residents on Army bases, particularly children. In some situations it is more practical and safer to "overcoat" deteriorating paint rather than scrape off the existing coating. "When a crack occurs in lead-based paint and its overcoating, the self- healing overcoating will heal itself as the liquid inside the microcapsules flows into the damaged area," said Stephenson. "The microcapsules also release a lead dust suppression compound that prevents hazardous lead dust from becoming airborne, while the film former cures over the damaged portion."

The new technology will prove especially useful for maintaining wooden Army base houses covered in lead-based paint, said Kumar and Stephenson.

In a 2003 laboratory experiment, ERDC-CERL researchers compared the benefits of a self- healing overcoat and a plain latex overcoat. They applied both materials on a wooden building covered in lead-based paint at Fort Ord, Marina, California, a former Army base. The self- healing overcoatings revealed a 95 percent reduction in lead dust over the controls in the lab, according to a December 2003 report prepared by the Army Corps of Engineers.

The inventors of self-healing coatings with microcapsules, patented on March 20, 2007, include Kumar, Stephenson, Curtis Thies, and Srinivasan Sarangapani. Kumar and Stephenson also developed the technology designed for self-healing overcoatings for lead-based paint on wooden buildings. Their application for a patent on this coating was published on March 2, 2006, and will be awarded by the end of 2008.



*Ashok Kumar*



*Larry "Dave" Stephenson*