

# Cadmium Alternatives High Strength Steel JTP

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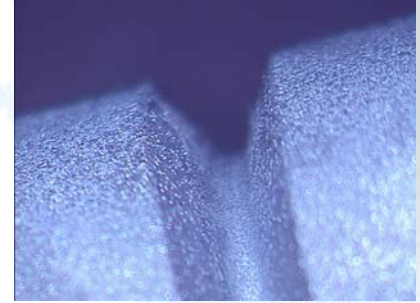
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# Cadmium Alternatives HSS JTP



## 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*

# Cadmium Alternatives HSS JTP

## 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

◆ Hill AFB

◆ ARL

◆ Alumiplate

◆ CTC

◆ Finishing Services, Inc.

◆ Boeing

◆ Marshall Labs

# Cadmium Alternatives HSS JTP

## 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)

# Cadmium Alternatives HSS JTP

## 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<sup>nd</sup> geometry at additional axial fatigues

### ➤ Air Force Added Test

- ◆ Torque Tension – adjusted acceptance criterion

# Cadmium Alternatives HSS JTP

## 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*

# Cadmium Alternatives HSS JTP

## 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

Coating	Replicate	FRACTURE STRENGTH (%)	TIME TO FAILURE (HRS)	PASS/FAIL
LHE Cd	1	89.5%	202	pass
	2	92.1%	203	pass
	3	93.7%	203	pass
	4	91.9%	203	pass
IVD Al	1	92.9%	203	pass
	2	94.6%	203	pass
	3	94.2%	203	pass
	4	97.4%	204	pass
Alumiplate	1	91.6%	203	pass
	2	95.2%	203	pass
	3	96.0%	204	pass
	4	98.2%	204	pass

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Questions?