U.S. Army
Aviation & Missile Command
Hexavalent Chromium Coatings Replacement Program
February 2008

Kerry Blankenship
AMCOM LCMC G-4 Engineering Services Coordinator

Paul Robinson
ManTech-SRS
**U.S. Army Aviation & Missile Command Hexavalent Chromium Coatings Replacement Program**

**Abstract**

Surface Finishing and Repair Issues for Sustaining New Military Aircraft Workshop, February 26-28, 2008, Tempe, AZ. Sponsored by SERDP/ESTCP.
AMCOM Testing effort focused on the performance of the coating system

- Technical approach was more holistic
  - Focus was on coating system performance vice individual system component capabilities

Test Program leveraged off of other DoD and commercial test efforts

- NAVAIR – ESTCP Non-Chrome Aluminum Pretreatments
- Air Force - PreKote
- Air Force/NAVAIR Non-Chrome Epoxy Primer
- Deft/Hentzen Class N Primer development
Testing performed Fall/Winter/Spring 2003-2004 at NAVAIR Patuxent River and ARL Aberdeen

- NAVAIR performed pretreatment and coating application
- ARL performed corrosion, EIS and adhesion testing on the coated samples
  - ASTM Adhesion testing performed on both wet and dry samples
  - Corrosion testing evaluated samples in neutral salt fog (B117) and Cyclic (GM9540)
Substrate Materials evaluated included:

- 2024 and 7075 Aluminum (T6 tempers) various test pretreatments
- 4340 High Strength Steel (Cd plated)
- ZE41A Magnesium (Dow 17 and PreKote Treated)
- G11 Composite (no pretreatment)

Coating Products Evaluated

- Class N Primer (MIL-PRF-85582 Type I)
- MIL-DTL-53039 and 64159 CARCs
- Alternate conversion coatings: Alodine 5700, Alodine T5900RTU and PreKote
Test Program Background

- Test results indicated the following materials were the best non-hexavalent chromium products
  - MIL-DTL-81706 Type II (TCP)
    - 4 Manufacturers have qualified products
      - Products available as concentrates or ready-to-use
      - NSNs requested and Army transition will follow
  - MIL-PRF-23377 Class N
    - 2 Manufacturers have qualified products
      - NSNs obtained and Army transition in-progress
• Initial Test coating applied to CH-47 by 1109th Aviation Classification Repair Activity Depot (AVCRAD) Groton Fall 2005
  – Pretreatment MIL-DTL-81706 Type II (TCP)
  – Upper fuselage received a Class C primer, lower fuselage the Class N primer
  – MIL-DTL-64159 Type II CARC
• Additional coating applications continued at the 1109th AVCRAD throughout 2006 and 2007
  – New coating system used on CH-47, UH-60 and AH-64 rotary-wing aircraft
Several Class N Primers are now available for use.

MIL-PRF-23377 Type I and II Class N NSNs

- Type I – 8010-01-555-3381 (1 Gal Kit)
  - Mfr P/N 16708TEP/16709CEH Hentzen
  - Mfr P/N 02GN084 (Deft)
- Type I – 8010-01-555-3386 (1 Quart Kit)
  - Same P/N
- Type II – 8010-01-555-3383 (1 Gal Kit)
  - Mfr P/N – 17176KEP/16709CEH (Hentzen)
Non-hexavalent Chromium Primers

- **MIL-PRF-85582 Type I and II Class N NSNs**
  - Type I – 8010-01-555-3385 (1 Gal Kit)
    - Mfr P/N - 44GN098 (Deft)
  - Type I – 8010-01-555-3388 (1 Quart Kit)
    - Mfr P/N - 44GN098 (Deft)
  - Existing NSNs for MIL-PRF-85582 Type I and II Class N
    - 8010-01-466-9037 (Type I 2-Gal/Kit)
    - 8010-01-466-9313 (Type II 2-Gal/Kit)
AMCOM Authorization for the use of Class N Primers in-progress

- Maintenance Information Message (MIM) will be distributed when NSNs have been added to the Authorized Users List (AUL) for Aviation Systems and Equipment (in-progress)
  - Per discussion with the Integrated Material Management Center (IMMC), the MIM is still at Aviation Safety awaiting final approval before distribution
- Follow-on MIMs will be issued for MIL-DTL-81706 Type II products when NSNs have been assigned
Request has been submitted to the GSA for NSN Assignment for MIL-DTL-81706 Type II Class 1a and 3 products (Trivalent Chromium Process – TCP)

- Type II products do not use hexavalent chromium (Cr+6)
- Primer adhesion in many applications is improved over Type I conversion coatings
- Corrosion inhibition performance not impacted by elevated temperatures

- No breakdown when used under powder coatings cured at temperatures that would damage Type I conversion coatings
• May be other potential applications for the TCP materials
  – Testing is in-process to evaluate TCP as a seal coating over:
    • Acid and alkaline zinc-nickel plate
    • Zinc plate
    • Phosphate treatments over steel
    • Final rinse/seal over hard anodized aluminum
New CARC coatings conforming to MIL-DTL-53039 Type II will be available in the near future

- Type II products contain <1.5 lb/gal VOCs and 0 Volatile Hazardous Air Pollutants
- CARCs use either silica or polymeric bead flattening
- New NSNs to be assigned to differentiate from older MIL-C- or MIL-DTL-53039 coatings
New ‘53039 Type II Beaded CARC will initially be available in the most common Aviation colors:

- Aircraft Green (Color No. 34031),
- Aircraft Black (Color No. 37038),
- Aircraft Interior Black (Color No. 37031) and
- Aircraft Interior Grey (Color No. 36231)
- Still awaiting final qualification of the new Desert Sage color (Color No. 34201) for the CH-47
- Insignia Blue (35044), Aircraft Red (31136), Aircraft White (37875) will be available as a Type I coating for the immediate future (silica flatteners)
NEW COATING TRANSITION

• When changing to the new primer and CARC coatings initial results were mixed
  – AVCRAD personnel closely followed mix/application guidelines with OEM techreps present
    • No noted difficulties and good results
  – Other facility painters did not review technical guidelines and proceeded to apply the new primer like the previous products
    • Inadequate mixing resulted in some of the coating failures
    • Wet/dry film thickness was not properly controlled
    • Improper paint gun settings and tip orifice sizes resulted in poor control of the applied coating
    • Top-coating was applied before primer had sufficient time to fully cure
G-4/Coating OEM performed an on-site assessment of the painting operations at a primary AMCOM facility.

Personnel provided recommendations to improve painting operations, maximize productivity, minimize waste:

Infrastructure review focused on several contributing areas:

- Storage areas need to be less exposed to wide temperature swings
- Mixing Equipment
  - Single or Dual Arm aggressive paint “shakers” are needed to properly mix the new high solids primer and CARC coatings
  - Proper process needs to be followed to mix the two-component coatings
• Infrastructure review (continued):
  – Application Equipment
    • High Volume/Low Pressure (HVLP) guns
      – All of the paint guns in each paint shop should be standardized (standardized in entire facility would be best)
        » Proper repair parts must be available in each shop
      – Proper tip orifice critical with the new coatings
    • Paint pots that use vertical or paddle agitators to keep suspended solids evenly distributed are required
      – Proper operation of in-pot agitators is important
      – Paint pots must be kept on optimum condition
Infrastructure Review (continued)

- Supply air
  - Supply air systems must provide sufficient pressure and volume
  - Inline air dryers to ensure air supplied to pressure pot/gun is moisture- and oil-free
  - Easily accessible and operable traps and blow downs to keep air lines contaminant free
  - Regular inspections and maintenance on the systems to maintain top performance
  - Airlines should be properly sized and configured for optimum performance
    - Separate supply lines for pot pressurization and atomization air
• Infrastructure Review (continued)
  
  – Paint Booth Climate Controls
    • Need to keep the booth at a nominal 50% relative humidity
    • Control temperatures in the booth at:
      – 70°F or above (winter months),
      – 90°F or below (summer months)
    • Aircraft should be acclimated to the booth temperature prior to coating application
• New Primers and CARCs are not the same coatings as previously used
  – Transition to the new coatings will require painter familiarization with the coating prior to spraying an aircraft
    • Hands-on training and test panel spraying recommended prior to 1st application on an aircraft
    • Training should emphasize:
      – Understanding ambient condition impacts on coating application and drying
        » Temperature and humidity
      – Proper mixing
      – Sufficient drying time between coating applications
      – Controlling wet-film thickness and edge blending
• POCs

- Mr. Kerry Blankenship, AMCOM G-4 Government Team
  Lead Engineering Services Group
  • Commercial - 256-876-8898 DSN 746-8898
  • kerry.blankenship@conus.army.mil

- Mr. J.P. Robinson, ManTech SRS Technologies
  • Commercial – 256-876-6161 DSN 746-6161
  • james.p.robinson2@conus.army.mil