

Field Repair of Chrome and Cadmium Replacements



Report to:
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Geo-Centers

Rowan Project #: 3106JSF4

Contract Number: N00173-00-C-2031
Subcontract Number: GC-3432-00-011
P.O. Number: 29222MK

Report Number: Final

Date: July 31, 2001

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EXECUTIVE SUMMARY

The Joint Strike Fighter is intended to avoid the use of environmentally unacceptable hard chrome and cadmium plating, which are used for wear and corrosion protection on all older military aircraft. In order to successfully replace these coatings, alternatives must be qualified, not only for original equipment manufacture (OEM) use, but also for depot repair and for Intermediate-Level (I-Level) repair. At the depot level, the standard repair procedure for coatings of this type is to strip and recoat. However, for I-Level repair, which may be done at the depot or in the field, coatings must be repaired rather than replaced. While there are a number of Cr and Cd alternatives gaining currency in the aerospace industry, there are as yet no accepted ways of repairing them.

This report evaluates the options for repair of the primary Cr and Cd alternatives:

- ❑ Hard chrome plating alternatives – thermal sprays, electro- and electroless plates, and electrospark deposition (ESD)
- ❑ Cadmium plating alternatives – electroplated Zn-Ni, Sn-Zn, Al, and Al-Mn, IVD Al, and niche products such as SermeTels, filled polymers, and stainless steels for cadmium replacement.

We consider the following repair options:

- ❑ Brush plating
- ❑ Electrospark deposition
- ❑ Thermal sprays
- ❑ Ceramic composites
- ❑ Polymer composites.

Most Cd alternatives will be able to be repaired by brush plated Zn-Ni or Sn-Zn, both of which are available commercially. The greatest difficulty is likely to be in repair of HVOF WC-Co and WC-CoCr coatings, both of which are gaining acceptance as hard chrome alternatives. Given the difficulty of damaging these hard but brittle coatings, coating damage is more likely to coincide with substrate damage. It will be essential to learn when these coatings can be repaired and when they must be replaced, and to do so we should develop non-destructive inspection (NDI) methods of assessing both substrate integrity and coating integrity outside the clearly damaged region. The complexity of these coatings, which comprise WC particles in a metal matrix, will probably make them more difficult to repair by traditional brush plating techniques. ESD and thermal spray (especially HVOF and arc spray) appear to offer the best possibilities for HVOF repair. Initial data show that HVOF coatings can be repaired using HVOF methods, but there are many questions of repair methodology and performance that must be answered before these types of repair procedures can be approved.

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