Cadmium Alternatives High Strength Steel JTP

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**Title:** Cadmium Alternatives High Strength Steel JTP

**Performing Organization:** Naval Air Systems Command, 47123 Buse Road, Patuxent River, MD, 20670

**Sponsoring/Monitoring Agency:** Naval Air Systems Command

**DISTRIBUTION/AVAILABILITY:** Approved for public release; distribution unlimited

**ABSTRACT:**
25th Replacement of Hard Chrome and Cadmium Plating Program Review Meeting, March 15-17, 2005, Greensboro, NC. Sponsored by SERDP/ESTCP.
Objective:
Demonstrate and validate the performance of cadmium alternatives on high-strength steel components on DoD platforms

- Write JTP for High-Strength Steel Components – complete
- Write JTP Execution Plan – complete
- Execute the JTP – in progress
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Demonstration Locations:

- JTP coordinated and assembled by Boeing Phantom Works, funded by the AF and Navy/ESTCP
- Execution Plan coordinated and assembled by CTC Johnstown, funded by the AF and Navy/ESTCP
- Numerous DoD/contractor sites involved with coating and testing

- NAVAIR
- ARL
- CTC
- Boeing
- Hill AFB
- Alumiplate
- Finishing Services, Inc.
- Marshall Labs
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**Alternative Coatings Selected by JCAT:**

- **Primary**
  - LHE Cadmium (control)
  - Zinc-Nickel, acid
  - Tin-Zinc
  - IVD Aluminum (control)
  - Aluminum-Manganese
  - Electroplated Aluminum
  - Sputtered Aluminum

- **Repair**
  - brush LHE Cadmium (control)
  - brush Sermetel 249/273
  - brush Zinc-Nickel, alkaline
  - brush Tin-Zinc
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Demonstration Tests Selected by JCAT:

- **Phase I**
  - Hydrogen Embrittlement
  - Hydrogen Re-Embrittlement (NRB immersion, exposed C-ring (Army))
  - Bend Adhesion (Q/A)

- **Phase II**
  - Appearance
  - Throwing Power
  - Composition Uniformity
  - Strippability
  - Galvanic Potential
  - Bend Adhesion
  - Paint Adhesion
  - Unscribed Neutral Salt Spray
  - Scribed Neutral Salt Spray
  - Galvanic Corrosion Resistance
  - Fluid Corrosion Resistance
  - Scribed w/primer/topcoat NSS
  - SO2 Salt Spray (Navy)
  - Run-on/Break-away Torque
  - Torque-Tension
  - Reparability (appearance, adhesion, corrosion)
  - Hydrogen Embrittlement (Q/A)
Demonstration Tests Selected by JCAT:

- **Phase III**
  - Rotating Beam Fatigue Smooth Bar (primary and repair coatings)
  - Rotating Beam Fatigue Notched Bar (primary coatings only)
  - Bend Adhesion (Q/A)
  - Hydrogen Embrittlement (Q/A)

- **Navy Added Tests**
  - Corrosion Fatigue
  - Stress Corrosion Cracking
  - Run-on/Break-away Torque – additional corrosion step
  - Rotating Beam Fatigue – may require 2\textsuperscript{nd} geometry at additional axial fatigues

- **Air Force Added Test**
  - Torque Tension – adjusted acceptance criterion
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Schedule/Milestones

- AF first draft completed 12/02
- Joint Community working meeting/JTP kick off at Hill AFB completed 03/03
- Multi-service JTP draft completed 4/03
- Service input completed 7/03
- JTP Execution Plan completed 2/04
- Contracts delays continue for over 12 months
- Contract signed for Phase II & III work completed 12/05
- NAVAIR executing Phase I tests in progress
- SOWs submitted for Phase II & III work in progress
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Schedule/Milestones

- Execution of JTP expected to continue through FY07
  - Phase I Test Report planned spring 2005
  - Phase II Test Report planned late CY 2006
  - Final Test Report planned mid CY 2007

- Field demonstrations
  - Deploy coatings on non-flight critical components spring 2006 thru 2008
  - Deploy coatings on flight critical components spring 2007 thru 2008
  - Interim field test report planned spring 2007
  - Final field test report planned spring 2008
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### Phase I Test Results

Hydrogen Embrittlement, ASTM F 519 Sustained Load Test in Air, Type 1a.1 Notched Round Bars

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<th>Coating</th>
<th>Replicate</th>
<th>Fracture Strength (%)</th>
<th>Time to Failure (HRS)</th>
<th>Pass/Fail</th>
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Questions?