



# *DoD Corrosion Prevention and Control*

## **Environmental Issues in Corrosion Prevention**

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## Report Documentation Page

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# Strategic Environmental R&D Program

- Joint efforts to develop new corrosion protection systems that are harmless to the environment.
- Joint investment in R&D focused on reducing or eliminating hazardous materials from DoD weapons systems and platforms by
  - The Strategic Environmental Research and Development Program (SERDP)
  - The Environmental Security Technology Certification Program (ESTCP)
- The major goal for these programs is the development of environmentally benign corrosion protection systems.
- The metrics are
  - the new systems must be environmentally benign or significantly less hazardous than the current systems.
  - the new systems must meet or exceed all of the corrosion protection performance specifications for current applications.
- There are two major focus areas:
  - alternatives to chromium and cadmium plating
  - alternatives to hexavalent chromium pretreatments, primers and topcoats.



# Corrosion Prevention Technology

## ● Background

- For many years corrosion protection was successfully achieved using inhibitors such as  $\text{Cr}^{6+}$  that are now restricted or prohibited because of environmental concerns.
- Understanding of coatings and protective materials performance was based on experience within a narrow range of materials

## ● Impact

- Mechanisms of corrosion inhibition changed drastically as the available materials shifted.
- Hexavalent chrome in coatings may be replaced by sacrificial magnesium which functions via totally different mechanisms. Such differences create a completely new set of testing requirements, risks, and applications issues.

## ● Requirement

- Multiple new corrosion protection materials must be evaluated, and implemented. They must be tested, with new test methods developed, and performance mechanisms understood to prevent failures in actual service.



# Hexavalent Chromium (Cr<sup>6+</sup>) Background

- Vital material in weapon systems and platforms due to corrosion protection properties
- Very toxic
- Many companies phasing out Cr<sup>6+</sup>
- Thousands of individual DoD applications
- Need practical approach to resolve trade-offs between DoD needs and environmental impact



# Cr<sup>6+</sup> Risk Management Options

- Cr<sup>6+</sup> and other contaminants present a dilemma
  - Corrosion needs to be prevented or contained
  - Trade-off between environmental hazards and corrosion deterioration
- Risk management options focus on reducing risks while maintaining mission requirements
  - Minimize use of Cr<sup>6+</sup>
  - Develop improved testing
  - Identify barriers to introducing safer substitutes
  - Develop/share database of tests, specs, and lessons learned



# Army Aviation and Missile Command Project

## Alternative Chemical Paint Strippers

- SPOTA Funded, 250K
- Approximately 300K matching funds from OSD Corrosion Policy Oversight Office
- Program will be executed by CTC
- Objective is to evaluate a number of currently available HAP-free chemical paint strippers which will be tested in accordance with AED, AMRDEC, LEAD, and CCAD requirements
  - Test Plan development in work
    - Performance Testing
    - Materials Testing
  - Coupons being procured



# Army Aviation and Missile Command Project

## Hexavalent Chrome Free Coating for Missile Weapon System

- SPOTA Funded, 345K
- Objective of program is to demonstrate the following:
  - Evaluate missile primers with TCP on aluminum substrates
  - Alternative hexavalent chrome free pretreatment for wash primer compatible with mixed substrates (steel and aluminum)
  - MIL-PRF-23377 class N primers applied over zinc phosphate treated steel substrates
- Test plan nearing completion, Phase I coupons being prepared, equipment being procured





# Army Aviation and Missile Command Project

## Compatibility of Chrome Free Coating Systems with Tagnite Housings

- SPOTA Funded, 250K
- Objective of program is to evaluate the compatibility of chrome free coating systems with Tagnite coated housings
  - Evaluates the use of MIL-PRF-23377 Class N primer over Rockhard
  - Evaluates the use of hexavalent chrome free conversion coatings as a field repair technique
- Test plan is currently being generated, initial test coupons are being procured



# Army Aviation and Missile Command Project

## Alternative Strippers for Legacy Pretreatments

- EQT Funded, 200K
- Objective of program is to generate a test protocol to evaluate alternatives to hexavalent-chrome based surface finish stripping solutions
  - Program will also consider hexavalent-chrome containing surface activators used in surface finishing operations
- Testing requirements are currently being generated by AED materials



# Other Projects Underway or Proposed to Replace Chromium and Cadmium

- W06AF01 – Magnesium Rich Primer for Chrome Free Aircraft Coating Systems
- W09NA03 – Pulse Water Jet Stripping of Chrome Plating and HVOF Coatings from Jet Engine Components
- W10NA02 – Amorphous alloys as hard chrome alternatives
- W10AR04 – Chromium Free Coatings for Missiles
- W10AR01 – Electroplated Aluminum Fasteners
- W10AR04 – HexChrome Free Coatings
- W10AR08 – "Green" Conducting Polymer Coating
- W10AR05 – Cadmium Alternatives for Fasteners and Bushings for Helicopters



# Specific Steps for DoD Cr<sup>6+</sup> Policy

- DoD policy on minimizing Cr<sup>6+</sup> use completed
- DFAR contract clause underway
- Conduct study on alternatives – identify barriers
- Identify where Cr<sup>6+</sup> substitutes have been proven for use
- Extend DoD Cr<sup>6+</sup> database into full knowledge base



# CPO Way Forward

- WIPT Approach
  - Establish a Cr<sup>6+</sup> usage certification process
  - Communicate state-of-the-art alternatives
  - Establish risk reduction process that accounts for performance/technical, environmental & logistics factors
- Establish a Cr<sup>6+</sup> elimination task force team
  - Develop action plan
  - Identify command use, applications, and current/future mitigation strategies
- Establish who will
  - Document, assess, monitor, track the use of Cr<sup>6+</sup>
  - Program & budget for mitigation of environmental regulations

