PROJECT ID:
590

Dry Ice Paint Removal and Cleaning

Fleet Readiness Center East is one of the facilities that would benefit from CO_2 blasting processes during the maintenance of the F-35 Lightning and other Navy aircraft programs. (Photo Credit: Heather Wilburn)

OBJECTIVE

The objective of this investigation is to evaluate whether dry ice can be utilized at Fleet Readiness Centers as an effective, environmentally friendly alternative to the use of plastic media blasting (PMB) for cleaning and organic coating removal.

PROBLEM STATEMENT

Plastic media blasting, a type of sandblasting, is the primary blast method for paint and coating removal at Fleet Readiness Centers East, Southeast and Southwest (FRCE, FRCSE and FRCSW). The waste generated from these processes is classified as hazardous waste.

At FRCSE alone, more than 100,000 pounds of contaminated blast media is disposed of annually, costing the facility more than $185,000 in disposal fees.
Glass bead and aluminum oxide media used in mechanical cleaning operations also generate a significant amount of hazardous waste.
There is a current need for effective, environmentally friendly, cleaning and stripping processes that create minimal hazardous waste.

DESCRIPTION

Dry ice (carbon dioxide (CO_2)) can be used in a dry and thermal cleaning process that does not create residual blasting media

An engineer tests the Cold jet Aero 80 device at FRCSE.
(Photo Credit: Kami Carter)

(secondary hazardous waste). At extremely low temperatures, CO_2 changes directly from a solid to a gas in a process called sublimation. When CO_2 pellets are shot from a compressed air source, the combination of kinetic energy and sublimation produces a sandblasting effect.

For this project, two methods will be investigated, both of which utilize the same commercial-off-the-shelf system—the Cold jet Aero 80. This system offers a variety of pressures and nozzles to optimize dry ice blasting and can be retrofitted with accessories for the purposes of mixed media blasting. In cases where substrate damage or entrapment (blast media becoming fused to the substrate) may occur, 100 percent CO_2 pellets will be evaluated. For applications where these conditions are not present, and/or that require the removal of corrosion or organic coatings, a mix of abrasive blast media and dry ice will be evaluated. For the mixed media application, dry ice will be mixed with currently approved blast medias such as glass bead, plastic media blast and aluminum oxide.

The use of dry ice blasting reduces the level of dust and secondary waste generated in traditional blast operations because most of the waste will evaporate. Both options offer environmentally friendly alternatives to traditional dry media blasting while promoting health and safety initiatives. However, the media mixed into the dry ice and resulting contaminants (i.e., coatings and corrosion byproduct) will still need to be collected and properly disposed of.

A design of experiment will be performed to determine the optimal mix ratio, nozzle, and pressure per application being investigated. Sound levels will also be evaluated, and oxygen monitors will be used to ensure there are no health risks. The blast technology will be demonstrated with CO_2 alone, modified to utilize the mixed media and demonstrated again with the mixed media.

RETURN ON INVESTMENT

At FRCSE alone, more than 100,000 pounds of contaminated blast media is disposed of annually, costing the facility more than $185,000 in disposal fees. Implementing dry ice blasting could result in $50,000 in cost savings while maintaining the same turnaround time. When using 100 percent CO_2, there is also the potential to conduct blasting in the hangar which may reduce turnaround time by as much as one week per component/aircraft.

NAVY BENEFITS

Use of dry ice blasting improves turnaround time while reducing the use of hazardous materials. The generation of secondary waste is drastically reduced, which lowers the cost of waste disposal. Additionally, this technology allows new capability for blasting at other Naval facilities. For instance, FRCSW has a need to blast the inside of an H56 helicopter, but is unable to with traditional blast media due to entrapment concerns. The use of dry ice would reduce the entrapment concerns and add new blasting capability.

This technology could be evaluated for implementation into fleet operations. The use of CO_2 blasting would allow the fleet to rapidly rework degraded ground support equipment and other components without the need for large walk-in booths or cabinets.

TRANSITION DESCRIPTION

Upon successful demonstration and validation, technical points of contact will provide applicable programs to get aircraft/component authorization. A report and technology transition packet will be provided upon completion of all testing and analysis. An implementation plan will be provided to FRCE and FRCSW technical point of contacts via the advanced technology innovation team.

CONTACT

For more specific information about this project, contact the Principal Investigator at 904-790-6383.

ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development, demonstration and validation (6.4) program, sponsored by the Chief of Naval Operations, Energy and Environmental Readiness Division (OPNAV N45) and managed by the Naval Facilities Engineering Systems Command (NAVFAC) out of the Engineering and Expeditionary Warfare Center (EXWC) in Port Hueneme, CA.

The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness and lethality. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at www.navfac.navy.mil/nesdi or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or ken.kaempffe@navy.mil.

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