

Zero-VOC Touchup Materials and Processes

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Zero-VOC Touchup Materials and Processes

PROJECT OBJECTIVE

- **Identify Zero VOC/HAP Coatings and Compatible Application Methods for Touchup of A.F. Equipment**
- **Evaluate Candidate Materials/Processes Identified**
 - ✓ **Performance**
 - ✓ **Potential Cost/Practices Impact on Air Force Maintenance Practices If Implemented, Especially Use and Limitations of Aerosol Sprays**

Zero-VOC Touchup Materials and Processes

PROJECT RATIONALE

- **Compliance Regulations “Encouraging” Implementation of Low/No VOC Processes & Coatings for All Maintenance Activities**
- **Aerosol Can Spray Use Is Most Problematic Area For Touchup**
 - ✓ **Propellant VOC – Exempt from Aerospace NESHAP**
 - ✓ **Spent Pressurized Can is Classified as Hazardous Waste**
 - **Safety**
 - **Remaining Contents**
 - ✓ **Restricted Use Can Affect Work Flow/Readiness**
 - ✓ **“Problem” Solution Varies With Each Base (Local EPD/Base Decision)**
 - **Robins AFB – High Usage**
 - **Davis-Monthan AFB: Strict Local Regs, Very Low Usage**
 - **Nellis AFB: Limited Usage (Missile Shop)**
 - **Hurlburt Field: Moderate Usage**
 - **Luke: Strict Local Regs, Very Low Usage**

Zero-VOC Touchup Materials and Processes

PROJECT RATIONALE

BASE	16 OZ AEROSOL CANS USED (2003 – 2004 Data)	AEROSOL SOLID HAZWASTE STREAM (POUNDS @ 0.3 POUND PER CAN)	AEROSOL HAZWASTE DISPOSAL COST (@ \$.72/POUND)
Robins AFB (High usage)	27,560	8268	\$5953
Hurlburt Field (Medium usage)	3105	932	\$671
Luke AFB (Restricted usage)	1500	450	\$324
Average Aerosol HAZWASTE Disposal Cost (cans only)			\$2316.
Total Aerosol HAZWASTE Disposal Cost (Air Force Wide – 262 Bases)			\$606,792.

Zero-VOC Touchup Materials and Processes

PROJECT STRUCTURE

- **Phase I (Complete) – Survey and Identify Current Zero VOC/HAP Materials and Application Process Candidates**
- **Phase II (In Progress) - Screen Candidates, Down-Select and Evaluate Touchup Materials/Processes**
 - ✓ **Coating Performance**
 - ✓ **Process Practicality/Fieldability**
 - ✓ **Cost Benefit**
 - ✓ **Impact on Current Maintenance Practices/Limitations**
 - **HAZMAT/HAZWASTE Management**
 - **Process Modification/Simplification/Improvement**

Zero-VOC Touchup Materials and Processes

ZERO-VOC COATING FORMAT “PREFERENCE”

- **Single Component (1K) – True Zero VOC**
 - ✓ e.g. Waterborne
- **1K – Exempt Solvent**
 - ✓ e.g. “Oxsol 100”
- **Two Component (2K) – True Zero VOC**
- **2K – Exempt Solvent**

Zero-VOC Touchup Materials and Processes

Touchup Packaging Formats

➤ **2K**

- ✓ **Pre-Measured Kits (A/B Components Packaged Separately)**
 - **Standard: 1 Gallon, 5 Gallon (Not Convenient for Touchup)**
 - **Touchup: < Pint**
- ✓ **Prepackaged with Applicator (Break Seal, Mix, Apply)**
 - **Pouches**
 - **Syringes**
 - **Felt Tip (“Sempen”)**
 - **Aerosols**

➤ **1K**

- ✓ **Cans/Containers (Standard, Touchup Volumes)**
- ✓ **Aerosols**
- ✓ **Applicators**

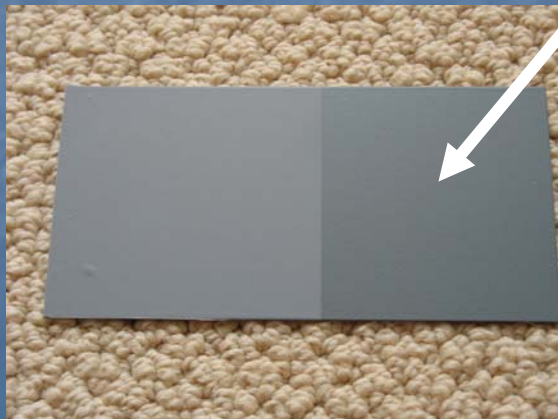
Zero-VOC Touchup Materials and Processes

TOUCHUP APPLICATION PROCESS FORMATS

- **Appliqué**
- **Brush/Roller**
- **Prepackaged Applicator (e.g. “Sempen”)**
- **Spray**
 - ✓ **Guns**
 - ✓ **Aerosols**

Zero-VOC Touchup Materials and Processes

FLUOROPOLYMER APPLIQUE'



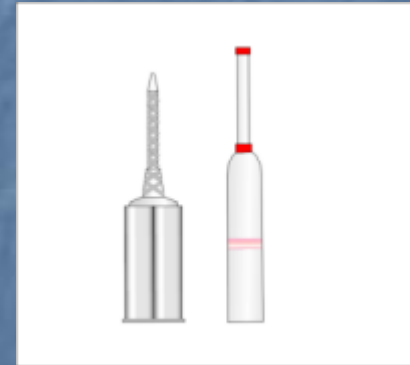
- **Temporary Spot Field Repairs**
- **Portable**

Zero-VOC Touchup Materials and Processes

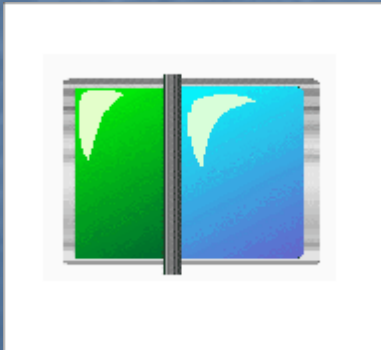
PREPAPACKAGED FORMATS (PORTABLE, SMALL JOBS)



"SEMPEN" 1K & 2K



2K MIX AS NEEDED



2K MIX PACK



2K KIT



Zero-VOC Touchup Materials and Processes

CONVENTIONAL/PREVAL AEROSOL

- Single Use Propellant
- VOC Propellant
- Portable
- 1K or 2K



1K

2K



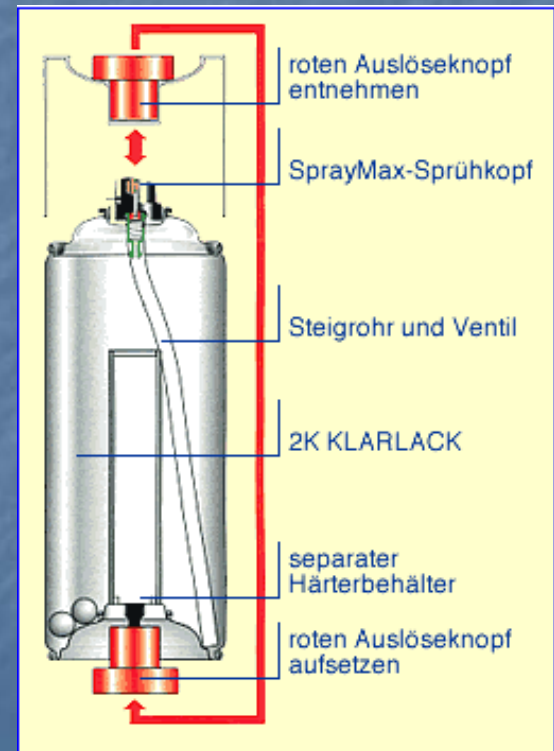
Preval



Zero-VOC Touchup Materials and Processes

2K CONVENTIONAL AEROSOL

- **Single Use Propellant**
- **VOC Propellant**
- **Portable**
- **Limited Availability**



Zero-VOC Touchup Materials and Processes

CO2 PROPELLANT



Separate Gun



Aerosol

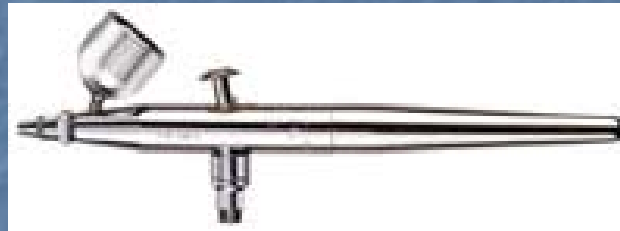
- **PORTABLE**
- **SMALL JOBS**
- **1K and 2K**

Zero-VOC Touchup Materials and Processes

COMPRESSED AIR



PORTABLE COMPRESSOR



AIRBRUSH



PORTABLE AIR TANK

- **Stationary/Portable**
- **1K and 2K**
- **Small Jobs**
- **Limited Application**

Zero-VOC Touchup Materials and Processes

COMPRESSED AIR AEROSOL



Single Use

- **Portable**
- **Small Jobs**
- **1K and 2K**



Rechargeable
(Shop Air Up to 200 psi)

Zero-VOC Touchup Materials and Processes

COMPRESSED AIR- HVLP TOUCHUP SPRAY GUN



- **Stationary Shop**
- **Portable with Mobile Compressor**
- **Small and Large Jobs**
- **1K and 2K**

Zero-VOC Touchup Materials and Processes

ZERO VOC COATING CANDIDATE CLASSES REVIEWED

- **2K MILSPEC Epoxy Primers**
- **2K MILSPEC Polyurethane Topcoats**
- **1K MILSPEC Polyurethane Topcoats (Moisture Cure)**
- **2K Commercial Epoxy Primers**
- **2K Commercial Polyurethane Topcoats**
- **1K Commercial Primers**
- **1K Commercial Polyurethane Topcoats**
- **1K Commercial Direct to Metal Primer/Topcoat**

Zero-VOC Touchup Materials and Processes

ZERO VOC/HAP COATINGS IDENTIFIED

➤ 2K – MILSPEC Primers

- ✓ **Deft: MIL-PRF-85582 Water Reducible Epoxy Primer**
 - True Zero VOC
 - Standard Pigments (Type I)
 - Chromate Corrosion Inhibitors (Class C2)

- ✓ **Hentzen: MIL-PRF-23377 Solventborne Epoxy Primer**
 - Exempt Solvent Formulation
 - Standard Pigments
 - Chromate and Non-Chromate Inhibitors (Class C and N)

Zero-VOC Touchup Materials and Processes

Zero VOC/HAP Coatings Identified

➤ **2K – MILSPEC Topcoats**

- ✓ **Deft: MIL-PRF-85285 Waterborne (Class W) Polyurethane**
 - True Zero VOC
 - Type III (Aircraft and Support Equipment)
- ✓ **Hentzen: MIL-PRF-85285 Solventborne High Solids (Class H) Polyurethane**
 - Exempt Solvents
 - Type III (Aircraft and Support Equipment)

Zero-VOC Touchup Materials and Processes

Zero VOC/HAP Coatings Identified

➤ **2K – Commercial Primers**

- ✓ Rustoleum S-71 “Sierra” Water-Based Epoxy Spray Primer
- ✓ Rustoleum S-70 “Sierra” Water-Based Epoxy Brush Primer

✓ **1K – Commercial Primers**

- ✓ Rustoleum “Sierra - Griptec” Water-Based Acrylic Primer
- ✓ Pruet-Schaffer 20-13562Z Red Oxide Water-Based Acrylic
- ✓ Pruet-Schaffer 20-26622-Z Grey Water-Based Acrylic

Zero-VOC Touchup Materials and Processes

Zero VOC/HAP Coatings Identified

➤ **1K – Commercial Topcoats**

- ✓ Rustoleum “Sierra - Performance Beyond” Water-Based Acrylic Urethane
- ✓ Rustoleum “Sierra - Metalmax” Water-Based Acrylic Urethane
 - Direct to Metal (DTM) Single Coat
 - May Be Used As Primer For “Performance Beyond” Urethane
- ✓ Pruet-Schaffer 24-26373z Gray Water-Based Acrylic Emulsion
- ✓ Integument “Fluorogrip” Appliqué

Zero-VOC Touchup Materials and Processes

PHASE II COATING/PROCESS EVALUATION

➤ Performance Evaluation

- ✓ Lab Screening (Adhesion, Flexibility, Fluid Resistance, Corrosion, Heat, Tape, Abrasion)
- ✓ Field – South Florida Test Range

➤ Hands-on Testing

- Practicality
- Effectiveness
- Fieldability
- Repair Quality

➤ Cost/Benefit Analysis (Materials, HAZMAT/Safety, Process Flow, War-Readiness)

Zero-VOC Touchup Materials and Processes

PHASE II COATING/PROCESS EVALUATION

- **Define Coating Systems (Primer/Topcoat)**
- **Screen Systems**
- **Down-Select Primer, Topcoat Materials**
- **Merge Coating Systems with Application Formats**
 - ✓ **Hands-On Evaluations**
 - ✓ **Cost/Benefit Analyses**

Zero-VOC Touchup Materials and Processes

SCREENING TEST COATING SYSTEMS

Coating Designation	Source	Primer	Topcoat
D1	Deft	ZVOC, -85582 T-I, C-C2 (std. pigments, strontium chromate inhibitors)	ZVOC, -85285 T-III, C-W (< 50 g/l - aircraft & support eq., waterborne)
H1	Hentzen	Exempt, -23377 T-I, Class C (std. pigments, strontium chromate inhibitors)	Exempt, -85285 T-1, C-H (< 420 g/l, aircraft, high solids)
H2		Exempt, -23377 T-I, Class N (std. pigments, non-chromate inhibitors)	Exempt, -85285 T-1, C-H (< 420 g/l, aircraft, high solids)
R1	Rustoleum	MetalMax DTM - 1K water-based acrylic urethane	None (one coat)
R2		MetalMax DTM - 1K water-based acrylic urethane	MetalMax DTM - 1K water-based acrylic urethane
R3		MetalMax DTM - 1K water-based acrylic urethane	S-39 - 1K water-based acrylic urethane
R4		Griptec - 1K water-based acrylic primer	S-39 - 1K water-based acrylic urethane
R5		S-70/S-71 - 2K water-based epoxy primer	S-39 - 1K water-based acrylic urethane

Zero-VOC Touchup Materials and Processes

SCREENING TEST COATING SYSTEMS - continued

Coating Designation	Source	Primer	Topcoat
PS1	P-S	20-13562Z, 1K water-based acrylic primer, red oxide	24-26373Z, 1K acrylic enamel
PS2		20-26622Z, 1K water-based acrylic primer, gray	24-26373Z, 1K acrylic enamel
Aero1	LHB Industries "So Sure"	Flat Black (37038) Acrylic Lacquer Aerosol MIL-L-81352	Flat Black (37038) Acrylic Lacquer Aerosol MIL-L-81352
Aero2		Exempt, -23377, T-I, Class C (std. pigments, strontium chromate inhibitors)	Flat Black (37038) Acrylic Lacquer Aerosol MIL-L-81352
INT	Integument	None - one coat	ECTFE Fluoropolymer Applique (one coat)
CONTROL 2	Deft	MIL-PRF-23377 Type I, Class C2 (std. pigments, strontium chromate inhibitors, 340 g/l)	MIL-PRF-85285 Type 1, Class H (< 420 g/l, aircraft, high solids)
CONTROL 1	Deft	MIL-PRF-23377 Type I, Class C2 (std. pigments, strontium chromate inhibitors, 340 g/l) "Low Density"	MIL-PRF-85285 Type 1, Class H (< 420 g/l, aircraft, high solids)

Zero-VOC Touchup Materials and Processes

SCREENING TESTS

- **Adhesion (Primer Property):** Test And Evaluation Per Mil-PRF-85285 On Steel And Aluminum
- **Flexibility (Primer/System Property):** Test and Evaluation Per Mil-PRF-85285 And ASTM D 522 – Room Temperature And Low Temperature Flexibility Tests Conducted On Conical Mandrel Bend
- **Solvent Resistance (MEK Rub, Topcoat Property):** Test and Evaluation Per MIL-PRF-85285 For Coating Cure
- **Fluid Resistance (Topcoat/System Property):** Test and Evaluation Per MIL-PRF-85285 On Aluminum and Steel
- **Weather Resistance (Primer/System Property):** GM 9540 Cyclic Corrosion Test, 20 Cycles (480 Hours). Tests On Scribed Aluminum and Steel
- **Heat Resistance (Topcoat Property):** Test and Evaluation Per MIL-PRF-85285
- **Tape Resistance (Topcoat Property):** Test and Evaluation Per MIL-PRF-85285
- **Abrasion Resistance (Topcoat Property):** Taber Abrasion Per ASTM D 4060 - 1000 Cycles, 1000 Gram Weights

Zero-VOC Touchup Materials and Processes

PROJECT STATUS/TIMELINE

- **Screening Tests**
 - ✓ **Test Coupons Completed and Delivered To Independent Test Laboratory**
 - ✓ **Tests In Progress – Completion By 4/15/06**
- **Hands-On Evaluation: 3/20/06 – 4/14/06**
- **Down-Select – Prepare Outdoor Coupons**
- **Outdoor Exposure Tests: 5/01/06 – 9/30/06**
- **Cost/Benefit Analysis: Current – 4/28/06**

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QUESTIONS?