



U.S. Army Research, Development and Engineering Command

Hexavalent Chromium Reduction in the Army: Success Stories and the Path Forward



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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Report Documentation Page

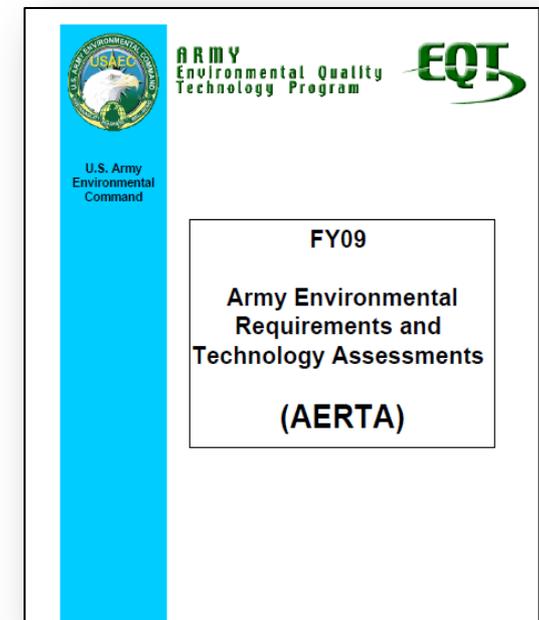
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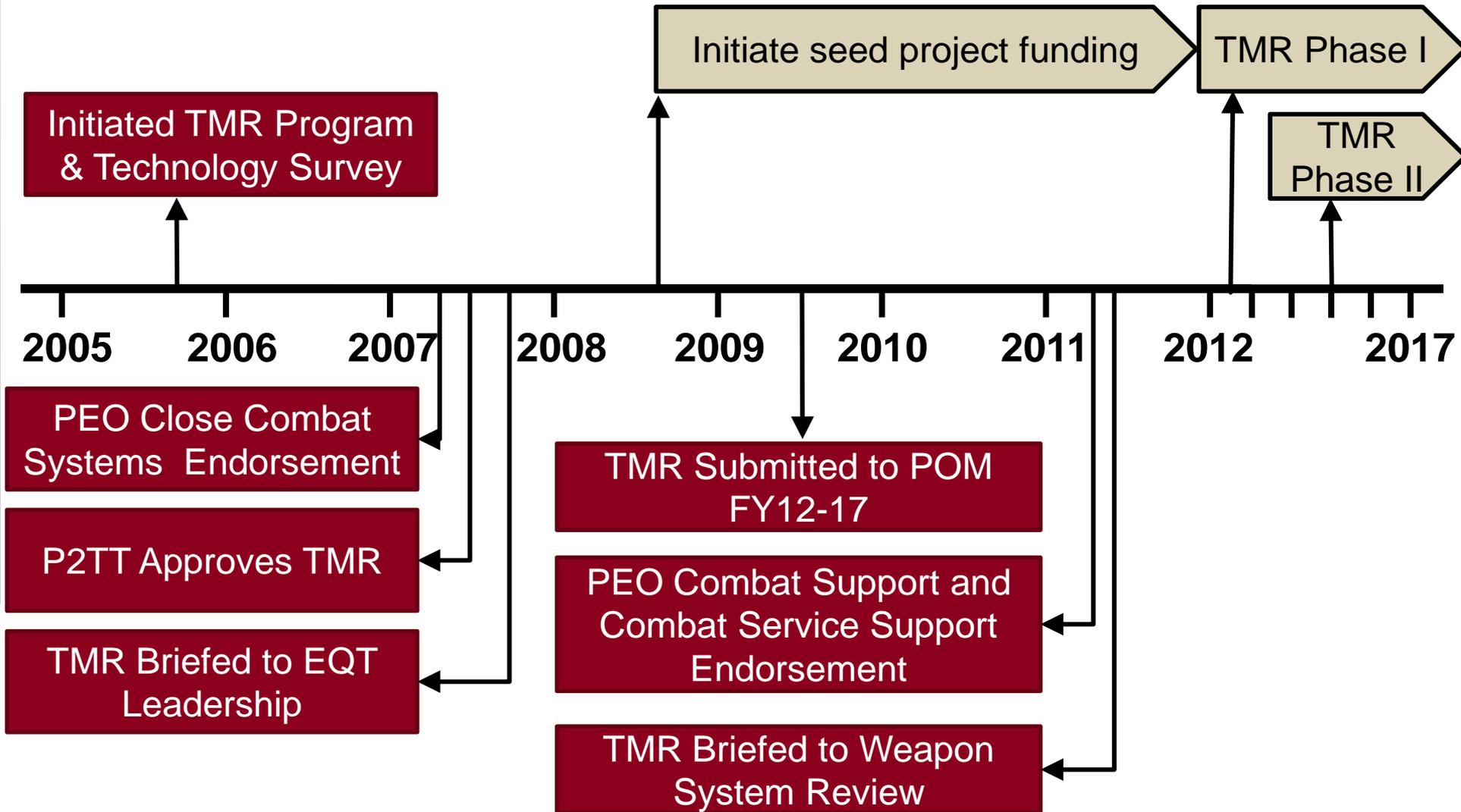


- Army Environmental Requirements and Technology Assessments (AERTA)
PP-2-02-03
- Reduce use of carcinogenic substances in metal plating, including
 - Hexavalent chromium (Cr(VI))
 - Cadmium (Cd)
 - Beryllium and its alloys
- Currently #2 overall Army environmental requirement
- Pollution Prevention Technology Team (P2TT) built Toxic Metal Reduction (TMR) Program to address AERTA
- TMR funded via Army Environmental Quality Technology (EQT) Program and additional leveraged programs





TMR Program Timeline





Phase I:

Funding: BA2-BA4, BA6

Timeframe: FY08-17

Thrust Areas:

- Alternatives to Cr(VI) in Metal Plating
- Cr(VI) Reduction in Pretreatment and Surface Finishing
- Alternatives to Cd in Plating and Finishing

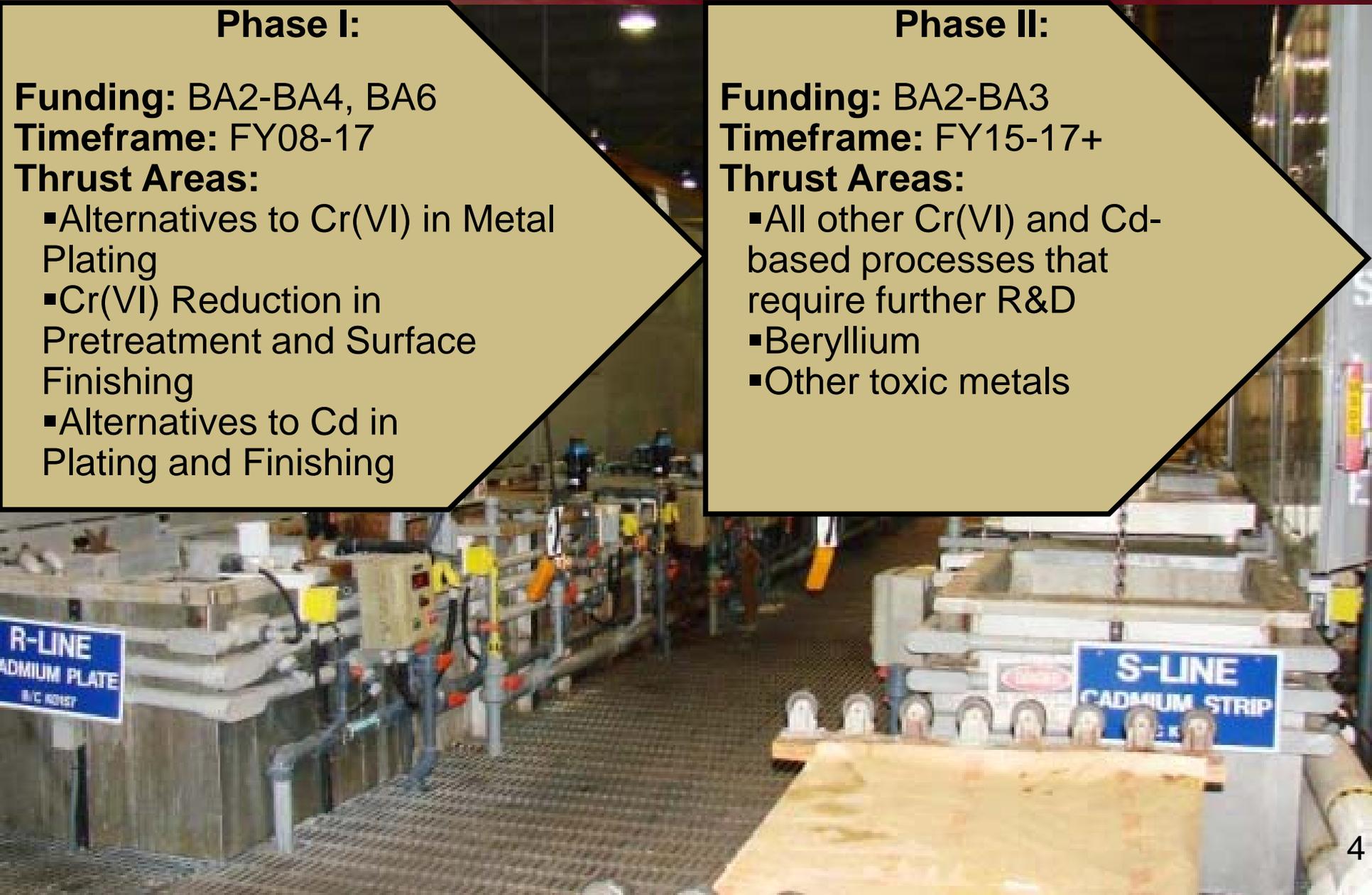
Phase II:

Funding: BA2-BA3

Timeframe: FY15-17+

Thrust Areas:

- All other Cr(VI) and Cd-based processes that require further R&D
- Beryllium
- Other toxic metals





ESOH costs
(per depot):
\$2M+/yr

■ Scope of Program

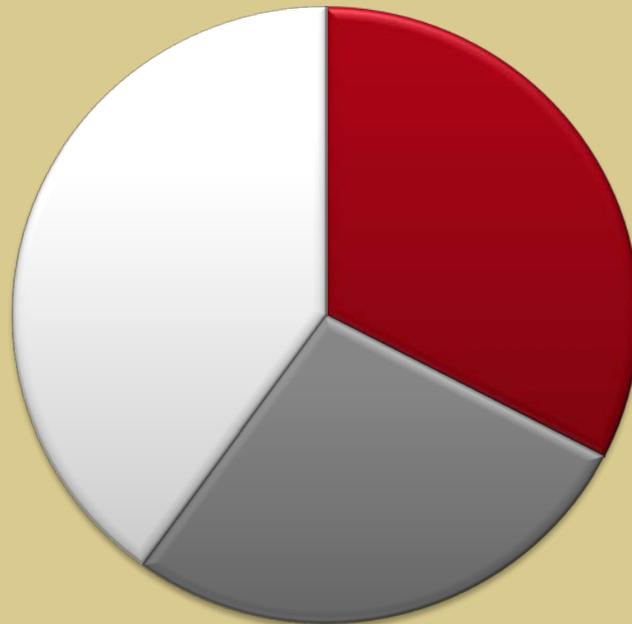
- All major Army industrial installations use Cr(VI) and/or Cd in production & maintenance processes and field maintenance / touch-up operations
 - Plating
 - Conversion Coatings
 - Stripping
 - Anodizing
 - Sealing
 - Wash Primer
- PMs specify these materials due to lack of validated alternatives on many systems
 - Ground vehicle systems
 - Communications
 - Support equipment
 - Aviation
 - Armaments
 - Electronics

■ Objectives

- Develop & field technologies to reduce
 - Cr(VI) used in electroplating by 75%
 - Cd used with Cr(VI) finishes by 75%
 - Cr(VI) in pretreatments and surface finishes by 100%
- Meet or exceed all operational performance requirements



TMR Technology Demonstration/Validation Efforts



Proposed Funding Allocation

- Alternatives to Cr(VI) Metal Plating
- Alternatives to Cd in Plating and Finishing
- Cr(VI)-Free Pretreatments, Finishes and Conversion Coatings

Transition all technologies to users at Technology Readiness Level 7 (prototype demo) and some at TRL 8 (full system demo)



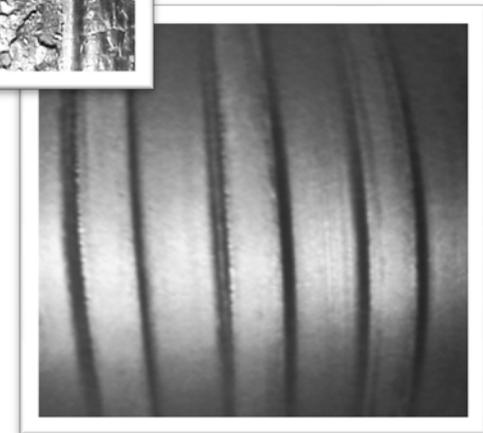
TMR Funded Project: Cr(VI) Elimination in Medium Caliber Guns



- Objectives:
 - Eliminate of Cr(VI) in manufacture of medium caliber bore coatings
 - Extend medium caliber gun barrel life
- Technical Approach:
 - Benet Laboratories explosively cladding tantalum-tungsten (Ta-W) alloy coatings on the bore
- Successes:
 - Test fired Ta-W clad barrel side-by-side with current Cr(VI) barrel with 3x increase in barrel life
- Follow-On:
 - Transition to Army MANTECH Program
 - Leverage technology in large caliber systems



Condemned
Cr(VI) Barrel



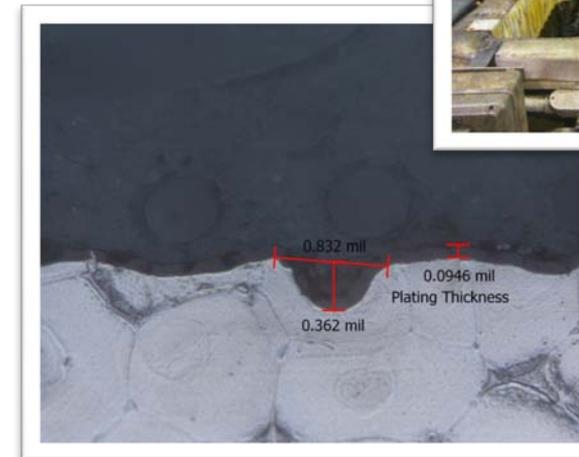
Ta-W Barrel
after similar
test



TMR Funded Project: Cr(VI)-Free Stripping Processes for Metal Finishing Operations



- Objective:
 - Eliminate Cr(VI) strippers for inorganic surface finishes during the overhaul & repair of Army Aviation assets
- Technical Approach:
 - Test COTS solutions on highest use processes and substrates at Corpus Christi Army Depot (CCAD)
- Successes:
 - Developed baseline data for Cr(VI)-based strippers to establish Army Aviation requirements for IGA/EGP and Weight Loss
- Follow-On:
 - Conduct IGA/EGP and Weight Loss tests for alternative processes





Sustainable Painting Operations for the Total Army (SPOTA)



Handheld Laser Depainting for Aviation

HAP-Free, Non-Cr(VI) Wash Primer



Non-Chromate Conversion Coating for Zinc-Plated Steel



Flashjet Depainting for Rotor Blades

Ordnance Environmental Program

Perchlorate- and Cr(VI)-Free Delays for Handheld Signals

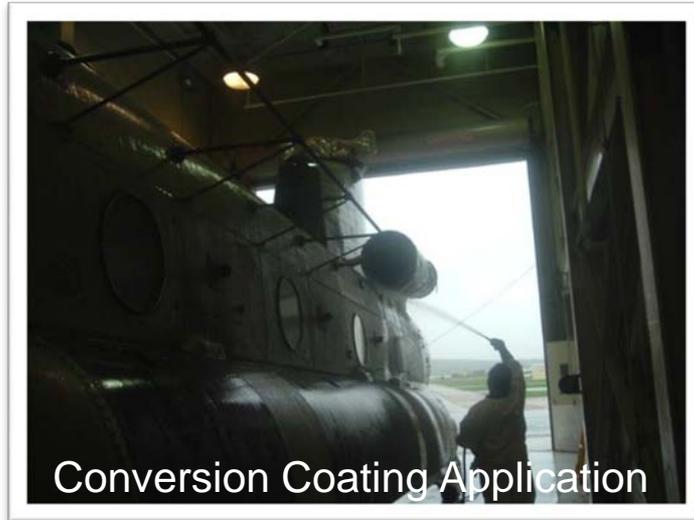




- **2003:** Initiated by AMCOM G-4 with NAVAIR and ARL
- **2005:** Demo CH-47 coated by 1109th Aviation Classification Repair Activity Depot (AVCRAD) in Groton
 - Expanded use to CH-47, UH-60, OH-58, AH-64, UH-1
 - No significant difference between the Cr(VI)-free and standard coating systems
- **2010:** 1108th AVCRAD transitioned to the MIL-PRF 85582 Class N primers and working towards implementation of the MIL-DTL-81706 Type II conversion coatings
- **2011 & Beyond:**
 - AMCOM G-4 coordinating with Ft. Rucker and CCAD to implement the Cr(VI)-free technologies coating system
 - G-4 coordinating with 1107th AVCRAD, Springfield, MO and 1106th AVCRAD, Fresno, CA to begin implementation of the new coating system



Non-EQT Army Efforts Past Success: Aviation Cr(VI) Free Conversion Coatings and Epoxy Primers



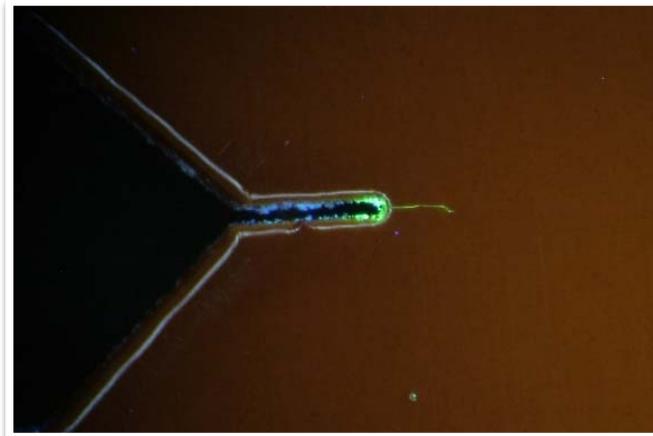


■ Cr(VI) Free Coatings for Missile Weapon Systems

- Demonstrate use of a total Cr(VI)-free coating system on missile weapon systems/support equipment assemblies (mixed metal) with NAVAIR & ARL

■ Tagnite Coated Magnesium Components

- Dem/Val of processing Tagnite coated magnesium housings (NDCEE)
- Nondestructive Inspection (NDI) testing of magnesium transmission housings for aviation systems (AMRDEC and NDI Center of Excellence)
- Cr(VI) free coating system for magnesium housings on aircraft (AMRDEC)





- Defense Federal Acquisition Regulation Supplement (DFARS); Minimizing Use of Hexavalent Chromium
 - Proposed DFARS clause published in FR 8 April 2010
 - Comments from industry incorporated into public draft
 - Army drafted Army Acquisition Policy – Awaiting final DFARS Clause
- Army Goals for Toxic Chemical Reduction
 - 1 Mar 10 Memo outlines Army Hazardous Material Management Plan to reduce Army use of three chemicals
 - Includes Cr(VI) containing epoxy primers – used primarily in aviation corrosion control
 - Goal: 9% reduction from 2010-2013 (base year CY2007)



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