

SUCCESS STORY

TOPIC NUMBER: N151-052

SBIR INVESTMENT: \$2,700,000

PHASE III FUNDING: \$5,500,000



COLD SPRAY REPAIR PROCESS DEVELOPMENT AND IMPLEMENTATION ON NAVY COMPONENTS

VRC Metal Systems built a ruggedized cold spray system, and developed engineering controls systems and repair certification and approval processes, resulting in greater efficiency in the repair process and extended life for Navy ships and aircraft.

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THE CHALLENGE

U.S. Navy vessels and their components and equipment experience severe environmental conditions, leading to a level of unacceptable corrosion through a combination of sea water exposure, heat, humidity, UV exposure, and general inaccessibility for continual maintenance. Copper brush electroplating is the standard repair technique for many Navy corrosion repair applications; however, this process is plagued by long buildup times and use of hazardous substances. Cold spray offers a viable opportunity to replace copper brush electroplating for many repair applications. The Navy set out, through the SBIR program, to develop a novel temporary repair solution for both sensitized and stress-cracked aluminum ship structures that stops crack growth and restores watertight boundaries.

THE TECHNOLOGY

VRC Metal Systems provided a solution in the form of its cold spray technology, which is an additive manufacturing process that accelerates metal powders to supersonic speeds to restore and repair damaged components. The portability of VRC's High-Pressure Cold Spray (HPCS) equipment allows for in situ repairs, eliminating time-wasting disassembly and the cost of replacing parts that can be restored instead. Cold spray can be used to repair damaged areas of a finished part on a plane or a submarine without causing additional problems such as warping, cracking, or softening. Although the original SBIR solicitation was geared toward ship structures, the technology developed by VRC is applicable to military aircraft as well.

THE TRANSITION

VRC Metal Systems received its first Phase III award for this technology from NAVSEA in 2017 under contract N00024-17-C-4020. The company went on to receive a basic ordering agreement (BOA) from NAVAIR (N6833519G0055) worth \$2.8 million for its Raptor™ Cold Spray System that will extend until 2024.

The VRC Raptor™ is a singularly contained, portable, HPCS system with a deployable 21kW heater. It utilizes hand-held or robotic applicators which can operate remotely. The system is programmable for coating applications as well as structural reconstruction.

THE NAVAL BENEFIT

Cold spray technology offers a coating repair solution resulting in a highly adherent and wear resistant material built up in a fraction of the time of brush electroplating. With VRC Metal Systems' cold spray technology, repair technicians can often repair a part without removing and replacing it, reducing the need for suspended operations. The repair process has minimal emissions and toxic fumes that impact the environment and/or the health of the workers. In some cases, the fixed portion can be even better than a new component by using a superior material to repair a sensitive substrate and at a fraction of the cost. Military aircraft are placed worldwide in a vast array of climates and conditions leading to corrosion, erosion, and damage; replacing parts as they exhibit wear is a traditional but expensive and time-consuming task. Seemingly minor damage can put parts outside of acceptable tolerances, and typical repair methods, such as welding, don't work on aluminum due to heat sensitivity and warping. The Raptor Cold Spray System remedies all of these issues by providing cost-efficient dimensional restoration onsite.

THE FUTURE

VRC Metal Systems continues to work with NAVSEA for the needed replacement of copper brush electroplating technologies, which require extremely long process times and exposure to hazardous chemicals. The cold spray system is being designed and developed in collaboration with the Bangor Intermediate Maintenance facility, Puget Sound Naval Shipyard, and Pearl Harbor Naval Shipyard. Initially, the target applications are the Ohio class, Los Angeles class, and Virginia class submarines.