

ESTCP Project WP-0801, UV Curable Powder Coatings for Military Applications



Presenter: Mr. Christopher W. Geib,
Science Applications International Corporation
(SAIC)

937.431.4332

geibc@saic.com

Report Documentation Page

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Outline

- UV-Curable Powder Coatings Overview
- Robotics as an aid to Curing
- Current Status of ESTCP Project WP-0801
- Future UVCPC efforts



UV-Curable Powder Overview

- Previous ways of thinking about powder
 - Coating cure temperatures – typically above 428°F
 - Prohibitive for use on tempered metals (Al, Mg, Ti)
 - Prohibitive to use on composites
 - Powder coatings were designed as barrier protection

UV-Curable Powder Overview

- Modern powder coatings can be formulated to have:
 - Lower melt & flow temperatures ($< 225^{\circ}\text{F}$)
 - UV or EB cure functionality can be added
 - Various advanced non-chrome corrosion inhibitors

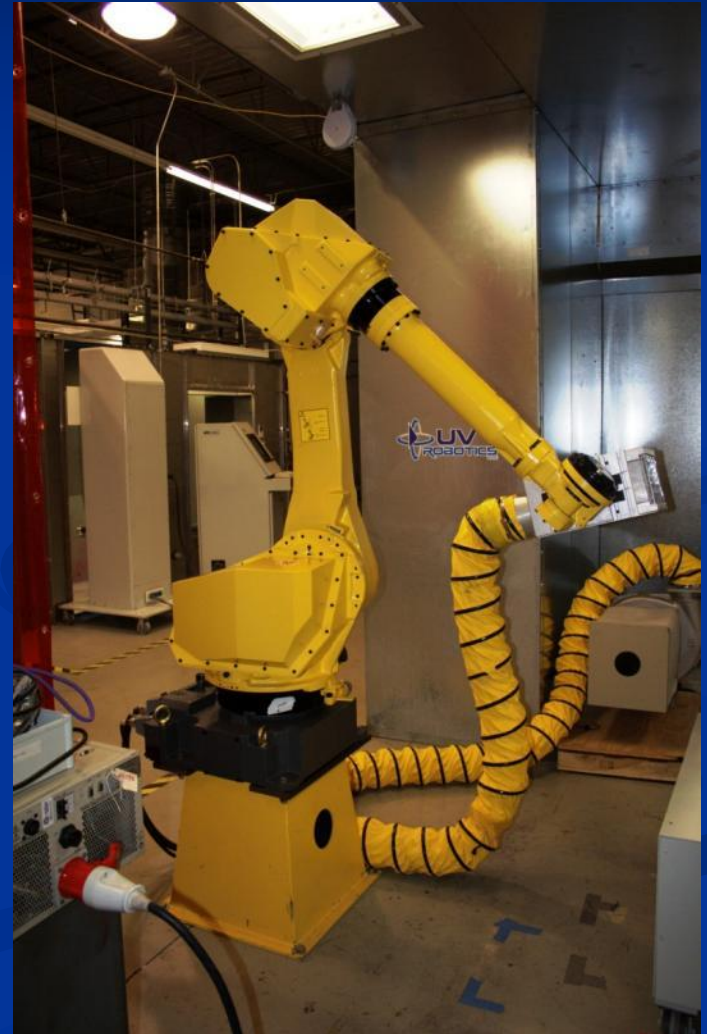
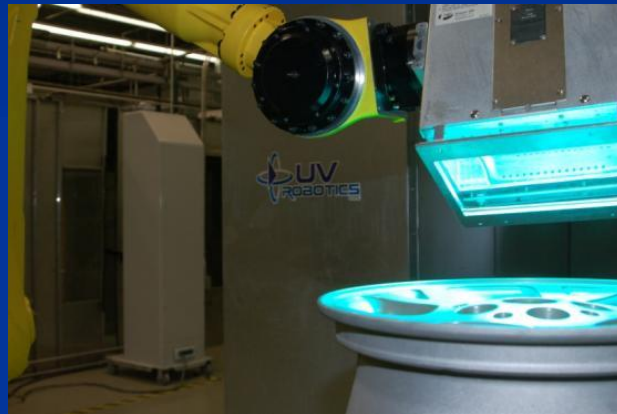


UV-Curable Powder Overview

- Advantages of UV-cure powder coating:
 - Elimination of volatile organics (VOC)
 - Elimination of hazardous air pollutants (HAP)
 - Reduction/elimination of hazardous waste
 - Transfer efficiencies as high as 95% (w/reclaim)
 - Decrease in thermal exposure.
 - Large bulky parts that cannot fit into existing ovens can be coated and cured.
 - UV-cure powder requires less energy because the energy is focused to a specific part only as long as needed.

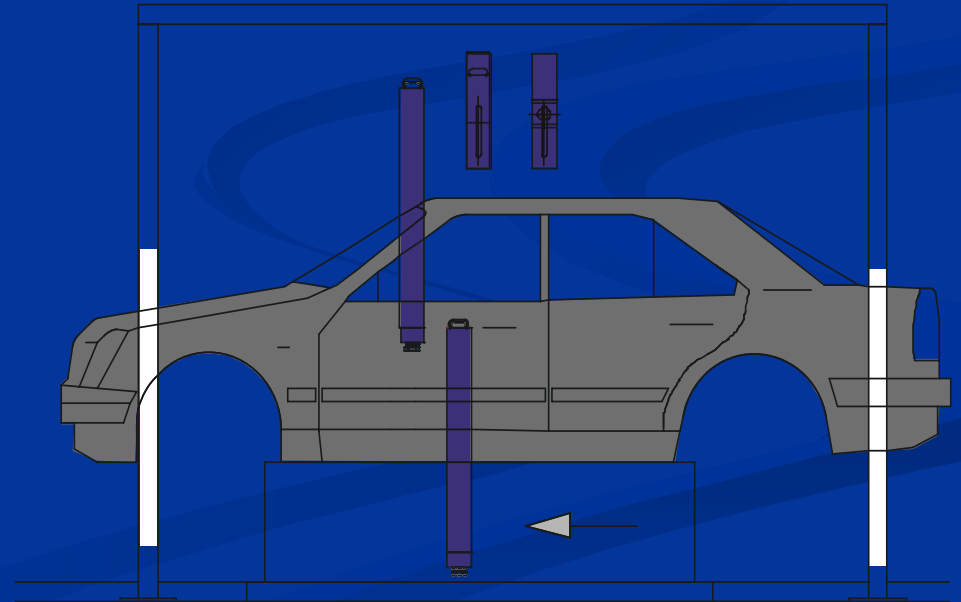
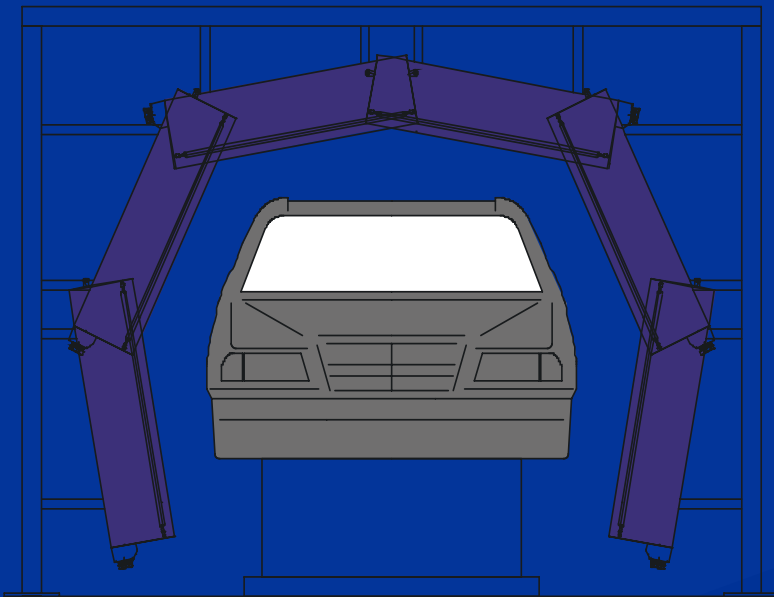
Robotics as an Aid to Curing

- Why Use Robots?



Robotics as an Aid to Curing

- Light tunnel approach using various size UV lamps to optimize cost and exposure



Robotics as an Aid to Curing

- Drawbacks of fixed lamp approach
 - High Capital Costs
 - Lamps, cooling, fixtures, integration
 - High Operating Costs
 - Replacement parts
 - Energy
 - Downtime
 - Technical Adequacy
 - Complete cure
 - Proper Re-alignment
 - Mixed product

Robotics as an Aid to Curing

- Advantages of Robotic Curing
 - Robots ensure repeatability
 - Robots with UV sources can maintain extremely close target distances
 - Robots can be re-programmed in seconds
 - Robotic curing is well suited to large or complex parts
 - Robots eliminate need for many lights

Current Status of ESTCP Project WP-0801

- The Problem:
 - DoD spends millions of dollars annually on solvent-based coatings
 - Hexavalent chrome primer use still very widespread
 - Contains or requires volatile solvent use
 - Significant hazardous waste costs
 - Hazardous materials pose risks to human health and environment
 - Process times measured in hours to days
 - Transfer rates are less than 60%

Current Status of ESTCP Project WP-0801

- The WP-0801 Objectives are:
 - Demonstrate a VOC/HAP-free, Ultraviolet cure powder coating (UVCPC) on DoD hardware
 - Demonstrate state-of-the-art robotics for curing



Current Status of ESTCP Project WP-0801



- Requirements of a UVCPC for military use:
 - Must perform at least as well as MIL-PRF-23377 primer
 - Must also perform as well as MIL-PRF-85285 topcoat
 - Can be prepared in gloss, semi-gloss, and flat finishes



Current Status of ESTCP Project WP-0801

■ Planned demonstration weapon systems:



EA-6B wheels, landing gear



HH-65 helicopter



P-3 wheels, landing gear, radomes



Mk-48 ADCAP torpedo



HC-130 main landing gear doors



KC-135 wing flap, refueling boom

Current Status of ESTCP Project WP-0801

■ Planned demonstration weapon systems (cont.):



Submarine icecaps



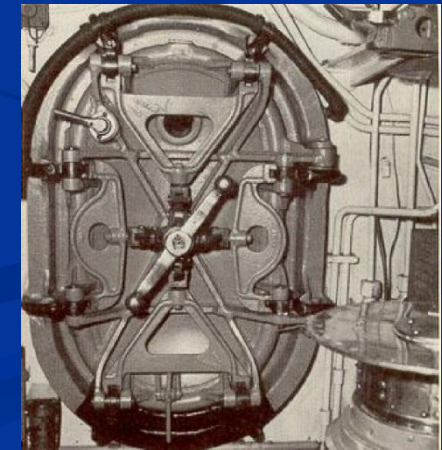
EA-18G wheels, landing gear



Ammunition and storage cases



Submarine communication buoys



Submarine interior components

Current Status of ESTCP Project WP-0801

- Powders:
 - Currently considering two vendors
 - Two colors, gloss white, semi-gloss gray
 - All will undergo strict validation testing at CTIO
- Robotics system:
 - Robot carries the IR and Hg vapor UV lamps
 - Evaluation of alternative UV sources continue
 - Evaluation of alternative application methods continue

Current Status of ESTCP Project WP-0801

- Major Program Milestones:
 - Joint Test Protocol submitted Sept 2008
 - Robot acquired and integration underway
 - Component identification complete
 - Powder and substrates order Jan 2009
 - Validation testing starts Feb 2009
 - Draft Demonstration Plan June 2009
 - Field Service/Demonstration begins Mar 2010
 - Joint Test Report draft Sept 2010
 - Final Report Mar 2012

Future UVCPC Efforts

- Future follow on efforts include large marine applications



Future UVCPC Efforts

- Future efforts in alternative UV light sources



High Energy UV LEDs



Pulsed Xenon lamps

Thank You!

Points of contact for UV-curable Powder Coatings ESTCP Project WP-0801:

Mr. Corey Q. Bliss
Principal Investigator
Air Force Research Laboratory/RXSSO
Wright-Patterson AFB, OH 45433
Corey.Bliss@wpafb.af.mil
(937) 255-0943

Mr. Christopher W. Geib
Co-Principal Investigator
Science Applications International Corp.
4031 Colonel Glenn Highway
Beavercreek, OH 45431
Christopher.W.Geib@saic.com
(937) 431-4332