Environmentally Compliant Coating Remover Evaluation

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Environmentally Compliant Coating Remover Evaluation

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Approved for public release; distribution unlimited

Outline

• Project Overview
• Project Team
• Background
• Objectives
• Technical Approach
• Laboratory Test Scope
• Laboratory Test Results
• Remaining Tasks
• Questions
Project Overview

- POP: 19 APR 2011 to 18 OCT 2012
- Award: $226,419 (includes $16,025 as fee)
- Project Team:
  - DSCR POC – Mr. Calvin Lee, HazMin Green Products Branch
  - USAF POC – Mr. Jeff Kingsley, AFRL/RXSA
  - Battelle Team
    - Project Manager – Annie Lane
    - Principal Investigator – John Stropki
  - Stakeholder Team
    - Ms. Diane Kleinschmidt, NAVAIR
    - Ms. Louise Nguyen, OC-ALC
    - David Ellicks, AFCPCO
    - Mr. Charles McKenna, AFCPCO-SKT (On-site Support Contractor)
Hazardous Min/Green Products Branch Approach

**Green Products Office**
Supporting the Enterprise:
- Help define the customers’ green needs
- Identify green products
- Assist in determining suitability of items
- Support cataloging process

*Developing productive relationships with customers’ organizations*

**Vendors**
DSCR will engage vendors in an effort to find the products our customers need
- Supplier Conferences
- Industry Publications
- Trade Associations

*Vendors work with the services to identify Green products that warrant Stock Numbers*

**DLA Customers**
Continuous customer liaison
- Navy: NAVAIR, NAVSEA
- Air Force: ALCs
- Army: TACOM, AMC, AEC

*Supply Support Requests sent to DLA*

DSCR offers a new, website where customers ask questions, get support, or just suggest improvements.

*Customers order more green items*
## Accomplishments and Results

<table>
<thead>
<tr>
<th>Biobased Product Item Category</th>
<th>Number of Products Evaluated</th>
<th>Number of Manufacturers Participating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Fluids</td>
<td>80</td>
<td>19</td>
</tr>
<tr>
<td>Diesel Fuel Additives</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Penetrating Lubricants</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Metalworking Fluids</td>
<td>62</td>
<td>8</td>
</tr>
<tr>
<td>Sorbents</td>
<td>72</td>
<td>17</td>
</tr>
<tr>
<td>Adhesive and Mastic Removers</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Greases</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Glass Cleaners</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Firearm Lubricants</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Chain, Cable, and Gear Lubricants</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
<td>Corrosion Preventatives</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Industrial and Multipurpose Cleaners</td>
<td>114</td>
<td>40</td>
</tr>
<tr>
<td>Parts Wash Solutions</td>
<td>22</td>
<td>9</td>
</tr>
</tbody>
</table>

Total of 491 products evaluated
Background

• Many DoD depainting operations currently use environmentally compliant peroxide-assisted benzyl alcohol strippers
  • These strippers have acceptable coating removal rates with minimal physical damage to metallic substrates

• However, several major drawbacks exist, including:
  • Limited effectiveness on coating stack-ups containing new non-Cr pretreatments
  • Potential for damage to resins used in structural composites
Project Objectives

• Conduct an unbiased evaluation of an alternative, environmentally friendly chemical coating remover

• Support implementation of the product by stakeholders at Air Force, Navy and other DoD depainting operations

1. Identify and evaluate applications in AF and Navy depots for alternative coating removers

2. Capture end user technical interest and acceptance of compliant coating remover

3. Support validation and transition of alternative remover to AF and Navy depainting operations
Technical Approach

• A two phased approach is recommended to support evaluation and possible implementation of the alternative coating remover at AF and Navy depots

  • **Phase I**: Conduct laboratory testing to comparatively assess the performance of the alternative coating remover against existing chemical removers in use at AF and Navy depots

  • **Phase II**: Perform demonstration/validation testing on coated military assets to facilitate stakeholder “buy-in” and incorporation of the alternative remover into AF Technical Orders and Navy Technical Manuals
Remover Candidate Selection

• Polygone 310-AG, RPM Technology
  • Identified under ESTCP Project WP-0621 completed by AFRL, NAVAIR and Battelle to evaluate aircraft sealant removers
  • Environmentally friendly product
  • Passed corrosion testing requirements for sandwich corrosion, hydrogen embrittlement and total immersion corrosion

• Desolift 5269, PPG Aerospace Coatings
  • Environmentally compliant benzyl alcohol product
  • Passed corrosion testing conducted by SMI in 2011
Laboratory Testing Scope

• Identified laboratory testing requirements from review of AF and Navy documents and survey of stakeholders

• Test plan focused on two efforts:
  1. Evaluation of removers against corrosion requirements
  2. Comparative evaluation of stripping efficiency

• Coating remover test matrix
  • Polygone 310AG, RPM Technology
  • Desolift 5269, PPG
  • Turco 6813E, Henkel
  • DePaint XP, Aerochem, Inc.
  • Plane Naked, Aerochem, Inc
  • DeKote AF, Aerochem, Inc
## Laboratory Testing - SMI Results

<table>
<thead>
<tr>
<th>Test</th>
<th>Polygone 310-AG</th>
<th>Desolift 5269</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immersion Corrosion</td>
<td>Passed</td>
<td>Failed(^1)</td>
</tr>
<tr>
<td>Dissimilar Metal Corrosion</td>
<td>Passed</td>
<td>Passed</td>
</tr>
<tr>
<td>Residue Corrosion</td>
<td>Passed</td>
<td>Passed</td>
</tr>
<tr>
<td>Sandwich Corrosion</td>
<td>Passed</td>
<td>Passed</td>
</tr>
<tr>
<td>Hydrogen Embrittlement</td>
<td>Failed(^2)</td>
<td>Passed</td>
</tr>
</tbody>
</table>

1. Passed requirement (except for Mg panels) in testing conducted by SMI in 2011; Also passed in follow-up testing conducted by Battelle on steel panels

2. Passed requirement in testing conducted by NAVAIR in 2010; verification testing underway with independent laboratory
## Laboratory Testing - Test Panel Prep

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Code</th>
<th>Coating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024 Aluminum</td>
<td>A</td>
<td>Pretreatment: MIL-C-81706 Chromate CC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primer: MIL-PRF-23377J, Type 1, Class C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Topcoat: MIL-PRF-85285, Type IV, Class H</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Pretreatment: MIL-C-81706 Chromate CC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primer: TT-P-2760, Type 1, Class C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Topcoat: MIL-PRF-85285, Type IV, Class H</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Pretreatment: MIL-C-81706 Chromate CC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primer: MIL-PRF-85582, Type I, Class C1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Topcoat: MIL-PRF-85285, Type IV, Class H</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Pretreatment: PreKote Pretreatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primer: MIL-PRF-23377J, Type I, Class C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Topcoat: MIL-PRF-85285, Type IV, Class H</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Pretreatment: PreKote Pretreatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primer: PR-1432-GV, then MIL-PRF-23377J, Type I, Class C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Topcoat: MIL-PRF-85285, Type IV, Class H</td>
</tr>
</tbody>
</table>
Laboratory Test Results - Unaged Panels

- Stripping performance on unaged panels was not ideal
  - Best performers still required 24 hour dwell for complete removal
  - Performance was reduced on coating systems with PreKote

24 hour stripping results on panels with PreKote pretreatment, 23377 primer and APC topcoat. Strippers, from the left, are DeKote, DePaint XP, Desolift 5269 and PolyGone 310 AG Gel.
Laboratory Test Results - Aged Panels

- Stripping performance was improved on aged panels
  - DeKote, DePaint and Desolift products performed best overall
Composite Panel Degradation Testing

• Fiberglass and graphite epoxy coupons were treated with the removers and inspected following a 24 hour dwell time

• Clear signs of fiberglass resin depletion were observed with use of the following removers:
  – DePaint XP, DeKote and Plane Naked
  – No evidence of fiberglass resin depletion was observed for the remaining removers

• There was no evidence of depletion on the graphite epoxy panels for any of the removers
Composite Panel Inspection Results

Control
DeKote
Desolift 5269

DePaint XP
Plane Naked
PolyGone 310 AG Gel
Turco 6813E

Graphite Control 50x
Graphite DePaint XP 50x
Graphite Desolift 5269 50x
Phase II Remaining Tasks

• Task 4: Field Testing
  • Perform field demonstration/validation testing at an AF depot and Navy Fleet Readiness Center to support product use and potential implementation
  • Conduct comparative testing on off-aircraft component parts and aircraft structures

• Task 5: Results Documentation
  • Summarize program results in a final report

• Task 6: Technology Transition
  • Support process owners in updating technical documents such as T.O. 1-1-8 and applicable Navy Technical Manuals
  • Establish NSNs for alternative removers
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