
IAEG WG2 Replacement Projects

Hexavalent Chromium and Cadmium

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IAEG[®]

INTERNATIONAL AEROSPACE
ENVIRONMENTAL GROUP[®]

INTERNATIONAL AEROSPACE ENVIRONMENTAL GROUP (IAEG)

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AGENDA

- Introduction to IAEG
- Work Groups
- Work Group 2 Replacement Projects
 - Cadmium Alternatives for Standard Parts
 - Hard Chrome Plating
 - Chromate Conversion Coatings
 - Corrosion Inhibiting Epoxy Primers
 - Bond Primers
 - Anodize Seal (NEW)
- Future WG2 Replacement Projects

INTERNATIONAL AEROSPACE ENVIRONMENTAL GROUP (IAEG)

Founded in 2011 by major aerospace companies

- Collaborate on and share innovative environmental solutions for the industry

Currently, its members generate more than 50 percent of total aerospace industry sales.

- Over 40 member companies
- Combined annual turnover >\$400B & >1,000,000 direct employees

Benefits of collaborating on projects

- Collaborating on hazardous material replacement projects can promote efficiency within the aerospace industry's supply chain while also delivering a sustainable solution.
- Demonstrates industry-wide effort to find alternatives to hazardous materials and to be more environmentally conscientious
 - Provides additional support Authorisation applications



<https://www.youtube.com/channel/UCSMifdRmHZYQjtl5k3MDKUO>

INTERNATIONAL AEROSPACE ENVIRONMENTAL GROUP (IAEG)

Working Group	Title
WG1	Chemical Reporting <ul style="list-style-type: none"> •Developed Declarable Substance List •Submit to standardization body (IPC)
WG2	Replacement Technologies <ul style="list-style-type: none"> •Industry collaboration focused on developing chemical substitutes
WG3	Greenhouse Gas Management & Reporting <ul style="list-style-type: none"> •WRI-endorsed industry guidance for gas reporting standard published
WG4	Common industry vocabulary <ul style="list-style-type: none"> •Providing a common definition of terms
WG5	REACH Authorization Surveillance <ul style="list-style-type: none"> •Supply Chain surveillance information •Consortium for dossier development
WG6	Supply Chain Sustainability Survey Harmonization <ul style="list-style-type: none"> •New industry standard in work
WG7	ISO 14001:2015 Transition Document
WG8	REACH Registration 2018

WG2 – REPLACEMENT PROJECTS



CADMIUM ALTERNATIVES FOR STANDARD PARTS

Statement of Work:

- Engage with standard bodies for the Aerospace Industry that are responsible for design of relevant parts
- Engage with suppliers of standard parts to validate and promote alternative material technologies
- Produce data for alternatives to cadmium plating that can be used to support substitution
- Where necessary, develop new alternative technologies where currently available candidates do not supply all required properties
- Demonstrate the availability of alternatives to cadmium plated industry standard parts to suppliers and users
- Make data on alternatives available to all project participants so that it can be used for in house evaluation of possible substitution of non-industry standard parts



CADMIUM ALTERNATIVES FOR STANDARD PARTS - COLLABORATORS

- Airbus
- The Boeing Company
- BAE Systems
- Northrop Grumman Corporation
- Rolls-Royce plc
- Saab AB
- United Technologies Corporation

CADMIUM ALTERNATIVES FOR STANDARD PARTS (CONTINUED)

PROGRESS:

- Analyzed data & identified gaps
- Discussions held with NASC Chairman
 - how we can influence change to standards
 - things to consider about standard parts & new coatings
- Possible cadmium alternative determined for fasteners
- Still reviewing data to determine possible cadmium alternative for electrical connectors

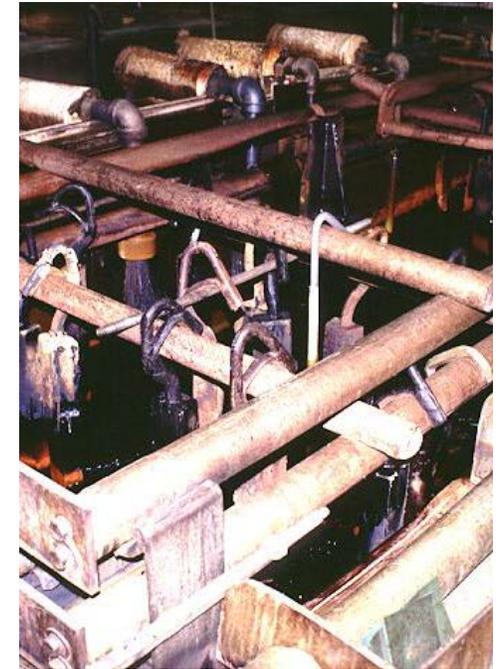
NEXT STEPS:

- Meet to summarize Face-to-Face activities & decide on approach for next steps
- Re-evaluate project timeline
- Continue information gathering from vendors, plating shops, etc
- Opportunity exists for additional companies to join as testing is not currently scheduled to launch

HARD CHROME PLATING

Statement of Work:

- Exchange data and experience that are (a) available in the public domain and (b) obtained from members' replacement activities
- Exchange data for alternatives to hard chrome plating that can be used to support substitution within OEM designs and standard parts
- Identify environmentally-compliant alternatives to hard chrome plating
- Demonstrate the availability of substitutes to those that are hard chrome plated



HARD CHROME PLATING - COLLABORATORS

- Airbus
- BAE Systems
- The Boeing Company
- Dassault Aviation
- General Electric Aviation
- GKN Aerospace Systems
- Rolls-Royce plc
- SAAB AB
- SAFRAN
- United Technologies Corporation

HARD CHROME PLATING (CONTINUED)

PROGRESS:

- All companies have completed data sharing
- Defined path forward: will investigate upcoming technologies

NEXT STEPS:

- Draft report on existing alternatives
- Data collection for upcoming technologies

CHROMATE CONVERSION COATINGS

Statement of Work:

- Revisit and develop performance criteria and associated performance test results to be used in the project
- Compile the suppliers' performance results already communicated by the suppliers
- Share and aggregate their own performance results, and compare to the suppliers'
- Conclude on the suitability of the final table, and decide if any future actions are needed



CHROMATE CONVERSION COATINGS - COLLABORATORS

- Airbus
- BAE Systems
- Bell Helicopter
- The Boeing Company
- Dassault Aviation
- General Electric Aviation
- Lockheed Martin Corporation
- Northrop Grumman Corporation
- Saab AB
- Spirit AeroSystems
- Thalès
- United Technologies Corporation
- Zodiac Aerospace

CHROMATE CONVERSION COATINGS (CONTINUED)

PROGRESS:

- All companies have completed data sharing of alternative conversion coating R&D and Implementation
 - Results are varied depending on application process
- Reviewed best practice for one of the preferred alternative conversion coating processes
- Held technical exchange with one of the alternative conversion coating suppliers

NEXT STEPS:

- Establish detailed process flow & Identify key parameters at the key process steps
- Review several products with that process to identify best practices

CORROSION INHIBITING EPOXY PRIMERS

Statement of Work:

- Exchange data and experience that are (a) available in the public domain and (b) obtained from members' replacements activities
- Exchange data for alternatives to corrosion protection by means of a chromate-loaded corrosion-inhibiting primer that can be used to support substitution within OEM designs and standard parts
- Identify environmentally-compliant alternatives to the application of a chromate-loaded corrosion-inhibiting primer
- Evaluate (and develop) if a Performance Requirement Document (IAEG WG2 PRD) or a short list of key fundamental requirements is needed to establish harmonized requirements (including test methods for critical test requirements)
- Discuss (define) what other information can be shared while respecting the signed NDA, to bring the most benefits to members
- At the end of the project, discuss if there is a will to evolve to a new scope such as an experimental collaboration. In which case, a new framework would be required.



CORROSION INHIBITING EPOXY PRIMERS - COLLABORATORS

- BAE Systems
- The Boeing Company
- Dassault Aviation
- General Electric Aviation
- GKN Aerospace
- Rolls-Royce plc
- Saab AB
- Spirit AeroSystems
- United Technologies Corporation

CORROSION INHIBITING EPOXY PRIMERS (CONTINUED)

PROGRESS:

- Discussed and categorized coating requirements and a gap analysis
- Discussed candidate coatings studied by one company
- Created road map, schedule, and status for Corrosion Inhibiting Epoxy Primers work packages

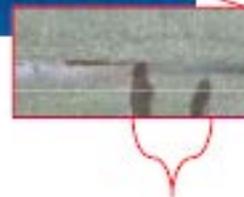
NEXT STEPS:

- Populating coating requirements
- Listing candidate materials
- Completing work packages

BOND PRIMERS

Statement of Work:

- Exchange data and experience that are (a) available in the public domain and (b) obtained from members' replacements activities
- Exchange data on alternatives for bond primer that can be used to support substitution within OEM designs and standard parts
- Identify environmentally-compliant alternatives to current bond primer systems
- Demonstrate the availability of substitutes to those that utilize conventional bond primer if the target engineering permits



BOND PRIMERS - COLLABORATORS

- Airbus
- The Boeing Company
- Bombardier
- Embraer
- General Electric Aviation
- GKN Aerospace
- Rolls-Royce plc
- Saab AB
- Spirit AeroSystems
- United Technologies Corporation

BOND PRIMERS (CONTINUED)

PROGRESS:

- Data collection of key applications & requirements (75% complete)
- Data on candidate replacements & status (25% complete)

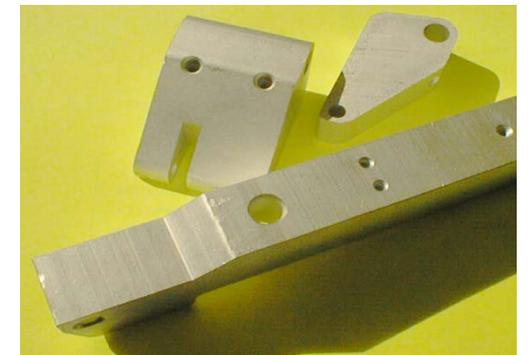
NEXT STEPS:

- Review data
- Draft summary report

ANODIZE SEAL

Statement of Work:

- Develop the composition of the alternative anodize seals to be considered for this project, appropriate performance criteria that will be used, and format to be used to gather the performance test results that shall be used in the screening
- Gather the performance results for alternative anodize seals tested by project members or suppliers
- Organize the performance results in a data table, and decide if additional requirements or clarification of performance results are needed
 - Obtain additional requirements and performance results (if required) from project members and suppliers
- Review the performance results obtained from the project members and suppliers, identify the data gaps from the list of performance results, and recommend the next course of action:
 - Discontinue this project and issue a final report, or
 - Issue an interim report and proceed with the project to resolve the data gaps that will lead to evaluating non-hex-chrome alternative anodize seals for aluminium



ANODIZE SEAL - COLLABORATORS

- BAE Systems
- The Boeing Company
- Honda Aircraft
- Raytheon
- Saab AB
- Textron/ Bell Helicopter
- Thales
- United Technologies Corporation

ANODIZE SEAL (CONTINUED)

PROGRESS:

- SOW finalized by WG2

NEXT STEPS:

- IAEG Approval of SOW
- Request IAEG member companies to join this new replacement project
- Have Collaboration Agreement signed by IAEG member companies who have expressed an interest to join this project



WG2 – PRIORITIZED LIST OF MATERIALS (POTENTIAL FUTURE REPLACEMENT PROJECTS)

PRIORITIZATION TO INITIATION: LAUNCHING A MATERIAL REPLACEMENT PROJECT IN WG2

Material Prioritization Process

- WG2 maintains Prioritized List of Replacement Materials
 - Cd & Cr Replacement Materials
 - Alternate Material Replacements
- Developed process to review regulatory lists as they are published & populate WG2 prioritization lists for voting
- WG2 Member companies vote to prioritize proposed replacement materials

Project Initiation

- Independent from Prioritization Lists
- Any WG2 company that wants to start a project may propose a project
 - Minimum of 2 companies for project initiation
- Templates established for Statement of Work & Collaboration Agreement

SUMMARY

1. IAEG founded in 2011 to collaborate on and share innovative environmental solutions for the aerospace industry
2. Over 40 member companies have joined IAEG
3. Eight Work Groups have formed to work on different aerospace environmental issues
4. Work Group 2, on Replacement Technologies, focuses on developing alternatives to hazardous materials
5. Six Replacement Projects are currently underway in WG2
6. Prioritization list has been prepared to determine future replacement projects for WG2

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