Cold Spray Repairs Save Time and Money

By Rita Boland

A new method of patching metal components with a cold spray process called Kinetic Metallization is saving the Naval Aviation Enterprise time and money in repairing aircraft components and returning them to the fleet.

Kinetic Metallization, generically referred to as cold spray, is an additive, solid-state thermal spray process that restores components' critical dimensional features lost to corrosion, wear or mechanical damage. The process bonds metal to metal in a relatively low-heat environment, filling in any corrosion or other damage in machine parts

These types of repairs often take less time and are safer than traditional methods. For example, traditional chrome coating takes 20 hours to cover a part with 20 mils (0.020") of metal, while Kinetic Metallization can do it with a tungsten carbide/cobalt composite in approximately two minutes. The process also eliminates the health hazards posed and safety precautions required by traditional methods.

This less expensive, faster method of repair has already saved approximately $1.6 million on repairs of a single F/A-18E/F Super Hornet part. The jet's Aircraft Mounted Accessory Drives (AMADs) cost approximately $168,000 each, and damage to one part of the AMAD previously required scrapping the entire drive. But with the repairs available through cold spray, 10 AMADs have been refurbished and sent back to the fleet and have amassed more than 8,000 cumulative flight hours.

Fleet Readiness Center Southwest (FRCSW) engineers and artisans demonstrated the technology Jan. 23 for Marine Corps Assistant Deputy Commandant for Aviation (Sustainment) William E. Taylor and Marine Corps Aviation representatives from Camp Pendleton, California, who are interested in expanding its use.

"This has a lot of promise," Taylor said.

"The repaired parts come out stronger and are less prone to mistakes," said Luc Doan, a materials engineer at FRCSW. "Of the approximately 150 parts repaired using cold spray, none have been returned for another repair. Additionally, none have resulted in machine rejections. With traditional methods, approximately 20-40 percent are machine rejected."

The results have been impressive.

According to Conrad Macy, a secondary power Fleet Support Team (FST) engineer for Naval Air Systems Command, the parts repaired with the cold spray process exhibit higher toughness and wear resistance than the original parts.

Macy was the impetus behind bringing this capability to Naval Aviation.

While making repairs to aircraft, Macy said he became tired of throwing away expensive parts because of minor damage. He felt sure some process could fix the parts, so he began searching for it. About six years ago, through a Small Business Innovation Research (SBIR) project with California firm Inovati, he found what he needed with Kinetic Metallization. The technology showcased its ability to increase fleet readiness by refurbishing previously scrapped components. These components often are in demand across Naval Aviation, but have long lead times.

Kinetic Metallization uses low-pressure helium or nitrogen and a sonic nozzle to accelerate particles. The combination of low pressure and sonic gas speed significantly decreases gas consumption compared to conventional cold spray processes while still achieving high particle velocities, according to the company website.

It also wastes less material compared to other cold spray machines and techniques, according to the Navy.

Macy worked with engineers at FRCSW to explore different options. The team brought an Inovati machine to its laboratory environment for three years, and its success led to installing another machine in the production shop at FRCSW in December 2015.

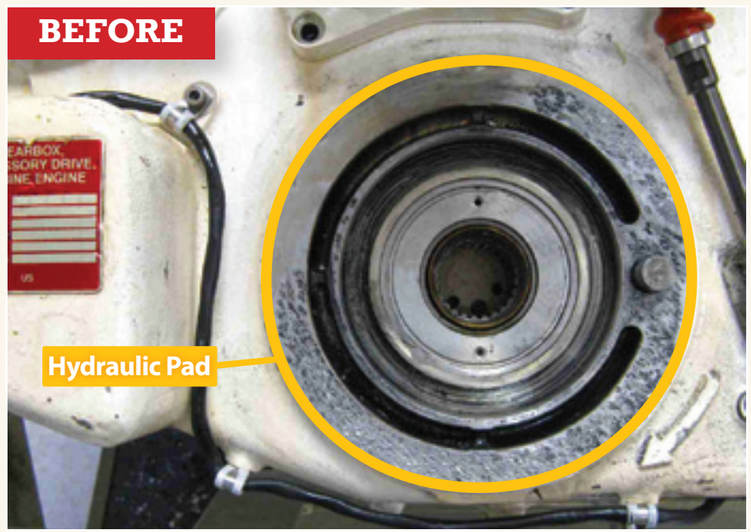
FRCSW is the main depot for all variations of the F/A-18, so most of the parts it has repaired using Kinetic Metallization have been for that platform. However, it has also been used for E-2 Hawkeye, F-5 Tiger II, CH-53 Sea Stallion and H-1 Huey parts, as well as for the LM2500 ship engine.

Engineers now are pressing forward with future applications for the technology, including using it on V-22 Osprey window sills. Through another SBIR, Macy is exploring the use of a rotating spray nozzle in the cold spray system. This rotating nozzle will further expand the repair capabilities of FRCSW by enabling bore repairs on components too large or heavy to be easily rotated.

Rita Boland supports Naval Aviation Enterprise Public Affairs.

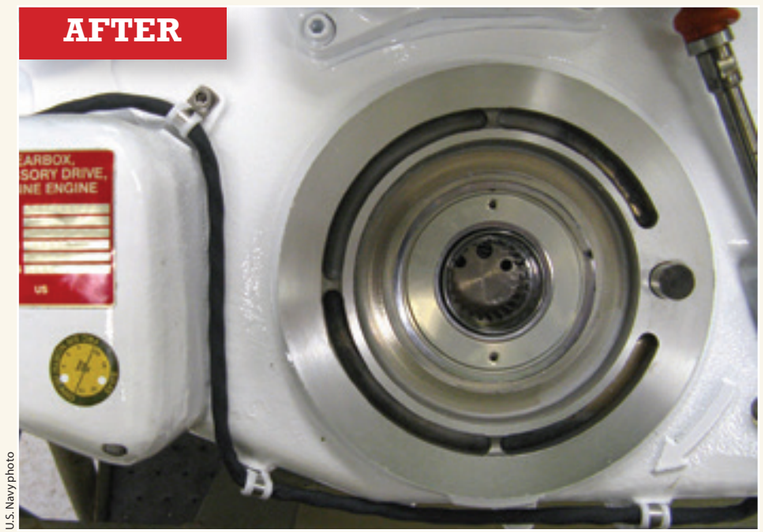
Photo courtesy of Inovati

A technician demonstrates the use of the Kinetic Metallization, or cold spray, processes used to restore metal parts.



U.S. Navy photo

This is a gearbox housing from the Aircraft Mounted Accessory Drive (AMAD) of an F/A-18 E/F Super Hornet. The AMAD converts energy from the engine to power the aircraft systems. The hydraulic pad on the housing experiences fretting, causing the part to be scrapped.



U.S. Navy photo

Fleet Readines Centers Southwest repair, the pad by machining away the damage, applying the cold spray process and machining back to drawing dimensions. The repaired part comes out stronger and is less prone to failure.