

# Cadmium Plating (Line of Sight/Non Line-of-Sight)

Co-Chair: Erin Beck and Debbie Naguy

# Current Usage

- Most Steel on Aircraft and ground support equipment operated below 450 degrees F
  - Bushings/Fasteners/Springs/Gears/Hinges/Pins
  - Some alternatives adopted on some parts, Cd still default
- Parts with deep bore or threaded
- Electrical Connectors
- Cd put on non-Al part mated to Al structure for galvanic protection
- Engines – NiCd being used on steel parts, specifically fasteners and rods

# Requirements

- Corrosion
  - Control Sacrificial
  - Both neutral and SO<sub>2</sub> salt fog
- Compatible with Al
- Process and coating resistant to HE
- Lubricious
- Solderable
- Conductive (including corrosion product)
- Low Fatigue debit
- Good Throwing Power
- Adhesion to substrate and organic coatings
- Takes on a conversion coating
- Production Considerations
  - Ease of Use/Bulk processing capability/'cost/stribability/disposability/does it leach/maintainability/repairability/environmental friendly components

# Requirements

- Personnel Exposure
  - Sanding and Grinding
  - PMB Facilities
  - Housekeeping
  - Demasking operations
- Waste
  - Wash down
  - Demasking (rags/mask)
  - Cd plating rinse tank waste

# Adoption of Alternatives

- IVD AI
  - Steel/bushings/bearings/fasteners
  - Limitation: IDs, expensive capital equipment, production throughput
  - Drivers for change: High Temp parts, HSS, Local compliance issues
- ZnNi
  - Low strength steel under 200 ksi
  - Stainless steel/copper/bushings/bearings/H-46 rotor hub and bushings/Boeing Commercial – Gears
  - Production friendly
  - Limitation: HE
  - Drivers for change: Senior management involvement

# Adoption of Alternatives

- Alumiplate
  - F-35, landing gear, electrical connectors
  - Limitations: Very expensive capital equipment, hazardous process
- Sputtered Al
  - C-17, landing gear IDs
  - Limitations: capacity
- LHE Alkaline ZnNi
  - Potential 100 percent Cd replacement
    - Pending HE and fatigue
- Base Metal Changes
  - Titanium, Stainless Steel, S53(still being developed)

# Adoption of Alternatives

- Funding Challenges – Competitive with other needs, outyear planning critical
  - Capital Purchase Program (CPP)
    - Reduction in Navy programs
  - AF Transformation Funding (\$150M/yr)
  - Component Improvement Program (CIP)
  - Acquisition Program Funding

# Drivers and Barriers

- Drivers:
  - EU regulations creating diminishing supply issues
    - EU demanding Cd free systems
  - Environmental Costs
    - Waste disposal fees, fines, permits, med surv, engineering controls, PPE, etc
    - Potential class action lawsuits
  - Improved technical performance

# Drivers and Barriers

- Barriers:
  - Lack of enforcement of EO, laws, etc (not stringent enough)
  - Effective communication of drivers to decision makers
  - Cost benefit/risk analysis needed
  - Legacy systems that will retire soon are not good investments for new technologies
  - High costs associated with configuration control, spec/manual/drawing changes
  - Lack of tech data
  - Status Quo mentality
  - One-for-one replacement does not currently exist – makes change more complicated
  - Cost of Cd is still low compared to alternatives

# Remaining Needs

- Data
- Qualify ZnNi for High Strength Steel
  - Dem/val and field test ZnNi on HSS
- Educate
- Cost/risk data
- Training
- Evaluate NDI with alternatives
- Continue development of other alternatives that don't contain Ni or provide superior performance benefit
- Repair and touch-up of alternatives including conversion coatings
- Look at non-metallic options