

Non Chromium Coatings For Aerospace



Charla Wise / Tony Phillips
Lockheed Martin
November 19, 2008

Overview



- *The Lockheed Martin Vision and Goals*
- *Policy*
 - *LM Chrome Reduction Approach*
 - *Chrome Reduction Projects*
- *What's Next*

Where We Are Going...

LMC Global Standards



- ***ESH Performance Standard:***
 - ***Identify and minimize ESH-related conditions and substances of concern in Lockheed Martin processes, products, and supply chains that may pose a risk to people, the environment or Lockheed Martin; foster replacement with low-risk, non-hazardous alternatives.***

Lockheed Martin Corporate Technical Position and Policy

Memorandum

DATE: December 20, 2007
TO: Tom Blakely, Russ Frew, Rick Johnson, Julie Sattler
cc: Andy Green, Charla Wise, Ed Morris, Steve Butt
FROM: Ray O. Johnson
SUBJECT: Hexavalent Chromium

Dear Colleagues:

As the result of a recently released Occupational Safety and Health Administration standard on the reduction of exposure to hexavalent chromium [29 CFR 1910.1026] in the workplace, we are accelerating our pursuit of alternatives to hexavalent chromium for application to our various products and processes. We must be in compliance with the new standard and ensure any needed engineering controls are in place by 2010. Accordingly, in our continual efforts to ensure a healthy and safe workplace for our employees, we have identified the reduction and eventual elimination of hexavalent chromium in all of our products and processes as a priority for the Corporation.

Hexavalent chromium is primarily used in primers and conversion coatings. While we need to eliminate hexavalent chromium to the maximum extent possible, we must also maintain product integrity by ensuring that alternative materials meet performance requirements and are compatible with the product's overall material and corrosion protection systems. Based on our initial analysis, there is no compelling evidence to indicate that a hexavalent chromium-based primer would perform appreciably better in our applications than the newest generation, non-hexavalent chromium primer.

Therefore, to reduce the use of hexavalent chromium, we propose the following actions that will eventually result in modifications to CPS-023:

- Continue and expand the use of non-hexavalent chromium products with the goal of reducing / eliminating hexavalent chromium from our products, processes and supply chain,
- Continue and expand research to identify additional acceptable alternatives to hexavalent chromium as a priority,
- Prioritize and apply resources to resolve corrosion issues while reducing / eliminating the use of known hazardous materials,
- Ensure that adequate qualification is completed prior to release of material change to products and processes.

As an interim step, reversion to hexavalent chromium products and introducing new applications of hexavalent chromium products, are undesirable and will require written concurrence of the Vice President of Engineering at the affected Business Unit and approval of the Senior Vice President and Chief Technology Officer at the Corporate level. Appropriate Materials and Processes handbooks and guidelines should be updated accordingly.

Excerpt from Cr⁺⁶ Policy Letter



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Impact of LM Policy Letter



“Policy Showed Customers That LM Had Top Level Management Direction To Reduce Cr⁺⁶.”

- Motivated LM Programs To Accelerate Testing / Implementation Of Nonchromated Primer
- LM Sites Leveraged The Policy Letter Into Starting Several Chrome Replacement Efforts
 - Aided In Approving Replacement Efforts
 - Customer Program Offices Were Receptive
 - Aided LM In Discussing Cr⁺⁶ Reduction Efforts With DoD, Program Offices
- Prioritized Testing, Increased Awareness, Empowered Change

More Policy Impacts



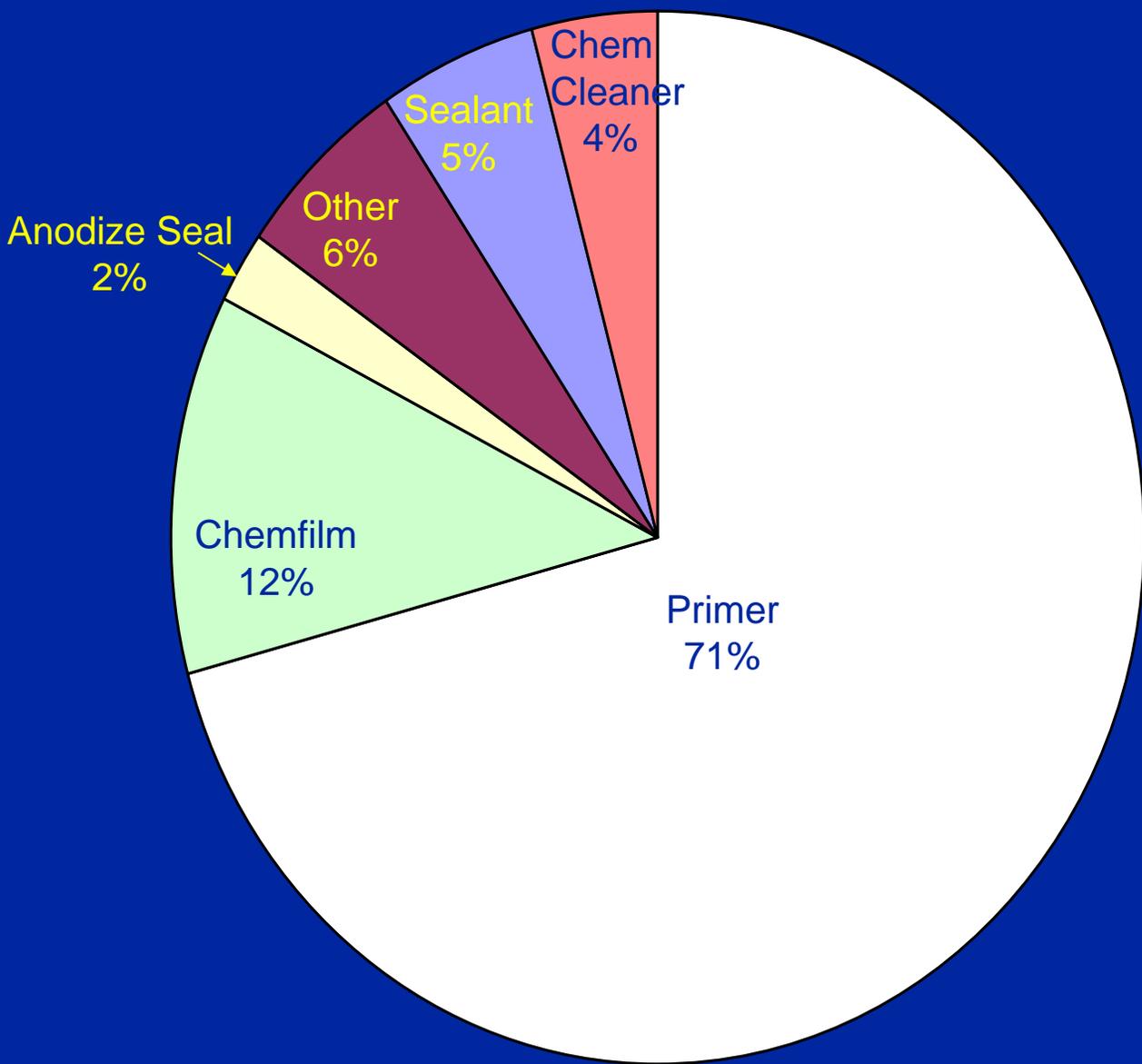
- Policy Definitely Is Forcing LM Programs To Look At The Non-chromium Alternatives.
- Policy Showed DoD That LM Is Serious About Looking For Nonchromated Primer.
- Additionally, LM Corporate Is Funding Chrome Reduction Projects!
- Anticipate That Corporate Commitment, Policy, and Funding Will Aid C-130 Program To Accelerate Plans For Flight Testing.

Policy Referenced In LM White Paper Requesting Customer Approval on NCP



“LM has initiated an effort to reduce .. (hex chrome) primer in the Owego facility. ... reason is a Lockheed Martin (LM) Corporate initiative ... to focus on the reduction of hex chrome. LM Executive Management also agrees with the importance of this initiative and has included it in a corporate policy ... to give direction to all LM sites to commence the task of trying to drive hex chrome out of their products. LM Corporate has also agreed to provide funding in order to reduce the amount of hex chrome used in Owego.”

Annual Lockheed Martin Usage of Cr⁶⁺ Compounds



Category	% Cr ⁶⁺ Compound
Anodize Seal	2%
Chem Cleaner	4%
Chemfilm	12%
Primer	71%
Sealant	5%
Other	6%
TOTAL	100%

Represents 2007 Usage Including Some '06 data

LM Use of NCPs (Nonchromated Primers)



- F-35 Implemented NCP (Deft 44GN098) in Late 2005
 - *First Aircraft To Use On Internal Structure*

Other Exterior Surface Uses:

- U-2 Authorized To Apply NCP In June 1996
- F-117 Began Using NCP Between Coatings In Feb '99
 - Approved NCP (10PW22) For All Exterior Layers In Aug '03
- F-22 NCP Implementation Started in Late 2002 (Exterior Only)



Current Key Corporate NCP Projects

- **Electronic Subassembly NCP**
 - Customer Approval Obtained
 - Drawing Changes Started
- **Michoud CF Epoxy Primer**
- **Fire Control / Target Acquisition Systems NCP**
- **Initiate Plan For C-130 Flight Test of NCP**
- **LM Aero Beyond Spec.
NCP Tests**

NCP: Nonchromated Primer



Electronic Equipment - Subassembly



- NCP Data Reports Provided to Current Programs
- ~500 Drawings Reviewed
- 9 Drawings: 67% of Cr Primer
 - 7 Drawings Changed ('08)
- 33 of 40 Priority Dwgs Changed
- ~330 Dwgs – No Change Req.
- ~120 Dwgs – TBD
- Fluids Testing Needed Before Changing Various Drawings



Applicable Programs:

VH-71, MH-60, MMH, A-10, E-2C, CP140, RFIS, B1B, B2, other aircraft subsystems

Michoud CF Epoxy Primer



Project Description:
Complete Final Product
Development Of LM Owned CF
(Chromium-free) Epoxy Primer
Formulation.



Goals/Objectives: Provide Kits For NASA Testing And
Additional Programs Testing. Further Development And
Testing As Needed To Extend Use To Other Programs And
Applications.

Applicable Programs: NASA Constellation Program (Orion,
Ares I, Ares V, Eds, Altair), F-16, DoD Depot Operations



Fire Control / Target Acquisition Systems



Project Description:

Verification testing of MIL-PRF-23377 Type I, Class N, NCP (non-chromate primer). Provide data report to current programs to support going forward to customers with request to use NCP in place of current chromate primer.



Goals/Objectives: Generate data to support requests to customers for change over to NCPs.

Applicable Programs: Target Acquisition Designation Sight/Pilot's Night Vision System (TADS/PNVS), Arrowhead, Sniper, Longbow FCR (Fire Control Radar)

What is Next?

- **VH-71 NCP Test**
 - Test Plan Approved by NAVAIR in 2008
- **C-130 Flight Test of NonCr⁺⁶ System**
- **Michoud CF Epoxy Primer**
- **Fire Control / Target Acquisition Systems Tasks**
 - Anodize, Passivation, & Deoxidizer
- **Electronic Equipment Subassembly Tasks**
 - Fluids Compatibility to NCP (41 fluids, 14 programs)
 - Finish Drawing Changes
- **Beyond Spec Tests (continued)**



