# Aircraft Depainting Technology

## Background:

Current chemical paint strippers contain hazardous components (i.e., phenols, methlyne chloride, and chromates), and depainting operations at maintenance depots are a major source of hazardous waste generation in the Department of Defense (DoD). Federal and state agencies [the Environmental Protection Agency (EPA), California's Air Quality Management Districts (AQMD), etc.] have begun to restrict the use and disposal of these hazardous materials through the Clean Air and Water Acts, the Resource Conservation and Recovery Act, and local EPA and AQMD rules. Alternative depainting methods must meet increasing environmental constraints; maintain aircraft rework operations; and be versatile [i.e., handle higher strength structures (such as carrier landings) and different Navy coatings]. Also, the harsh Navy operating environment can affect aircraft structural integrity adversely, which can further complicate process replacement efforts.

## Objective:

The goal of this project was to develop non-hazardous replacements for chemical paint stripping use on naval aircraft, weapon systems, and support equipment. Several generic alternative stripping methods to the present chemical removers were developed. These techniques need to be optimized and evaluated for use at the Naval Aviation Depots. This program identified the best alternatives from existing/developmental methods such as non-hazardous chemical paint strippers (i.e., no chrome, methyl chloride, etc.) and mechanical procedures (i.e., flash lamp, dry ice, waterjet, etc.).

## Summary of Process/Technology:

Procedure efficiency, substrate surface effects, hazardous waste generation, and aircraft applicability were investigated in order to determine the best procedure for Navy applications. Comparison of each technique's advantages and disadvantages also were performed. Mechanical procedures eliminate chemicals but can damage substrate surfaces. Since some aircraft skins are very thin, this is not acceptable. However, combinations of some techniques (i.e., flash lamp and dry ice) could eliminate or minimize surface damage to an acceptable level. The flash lamp degrades the coating, and the reduced pressure dry ice performs the final removal. The practical application of flash lamp/dry ice (Flashjet) requires the use of robotic assisted manipulation. Two manipulators were under investigation. The first was a mobile (vehicle integrated) semi-robotic system for depainting large aircraft. The second was a fixed gantry system for small aircraft and off-aircraft components.

## Benefit:

The elimination of the majority of chemical paint strippers would reduce the total amount of hazardous materials generated by the Navy significantly. Furthermore, requirements for emission control equipment for methylene chloride (estimated at $1M/facility) would be eliminated. In addition to reducing handling and waste disposal costs, naval aircraft and equipment will be properly maintained. This is particularly important considering the cost of the aircraft and equipment as well as the severely deleterious environment in which the Navy operates.

## Accomplishments:

The Flashjet system and manipulator arm-vehicle assembly were assembled and demonstrated at the former McDonald-Douglas Aerospace (now Boeing) plant in St. Louis, MO. Phase I of the research effort included modifications to the manipulator system and associated sensors required for interfacing with procurement of the flash lamp and Flashjet system design modifications. Phase II of the integration effort involved modification of the carbon dioxide pelletizer, integration of the stripping head and cell controller, and check out of the entire system. Assembly of the manipulator system sensors was completed and operational trials and a demonstration of the manipulator-vehicle assembly were conducted. Control of standoff distance and traverse speed over the surface were demonstrated. Movement of the end effector was programmed over flat and curved surfaces as would be encountered on aircraft. All systems worked well and control over standoff distance and traverse speed met specified limits. This project was completed in FY 1997 and transferred to the Environmental Security Technology Certification Program (ESTCP) for demonstration/ validation of the process.

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