Welcome to the JTEG Monthly Teleconference

Topic:
Corrosion Prevention and Repair

30 March 2015
AGENDA

1300-1310: Welcome and JTEG Background - Greg Kilchenstein (OSD-MPP)

1310-1311: Administrative Notes – Debbie Lilu (NCMS)

1311-1325: Effects of Corrosion on DoD Equipment - Rich Hays (OSD-CPO)

1325-1345: OSD Corrosion Policy and Oversight Overview
Rich Hays (OSD-CPO)

1345-1405: Army Corrosion Control and Prevention Executive Overview
Dr. Roger Hamerlinck

1405-1425: Navy Corrosion Control and Prevention Executive Overview
Mr. Matt Koch

1425-1445: Air Force Corrosion Control and Prevention Executive Overview
Dr. David Robertson

1445-1500: Review & Wrap Up – JTEG Principals
Joint Technologies Exchange Group (JTEG)

- Provide a forum for the exchange of information on new technology, processes, and equipment developments
- Collect, analyze, and disseminate depot maintenance requirements for new technology, processes and equipment
- Advocate for new technology or equipment with cross-service potential to increase efficiency
- Facilitate joint service technology development
Technology Forum Protocol

- Please keep your phones on mute unless you are presenting. Should you have to temporarily drop off please hang up and call back.
- Questions will be addressed via Q&A on DCO.
- Presenters - slides will be advanced by Greg / Ray.
- Briefs (when cleared for public release) and Q&A will be posted on JTEG website.

http://jteg.ncms.org
IMPACT OF CORROSION

OFFICE OF THE UNDERSECRETARY OF DEFENSE
FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS

Presentation to Joint Technology Exchange Group
30 March 2015

Rich Hays
Deputy Director, Corrosion Policy and Oversight Office
**DoD Cost of Corrosion Results to Date**  
(Most recent studies - $ in billions)

### Study year baseline

<table>
<thead>
<tr>
<th>Study year baseline</th>
<th>Study segment</th>
<th>Annual cost of corrosion</th>
<th>Corrosion as a percentage of maintenance</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2010</td>
<td>Army aviation and missiles</td>
<td>$1.5</td>
<td>20.9%</td>
<td>FY2007 and FY2008</td>
</tr>
<tr>
<td></td>
<td>Marine Corps ground vehicles</td>
<td>$0.3</td>
<td>12.3%</td>
<td>FY2007 and FY2008</td>
</tr>
<tr>
<td></td>
<td>Navy and Marine Corps aviation</td>
<td>$2.7</td>
<td>23.0%</td>
<td>FY2008 and FY2009</td>
</tr>
<tr>
<td>2010-2011</td>
<td>Air Force aircraft and missiles</td>
<td>$5.1</td>
<td>23.9%</td>
<td>FY2008 and FY2009</td>
</tr>
<tr>
<td></td>
<td>Navy ships</td>
<td>$3.3</td>
<td>21.6%</td>
<td>FY2008 thru FY2010</td>
</tr>
<tr>
<td>2011-2012</td>
<td>Army ground vehicles</td>
<td>$1.7</td>
<td>12.3%</td>
<td>FY2008 thru FY2010</td>
</tr>
<tr>
<td></td>
<td>Marine Corps ground vehicles</td>
<td>$0.3</td>
<td>14.3%</td>
<td>FY2009 thru FY2011</td>
</tr>
<tr>
<td>2012-2013</td>
<td>DoD facilities and infrastructure</td>
<td>$3.0</td>
<td>14.4%</td>
<td>FY2009 thru FY2011</td>
</tr>
<tr>
<td></td>
<td>All other DoD segments</td>
<td>$3.6</td>
<td>17.9%</td>
<td>FY2009 thru FY2011</td>
</tr>
<tr>
<td></td>
<td>Army aviation and missiles</td>
<td>$1.9</td>
<td>21.9%</td>
<td>FY2009 thru FY2011</td>
</tr>
<tr>
<td>2013-2014</td>
<td>Navy and Marine Corps aviation</td>
<td>$3.6</td>
<td>28.2%</td>
<td>FY2010 thru FY2012</td>
</tr>
<tr>
<td></td>
<td>Air Force aircraft and missiles</td>
<td>$6.0</td>
<td>24.9%</td>
<td>FY2010 thru FY2013</td>
</tr>
</tbody>
</table>

**Total DoD annual corrosion cost**  
$23.4 billion  
20.7%
<table>
<thead>
<tr>
<th>Study year</th>
<th>Study segment</th>
<th>Annual non-available time attributable to corrosion</th>
<th>Average non-availability per end item attributable to corrosion</th>
<th>Data baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010–2011</td>
<td>Army aviation and missiles</td>
<td>1,717,898 hours</td>
<td>17.4 days</td>
<td>FY2008 and FY2009</td>
</tr>
<tr>
<td></td>
<td>Navy and Marine Corps aviation</td>
<td>95,237 days</td>
<td>26.5 days</td>
<td>FY2008 and FY2009</td>
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<tr>
<td></td>
<td>Air Force</td>
<td>2,102,476 hours</td>
<td>15.9 days</td>
<td>FY2008 and FY2009</td>
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<tr>
<td>2011–2012</td>
<td>Army ground vehicles</td>
<td>662,649 days</td>
<td>1.7 days</td>
<td>FY2008–FY2010</td>
</tr>
<tr>
<td>2012–2013</td>
<td>Marine Corps ground vehicles</td>
<td>209,115 days</td>
<td>3.3 days</td>
<td>FY2009–FY2011</td>
</tr>
<tr>
<td></td>
<td>Army aviation and missiles</td>
<td>2,028,590 hours</td>
<td>19.7 days</td>
<td>FY2010–FY2012</td>
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<tr>
<td>2013–2014</td>
<td>Navy and Marine Corps aviation</td>
<td>116,484 days</td>
<td>29.9 days</td>
<td>FY2010–FY2012</td>
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<tr>
<td></td>
<td>Air Force</td>
<td>2,259,412 hours</td>
<td>16.6 days</td>
<td>FY2010–FY2013</td>
</tr>
</tbody>
</table>
DoD Corrosion Impact on Safety

Army Aviation
Corrosion-related Mishaps
Department of Navy Aviation
Corrosion-related Mishaps

Number of corrosion-related mishaps

Fiscal year


Class A  Class B  Class C
Corrosion Impact on Cost

All Aviation

HH-60
## Corrosion Impact on Cost – All HH-60 Assets

($ in millions)

<table>
<thead>
<tr>
<th>Level of maintenance</th>
<th>Model</th>
<th>Maintenance cost</th>
<th>Corrosion cost</th>
<th>Percent corrosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depot</td>
<td>HH-60</td>
<td>$406.8</td>
<td>$75.4</td>
<td>18.5%</td>
</tr>
<tr>
<td>Field</td>
<td>HH-60</td>
<td>$1,690.5</td>
<td>$366.7</td>
<td>21.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>HH-60</td>
<td><strong>$2,097.3</strong></td>
<td><strong>$442.1</strong></td>
<td><strong>21.1%</strong></td>
</tr>
</tbody>
</table>

### Graph

- **Depot**
- **Field**

**Total Maintenance Cost ($M)**

**Corrosion Cost ($M)**
Corrosion Impact on Cost – All HH-60 Assets

Total Corrosion Costs ($M)

- Landing Gear
- Environmental Control
- Flight Control
- Armament
- Engines
- Misc. Aircraft
- Power Dist. And Electrical
- Avionics
- Rotor and Propellor System
- Airframe

Airframe has the highest total corrosion costs, exceeding $50 million.
Corrosion Impact on Availability – All HH-60 Assets

Environment Matters!
Between 10% and 30% of every maintenance dollar is spent to prevent or correct corrosion problems.

Corrosion has a measurable and significant impact on system availability.

Corrosion directly causes, or is a factor in, many safety mishaps.

CPO-sponsored “Impact of Corrosion” studies can be used as a tool to identify and prioritize areas that need to be addressed.
CORROSION POLICY AND OVERSIGHT

OFFICE OF THE UNDERSECRETARY OF DEFENSE
FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS

Presentation to Joint Technology Exchange Group
30 March 2015

Rich Hays
Deputy Director, Corrosion Policy and Oversight Office
How Many Laws Govern Corrosion?

- **2\textsuperscript{nd} Law of Thermodynamics**
  
  “Every process occurring in nature proceeds in the sense in which the sum of the entropies of all bodies taking part in the process is increased. In the limit, i.e. for reversible processes, the sum of the entropies remains unchanged.”

  (Planck)

- **10 U.S.C. 2228**
  
  “…the deterioration of a material or its properties due to a reaction of that material with its chemical environment.”
Corrosion Examples

General and Crevice Corrosion of Steel

Alkali-Silica Reaction in Concrete

Environmentally Influenced Cracking

uV Degradation of Organic Coating System
DoD Corrosion Organization

**USD**
Acquisition, Technology, and Logistics

- ASD, Logistics and Materiel Readiness
- ASD, Research and Engineering
- DUSD, Installations and Environment
- Navy Corrosion Executive
- Army Corrosion Executive
- AF Corrosion Executive

**Director, Corrosion Policy and Oversight**

**WIPTs**

**DoD Corrosion Prevention and Control IPT**

- Policy and Requirements
- Outreach and Communications
- Metrics, Impact and Sustainment
- Facilities
- Training and Certification
- Specifications/Standards and Product Qualification
- Science and Technology

IPT member representatives:
- OSD
- Joint Staff/J-4
- Army
- Navy
- Air Force
- Marine Corps
- Army Corps of Engineers
- Joint Council for Aging Aircraft
- National Aeronautics and Space Administration
- US Coast Guard
- Defense Logistics Agency
- General Services Administration
What We Do

Activities

- Policy Development and Implementation
- Weapon System and Major Facility Program Reviews
- Workforce Development
- Corrosion Metrics Collection and Analysis
- Specifications and Standards
- Communication and Outreach

Project and Research Sponsorship

- Demonstration/Implementation Projects through Military Departments
- Technical Corrosion Collaboration
Policy

Draft DoDI 5000.02 – *Operation of the Defense Acquisition System* – requires CPC planning for all systems (including MAIS, COTS, and GOTS) throughout the lifecycle
- “…..planning for and establishing 1) a management structure for CPC, and 2) the technical considerations and requirements in order to implement an effective CPC regime throughout the life cycle of a program.”
- Planning documented in the Systems Engineering Plan and the Life Cycle Sustainment Plan

DoDI 5000.67 - *Prevention and Mitigation of Corrosion on DoD Military Equipment and Infrastructure* – establishes structure of DoD Corrosion Program and responsibilities

DoDD 4151.18 - *Maintenance of Military Materiel* – requires that corrosion prevention and control programs and preservation techniques be established throughout the system life cycle.

70% of sustainment costs are locked in by initial design
Oversight of Major Acquisition Programs
Specifications and Standards

- Most corrosion-related specs and standards eliminated during acquisition reform in the 1990’s
  - Causes corrosion requirements to be negotiated individually during acquisition

- Working with MilDeps to reestablish some needed Specs & Stds
    - Supported by DI-MFFP-81403, Corrosion Prevention and Control Plan, and DI-MFFP-81402, Metal Finishes and Finishing Processes and Procedures (a.k.a. finish specification)
  - MIL-HDBK-502A, Product Support Analysis – includes CPC planning

- Migrating some requirements to commercial standards
  - Developing new standards with non-governmental standards bodies (e.g. SAE)
  - TA-STD-0017, Product Support Analysis (previously LSA)
  - Assisting in development of Joint SSPC-NACE Std for CPC Planning
Workforce Development

- DAU CLM-038, *Corrosion Prevention and Control Overview*
- DAU CLE-070, *Corrosion and Polymeric Coatings*
- Web-based training modules ([www.corrconnect.org](http://www.corrconnect.org))
- Strategic partnership with NACE and SSPC – delivering training to active duty military and government employees
- University of Akron – BSc. in Corrosion Engineering
- University of Florida – developed Distance Learning Course
Communication and Outreach

- DoD and Allied Nations Corrosion Conference
- Series of “awareness” videos for leadership and general public
- Educational gaming – “CorrSim”
- CorrDefense e-magazine
Objective – Implement mature corrosion control technologies in new and existing weapon systems and facilities

- Military Department-generated projects to qualify products and processes
- Demonstrate effectiveness in operational systems
- Update technical and logistics documentation
Objectives

- **Produce solutions** (knowledge, technologies, processes, materials, etc.) that tangibly reduce the impact of corrosion on DoD weapons systems and infrastructure.
- **Produce individuals** with education, training and experience, who will form the future core of the corrosion prevention and control technical community within DoD, its support network, and its suppliers.

>$90M Investment Since 2008
TCC Technology Investment Categories

Performance Prediction

- Models
- Accelerated Testing
- Validation
- Design Tools

Assessment of Finish

- Mechanical Properties
- Integrity
- Galvanic Interaction
- Degradation Mechanisms

Surface Engineering

- Mechanical
  - Coating removal
  - Substrate damage
- Adhesion Promotion
- Sacrificial
- Cleanliness Requirements

Product Support

- Packaging/Storage
- Shelf-life
- Energy
- Maintenance
CPC Resources

- **Corrosion Prevention and Control Guidebook for Military Systems and Equipment**
  - Guidance for all military systems and equipment – including MAIS and COTS/modified-COTS
  - Beyond general guidance, provides more specific assistance prior to each acquisition phase milestone for six areas of emphasis:
    - Management
    - Systems Engineering
    - Life Cycle Logistics
    - Test & Evaluation
    - Contracting
    - Cost Estimating and Budget

- SEP and LCSP Outlines
- DAG CH 4 and CH 5
- Military Department Corrosion Control and Prevention Executives (CCPE’s)
Some Final Thoughts

- **Corrosion is rarely just a technical problem**
  - Prevent
  - Detect
  - Mitigate
  - Manage

- **Corrosion doesn’t hurt today but it hurts tomorrow**
  - Easier to invest in corrective than preventive maintenance
  - Hard to maintain leadership focus

- **Corrosion is often a “people” problem**

- **Successful corrosion control requires**
  - Awareness and buy-in from leadership
  - Teamwork between subject matter experts, designers, and maintainers – “Corrosion control is not the most important thing we do.”
  - Tools, training, and time for the personnel implementing the processes
Questions?

- STAINLESS STEEL SCREW HEADS
- CADMIUM PLATED SCREW HEADS

- Magnesium Engine Housing
- Rotor Blades
- Trunion Bearings
- Main Landing Gear Brake Assembly
Briefing to the JTEG  
30 March 2015  

U.S. Army Corrosion Prevention and Control Program  

Dr. Roger D. Hamerlinck  
OASA(ALT), SAAL-PA  
roger.d.hamerlinck.civ@mail.mil  
(703) 617-0250
Indicates that they are a member of the Army Corrosion Board and Army Corrosion Integrated Product Team

SOURCE: Profile of the U.S. Army a reference handbook 2014/2015
CHALLENGES TO TECHNOLOGY INSERTION

• Not needed for every TOE/TDA – environment dependent

• How should these solutions be authorized/assigned to the end item
  o Associated Support Item of Equipment (ASIOE)
    ✓ Separately authorized, separately type classified
  o Component of End Item (COEI)
    ✓ Looses it visibility when installed on the end item – just another part
  o Basic Issue Item (BII)
    ✓ Emergency maintenance
    ✓ Put into operation
    ✓ Must be transferred with the item
  o Additional Authorized List (AAL) Item
    ✓ Discretionary item
    ✓ Unit funds the acquisition and re-procurement

• These solutions need maintenance and parts – Added resource requirements

• Availability of funding – affordability

• Does technology truly resolve the root cause for why it corroded

TOE = Table of Organization and Equipment
TDA = Table of Distribution and Allowances
CONCLUSION

If the Army is to succeed in reducing the cost, readiness, and safety impacts of corrosion, I need you to:

• Be the example – perform preventive maintenance
• Establish a command culture that emphasizes prevention of corrosion
• Take the time to file Quality Deficiency Reports (QDRs) and Storage Deficiency Reports (SDRs)
• When you have a “good” idea, let us know, but remember we need the analysis too!
JTEG Brief

Mr. Matthew Koch
DON Corrosion Control & Prevention Executive
ASN RD&A-DASN RDT&E
IMPACT OF CORROSION

- $22.4 Billion/Year Problem for DoD
ACTIONS TO ADDRESS CORROSION

- Congress enacted legislation to address corrosion and DoD has developed policy and guidance

- GAO audits military departments on compliance with USC § 2228 requirements and reports findings to Congress

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Congress establishes DoD Corrosion Executive (P.L. 107-314, 10 USC § 2228)</td>
</tr>
<tr>
<td>2005</td>
<td>DoD implements corrosion planning requirements (DoDI 5000.02)</td>
</tr>
<tr>
<td>2008</td>
<td>Congress establishes Service Corrosion Executives (P.L. 110-417, 10 USC § 2228)</td>
</tr>
<tr>
<td>2009</td>
<td>DON appoints Corrosion Executive, stands up Corrosion Cross-Functional Team, and delivers first annual report to Congress</td>
</tr>
<tr>
<td>2010</td>
<td>DoD requires Corrosion Prevention and Control Plan (CPCP) for all ACAT I program (DoDI 5000.02)</td>
</tr>
<tr>
<td>2013</td>
<td>Corrosion Planning requirement expanded to both the Systems Engineering Plan (SEP) and the Life Cycle Sustainment Plan (LCSP)—(Interim DODI 5000.02)</td>
</tr>
</tbody>
</table>
ROLE OF NAVY CORROSION EXECUTIVE

- Policy (DON-Level and Alignment with OSD & SYSCOM Policies)
- Develop Strategic Plan for Addressing Corrosion in the DON
- Annual Report to Congress on DON Corrosion Health, Needs, and Initiatives
- Corrosion Planning Review in SEP, LCSP, CPCP during Acquisition
- Annual Assessment of Department CPC Program(s)
- Hex- Chrome Waiver Authorization
ROLE OF NAVY CORROSION EXECUTIVE

- Primary POC for Interaction with OSD AT&L Corrosion Policy & Oversight – (Projects, Reports, etc.)
- Lead Cross-DON CPC Communication (Chair Corrosion CFT)
- Facilitate Cross-DOD CPC Standards/Specifications
- Adjudication of Cross-DON CPC Issues
- Response to DON Corrosion-Related Congressional Inquires executed by GAO
Corrosion Cross Functional Team (CFT) is chartered by Flag Officer panel and represented by SYSCOM SME
The Corrosion Cross Functional Team (CFT) includes members from OPNAV, SYSCOMS, ONR, and US Coast Guard.

Meets Bi-Monthly to ensure ongoing and up to date forum on the state of corrosion health and challenges in the Navy.

Encourages cross talk between acquisition, research, logistics, and sustainment communities.

CFT members provide a direct link between the corrosion office and various activities, program managers, engineers, and assets.

Creates an up to date, knowledgeable community capable of identifying and addressing systematic corrosion issues.
ORGANIZATIONAL-LEVEL CORROSION SUSTAINMENT EFFORTS IN DON

- **AIR – Maintenance Readiness Teams (MRT)**
  - Provides Organizational-level corrosion prevention, detection and repair at fleet aviation command locations

- **SHIPS – Corrosion Control Assistance Teams (CCAT)**
  - Provides ship-board tools, training and technical expertise on organizational level corrosion repair

- **GROUND VEHICLES – Corrosion Service Teams (CST)**
  - Rate the current corrosion condition of the asset
  - Provides on-the-lot organizational level corrosion repair and application of corrosion preventative compounds
EXAMPLES OF ORGANIZATIONAL-LEVEL CORROSION MITIGATION TECHNOLOGIES (NAVAIR)

- Bristle discs
- Wash pads
- Water diverter
- Alodine pens
- Mildew cleaning
- Aerosol cleaners
CORROSION EXECUTIVE FOCUS AREAS

1. Feedback into Acquisition
2. Training and education opportunities
3. Communication and Collaboration
4. Proper representation in Annual reporting
DON FY-14 ANNUAL REPORT ON CORROSION

- **Requirement**
  - Title 10 USC § 2228

- **Scope**
  - CPC accomplishments & activities
  - Current FY focus areas & funding levels

- **Recommendations pertaining to Department CPC activities**
  - Audience
  - Department of the Navy
  - Secretary of Defense
  - United States Congress
DON FY-15 STRATEGIC PLAN FOR CORROSION

- **Requirement**
  - Title 10 USC § 2228

- **Goals & Objectives**
  - Institutionalize Corrosion Prevention & Control
  - CPC in Policy & Guidance
  - CPC in Technology Development & Integration
  - Education & Training for CPC Workforce
  - Communication & Collaboration as a Tool

- **Performance Metrics**
  - Quantifiable metrics for success

- **Audience**
  - Department of the Navy
  - Secretary of Defense
  - United States Congress
The most current Navy-wide preservation issues will be discussed by a wide range of key leaders and practitioners in the government, military, shipyards, intermediate and depot level repair activities, research facilities, ship owners/operators, and coatings manufacturers & suppliers.

*DON Corrosion Executive is orchestrating Government approvals for conference travel to facilitate this event. For 2015, this event encompasses all Navy.*

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JTEG Overview of Air Force Corrosion Prevention and Control

Dr. David Robertson
Air Force Corrosion Control and Prevention Executive
SAF/AQR
Agenda

- Impact to AF
- AF Organization
- Strategic Plan and Policies
- Technology Implementation Example
Impact

FY13 Aerospace System Maintenance Costs

- Other MX Cost ($B): $18.215
- Corrosion MX Cost ($B): $6.025

The depot portion of corrosion MX is $3.4B

FY13 Aerospace System Non-Available Hours

- NAH Due to Other: 12,617,636
- NAH Due to Corrosion: 2,244,126
Organization

AF MAJCOMS

- ACC
- AMC
- AFSOC
- AFSPC
- AETC
- AFLCMC
- AFCPCO
- AFSC
- AFTC
- USAFA
- PACAF
- AFRC
- USAFE
- AFGSC
- AFMC
- AFNWC
- AFRL
- AFIMSC
- AFCEC

Headquarters AF (HAF)

- SAF/AQ
- SAF/AQR
- AF CCPE
- SAF/MR
- SAF/FM
- SAF/CIO – AF/A6
- SAF/IA
- SAF/SP
- SAF/IE
- Asst Secretary of the Air Force (Installations, Environment, and Logistics)

- AF/A1
- AF/A2
- AF/A3/5
- AF/A4/7
- AF/A8
- AF/A9
- AF/A10

= Represented in AF Corrosion Prevention and Control Working Group (CPC WG)

* This organizational chart is effective 1 Jan 2015
AF Corrosion Strategic Plan

Published Aug 1, 2014

USAF CPC Program

Metrics  R&D  Specs/STDs  Skilled Workforce

Communication

Guidance

Prevent, Predict, Detect, & Manage
Acquisition Oversight
Weapon Systems

  - Requires a CPCP approved by PEO (ACAT 1 to 3) (Table 4.1)
  - Lead Systems Engineer is to ensure the RFP considers corrosion (5.1.4.1.2)
  - PM is to integrate CPC into the program integrity efforts (5.4.1.3.1)
  - CPC planning is to be integrated into the SEP and LCSP (5.4.6)
  - For ACAT 1, PM must include CPC Planning in the MS A SEP under “Design Considerations” and prepare a CPC Plan at MS B and C. PM must provide the CPC Plan to the CCPE prior to PEO approval (5.4.6.1)
  - For new starts, the PM is to obtain early CCPE involvement (5.4.6.3)
  - PM must obtain PEO approval and CCPE coordination for Cr6+ use (5.4.6.4 and DFARS reference)
  - PSM is accountable to the PM for CPC (6.1.1)
- Mil-Std-1568C, Materials and Processes for CPC in Aerospace Weapon Systems
- Mil-Std-1530C, Aircraft Structural Integrity Program
- ASIP Reviews
AF CPC Enterprise On-going Activities

- Implementation of improved materials and processes
  - Assessment and assistance for field implementation of new materials (AFLCMC, AFRL)
  - Military standard for CPC of aerospace systems (AFRL, other MilDep, AQR, OSD, AFLCMC)
  - Electronics CPC standard with SAE (OSD, other MilDep, AFRL, AQR)
  - Integration of corrosion with the Aircraft Structural Integrity Program (AFLCMC, AQR)
  - MAJCOM corrosion surveys (AFLCMC/CPCO, MAJCOMs)

- Communication and collaboration
  - AF CPC Working Group telecons (HAF, MAJCOMs, AFMC Centers)
  - DoD CPC IPT and supporting WIPTs (OSD, other MilDep, AQR, AFRL, AFLCMC/CPCO)
  - Technical Corrosion Collaboration program (OSD, other MilDep, AFRL, AQR, various universities, USAFA, AFIT)

- Information and training
  - Technical Order updates for improved materials and processes (AFLCMC/CPCO)
  - Information clearinghouse for maintainers and engineers (AFLCMC/CPCO)
  - Training development and implementation (AFLCMC/CPCO)

- Research
  - Technologies that track aircraft exposure, enabling CBM and improved depot workload planning (AFRL, AFLCMC)
  - Coatings development, testing, and integration (AFLCMC, AFRL)
  - Corrosion-conscious engineering design tools (AFRL)
  - Structural integrity effects of corrosion (AFRL, USAFA, AFIT)
  - Realistic accelerated corrosion testing (AFRL)
Example of Focused Technology Implementation Effort

- The AF CPC enterprise recognizes that coating – decoating activities are among the biggest drivers of depot cost and risk
- CrVI is a big ESOH risk and cost for the depots
- CPC enterprise is utilizing a balanced, risk-based approach, to implement CrVI replacements
- Initial focus is on replacements for CrVI with biggest sustainability impacts and low corrosion risk
# AF CPC Risk-Based Prioritization Framework

*(Hexavalent Chromium Replacement)*

## Corrosion and Mishap Risk Posed by this Application Area
*(Green indicates application area will tolerate less capable alternatives)*

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<tbody>
<tr>
<td>Primer on support equipment and infrastructure</td>
<td>Visible and repairable</td>
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<tr>
<td>Aircraft Outer Mold Line (OML) Primer</td>
<td>Sometimes</td>
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<td>Larger source of worker CrVI exposure</td>
<td>Larger source of installation ESOH costs</td>
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<tr>
<td>Bare metal surface treatments/Conversions Coatings/&quot;Sealers&quot;</td>
<td>improve performance of outer mold line replacement</td>
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<td>Sealants</td>
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<td>Adhesive bonding primers</td>
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<td>Internal Structural primer</td>
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<td>Fuel tank primers, coatings, and sealants</td>
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</table>

## Risk Assessment of the Use of CrVI in this Application Area
*(Green indicates application poses lower ESOH risks to AF personnel and installation environment)*

## Risk Assessment of the Use of Alternatives in this Application Area
*(Green indicates adoption of alternatives would not increase risk in these areas)*

- **Near-term Focus Areas for Implementation**
  - Primer on support equipment and infrastructure
  - Aircraft Outer Mold Line (OML) Primer
  - Bare metal surface treatments/Conversions Coatings/"Sealers"
  - Sealants
  - Adhesive bonding primers
  - Internal Structural primer
  - Fuel tank primers, coatings, and sealants

- **Longer-term Areas**
  - Aircraft Outer Mold Line (OML) Primer
  - Fuel tank primers, coatings, and sealants

## DoD Worker Exposure Risk if CrVI Used

- **Corrosion**
  - Known life cycle structural integrity risk
  - Known life cycle mishap risk

- **Mishap**
  - Limited or no expected worker exposure
  - Limited or no installation ESOH costs

## ESOH Life Cycle Cost

- **Corrosion**
  - Higher life cycle probability of loss of aircraft or of availability

## Technical Maturity Risk

- **Corrosion**
  - Limited or no installation ESOH costs

## Life Cycle Cost

- **Corrosion**
  - Some alternatives require more frequent inspection and application

- **Mishap**
  - alternatives still require exposure controls

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*I n t e g r i t y  -  S e r v i c e  -  E x c e l l e n c e*
CrVI Replacement

- Examples of OSD-funded AF CPC projects
  - C-130 Non-Chrome Field Test
  - Universal Primer on Ground Support Equipment
  - F-16 Reduced Chrome Study
  - Evaluation of Non-Chrome Paint Systems in Field Environments

- AF CPC enterprise partnering with lab, ESOH, product support, life cycle management communities to focus on AF aircraft outer mold line (OML) coating systems
  - MIL-PRF-32239A, Coating System, Advanced Performance, for Aerospace Applications
  - Supported by data from outdoor exposure testing
Summary

- The CPC enterprise in the AF encompasses many organizations and activities
- A strategic plan is in place along with policy to focus the efforts
- Technology transition and implementation is important to realize improved CPC and reduce costs
Questions?
Corrosion Prevention and Repair Forum

Review & Wrap-Up

30 March 2015