

**Engineering and Technical Services for
Joint Group on Pollution Prevention
(JG-PP) Projects**

C-130 Field Evaluation Report

**Inspection of Aircraft
for Validation of Alternatives to
Chromate-Containing Primer Coatings
for Aircraft Exterior Mold Line Skins**

January 20, 2001

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1. INTRODUCTION

The Joint Logistics Commanders (JLC) chartered the Joint Group on Acquisition Pollution Prevention (JG-APP) to coordinate joint service activities affecting pollution prevention issues identified during a weapon system's acquisition process. JG-APP has become the Joint Group on Pollution Prevention (JG-PP) to accommodate an expanded focus to address sustainment needs.

The Joint Logistics Commanders (JLC) and Headquarters National Aeronautics and Space Administration (NASA) co-chartered JG-PP to coordinate joint service/agency activities affecting pollution prevention issues identified during system and component acquisition and sustainment processes. The primary objectives of the JG-PP are to:

- Reduce or eliminate the use of hazardous materials (HazMats) at manufacturing, remanufacturing, and sustainment locations
- Avoid duplication of efforts in actions required to reduce or eliminate HazMats through joint service cooperation and technology sharing.

JG-PP projects typically involve an original equipment manufacturer (OEM) producing multiple defense systems for more than one of the Services, as well as at least one depot servicing one or more of the defense systems. JG-PP technical representatives for each project begin by selecting a target HazMat that is used in the production or sustainment processes and may cause environmental and/or worker health concerns. Project participants then identify alternative technologies for evaluation.

At the Boeing Military Aircraft and Missile Systems Group pilot site located in St. Louis, Missouri (formerly McDonnell Douglas Aerospace), chromium in primer coatings was identified as the target HazMat to be eliminated or reduced. The chromate primers are applied to aircraft exterior mold line skins by wet-spray coating. The main substrate is aluminum alloy that has been anodized or chromate conversion coated, but other substrates such as steel, carbon epoxy, and titanium are also present on aircraft exterior surfaces and will be coated by these primers.

The project technical representatives reached consensus on the critical technical and performance requirements that an alternative must satisfy to be qualified for use in the identified application. These requirements were documented in the *Joint Test Protocol (MD-P-1-1) for Validation of Alternatives to Chromate-Containing Primer Coatings for Aircraft Exterior Mold Line Skins*, dated December 23, 1997. The *Potential Alternatives Report (MD-A-1-1) for Alternatives to Chromate-Containing Primer Coatings for Aircraft Exterior Mold Line Skins*, dated May 1, 1998, provides a list of alternatives recommended for testing.

The testing was executed in three phases: two phases of laboratory testing and one of field evaluation. The *Joint Test Report (MD-R-1-1) for Laboratory Validation (Testing) of Alternatives to Chromate-Containing Primer Coatings for Aircraft Exterior Mold Line*

Skins, dated February 24, 1998, documents the laboratory testing accomplished on the potential alternatives. The results of the laboratory testing were analyzed to select a limited number of nonchromate primers to be applied to operating aircraft to allow further evaluation of the nonchromate primers. After examining the test panels and analyzing the test results, the project participants selected Dexter Aerospace Materials 10PW22-2/ECW-119 and PRC-DeSoto EWAE118A/B for field evaluations on operating aircraft.

2. BACKGROUND ON OPERATIONAL TESTING

Operational testing was originally scheduled for completion in December 1999. In September 1999 the project participants elected to extend the operational testing phase for two additional years, through December 2001. Rational for the extension was to observe the effects of additional six-month sea deployments on the seven F/A-18 test aircraft and to expand the operational testing to include additional test units. Additional test units include the C-130 described in this report, two F-15s painted in February and a C-17 painted in July.

This field evaluation report documents the performance of the PRC-DeSoto EWAE118 primer on sections of the C-130 after approximately one year of service. Areas primed with the nonchrome primer were the right-hand horizontal stabilizer, the right-hand side of the vertical stabilizer and an area of the fuselage aft of the jump door, approximately 3 feet by four feet. The aircraft is assigned to the Channel Islands Air National Guard, Port Hueneme, CA.

Table 1. Inspection and Flight Hour Data

Aircraft #	Date Painted	Flight Hours When Painted	Flight Hours on 11 January 2001	Flight Hours Since Painted
62-1811	03 March, 2000	20,104.4	20,215.8	111.4

The inspection team for this inspection included:

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Steve Finley, AFRL/MLSSO

SMSgt Jerry Powell, ANG Corrosion Manager

Larry Triplett, Boeing Aircraft & Missile Systems Group

Larry Triplett, Boeing, Aircraft & Missiles Systems Group prepared these inspection results and summary.

3. INSPECTION RESULTS

Horizontal Stabilizer Upper Surfaces: Minor peeling was noted around an access cover and adjacent to the sealant joint at the tip assembly of the right-hand upper horizontal stabilizer, (Ref. Figure 1). The peeling adjacent to the access cover was observed at the last inspection and has continued to grow in length. The adhesion loss was confined to within 0.2 to 0.4 inches of the sealant joint indicating potential contamination. There was no evidence of corrosion found on the aluminum substrates.

For documentation purposes it was noted at the last inspection that the anti-skid walkway coating on the upper surface of the left-hand horizontal stabilizer was not uniform. There were several areas where the filler material was concentrated resulting in thick clumps of coating toward the center and outboard end but the coating is still adhering well. Sealant had been replaced between the tip assembly and the torque box and not repainted. (Ref. Figure 2)

Horizontal Stabilizer Lower Surfaces: Butt joint sealant had been replaced and new fasteners installed in removable covers along the aft edge of the horizontals since the last inspections. There were also fasteners with chipped paint exposing the fastener heads. (Ref. Figures 3 & 4)

Vertical Stabilizer: Small areas of chipped paint, resulting from erosion, were found on the leading edge of the vertical stabilizer. Total film thickness adjacent to the defect area was thin, ranging 2.5 – 2.9 mils. Four steel screws on each side of the vertical had rust stains penetrating the paint. There was no difference between the severity of rust between the test and control side. (Ref. Figure 5)

Color and gloss readings were taken at the same locations as those recorded after painting in March with insignificant differences between the control and test sides. Readings were recorded two times in each location. One reading was taken prior to cleaning and a second reading after cleaning. (Ref. Tables 2-5). There was no evidence of paint application in areas where readings were taken, since the aircraft was painted.

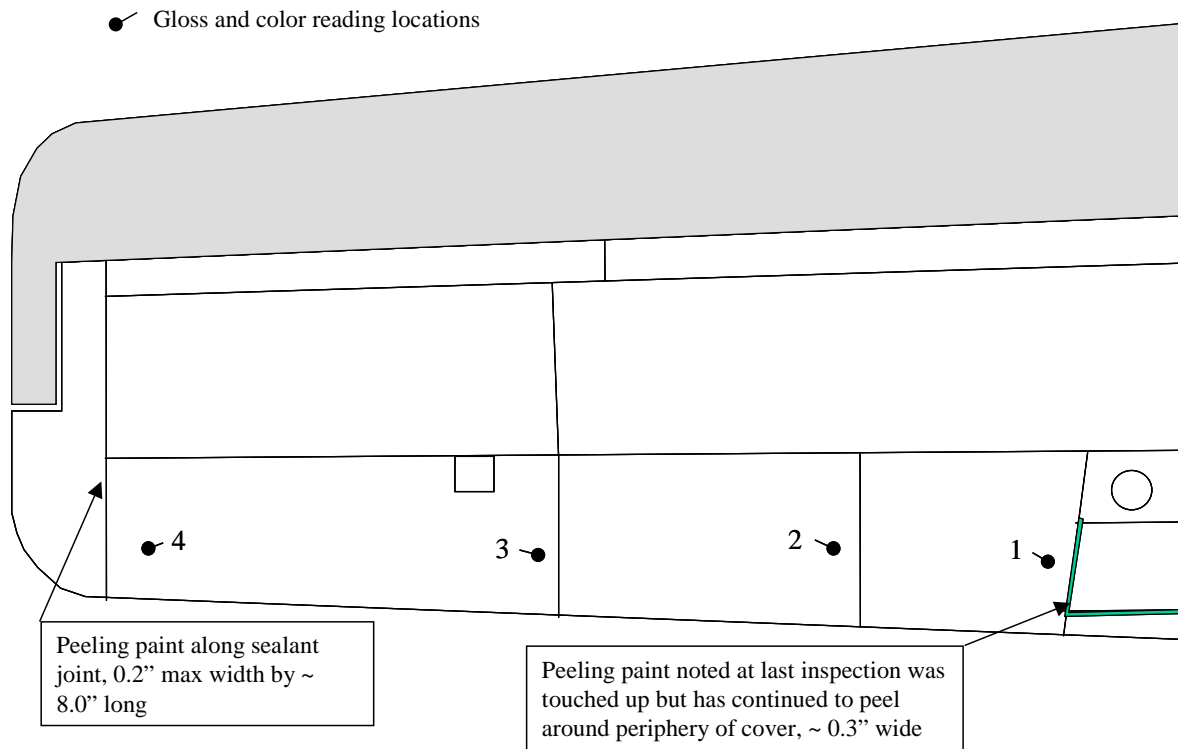


Figure 1. Right-hand Horizontal Stabilizer Looking Down

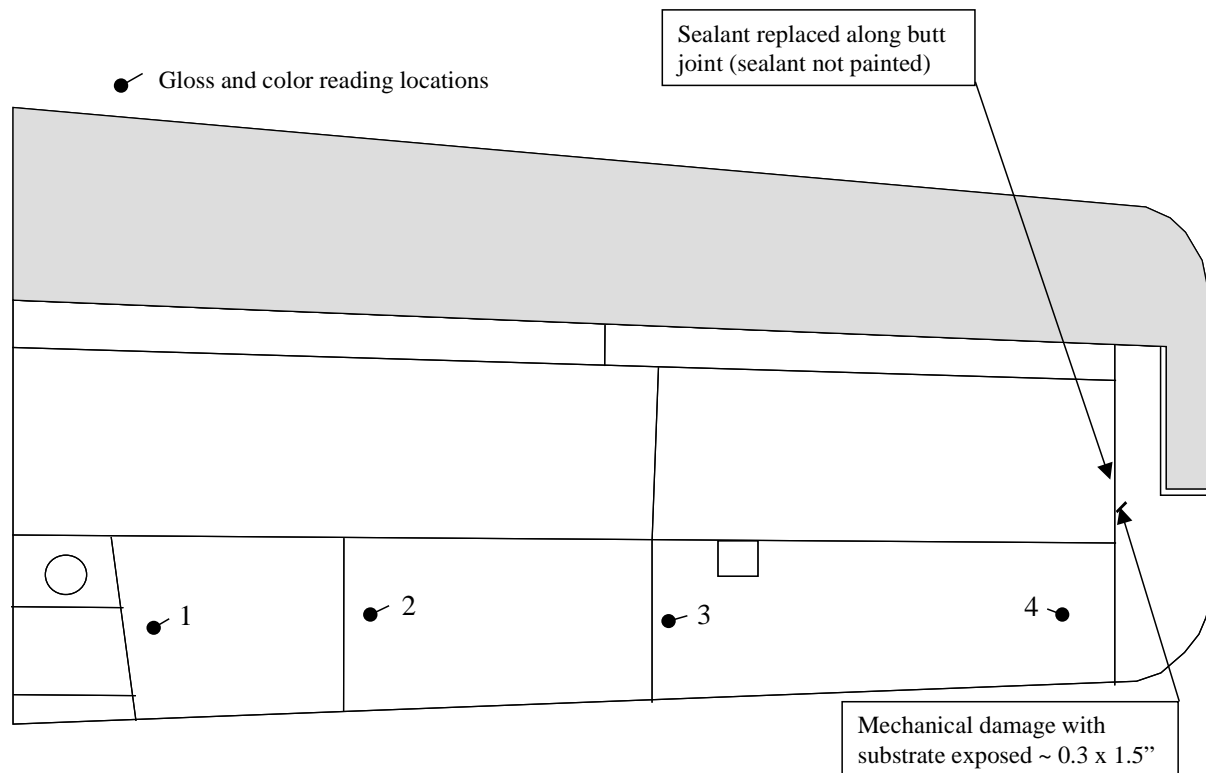


Figure 2. Left-hand Horizontal Stabilizer Looking Down

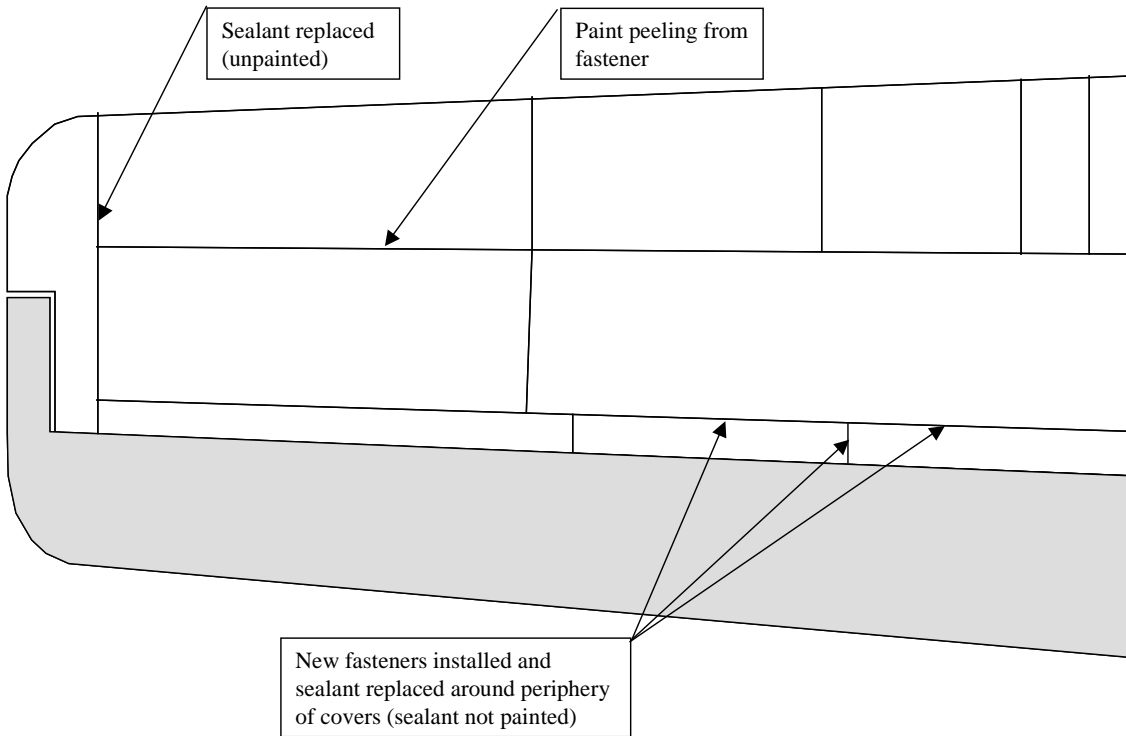


Figure 3. Right-hand Horizontal Stabilizer Looking Up

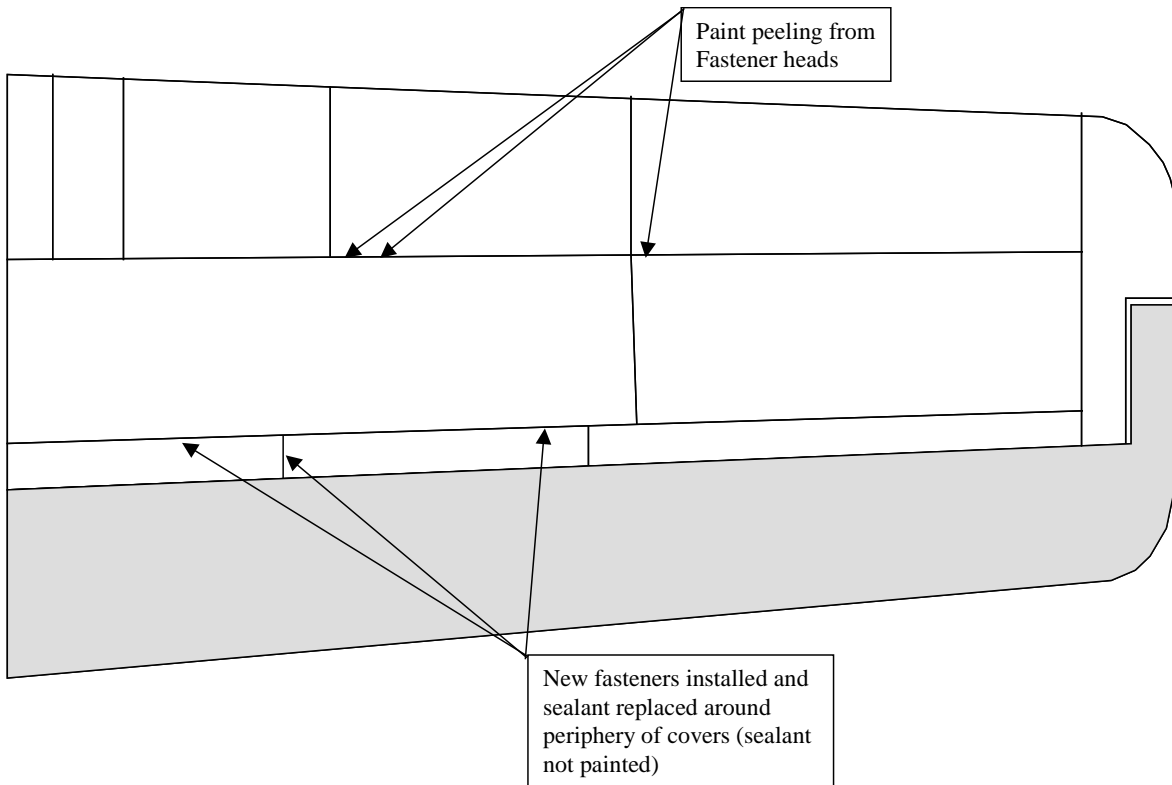


Figure 4. Left-hand Horizontal Stabilizer Looking Up

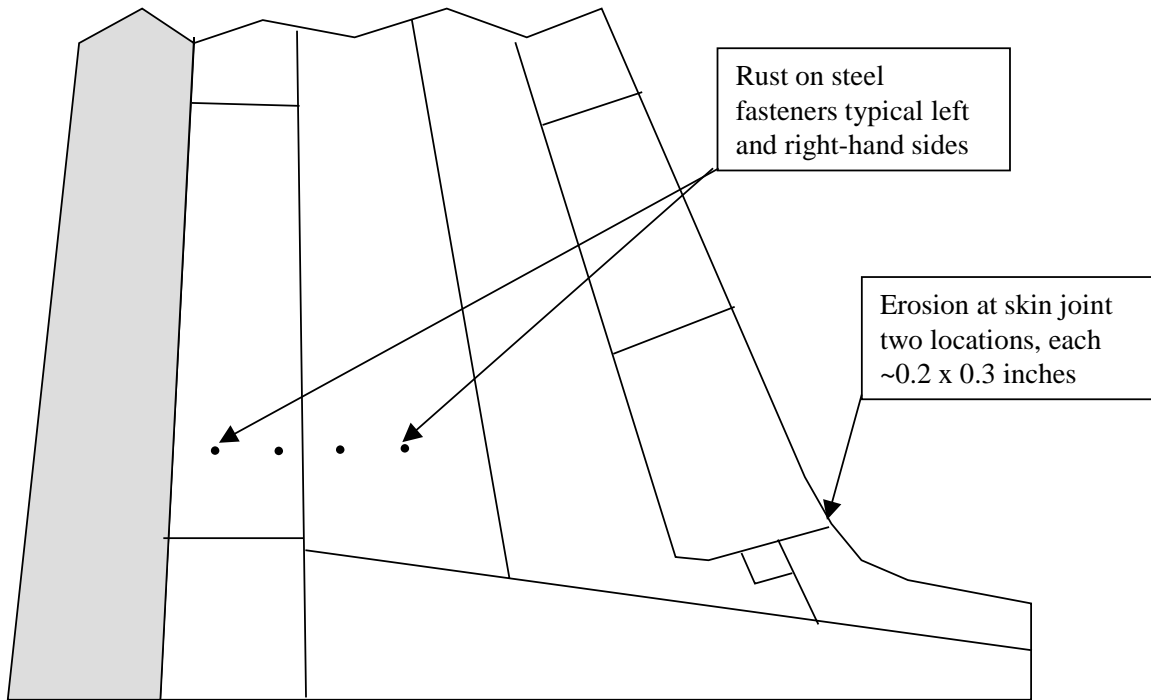


Figure 5. Vertical Stabilizer Right-hand View

Table 2. Color Data

Location	Delta*			
	ΔL	Δa	Δb	ΔE
R/H 1	-0.45	-0.08	-0.15	0.481
R/H 2	-0.36	-0.03	-0.11	0.3776
R/H 3	-0.31	-0.23	-0.05	0.3892
R/H 4	-0.09	-0.17	0.25	0.3154
L/H 1	-0.48	-0.02	0.16	0.5064
L/H 2	-0.35	-0.06	-0.19	0.4027
L/H 3	-0.16	-0.14	-0.19	0.2851
L/H 4	-0.20	-0.22	-0.20	0.3583

* Deltas are differences between the initial readings after painting and inspection readings, actual readings omitted for brevity.

Table 3. Color Data after Cleaning

Location	Delta			
	ΔL	Δa	Δb	ΔE
R/H 1	0.00	-0.03	0.55	0.5508
R/H 2	-0.06	0.02	-0.01	0.064
R/H 3	0.17	-0.04	0.02	0.1758
R/H 4	0.45	-0.02	0.05	0.4532
L/H 1	0.21	-0.11	0.18	0.2977

L/H 2	0.02	0.08	-0.10	0.1296
L/H 3	-0.50	0.02	-0.09	0.5084
L/H 4	0.15	-0.07	-0.03	0.1682

Table 3. 60° Gloss Data

Location	Initial 3-13-00	2nd Insp. 01-11-01	Delta
R/H 1	2.1	0.9	-1.2
R/H 2	2.7	1.1	-1.6
R/H 3	2.7	0.5	-2.2
R/H 4	2.2	1.3	-0.9
L/H 1	2.6	1.2	-1.4
L/H 2	2.7	1.1	-1.6
L/H 3	2.1	1.1	-1.0
L/H 4	2.4	1.1	-1.3

Table 3. 60° Gloss Data after Cleaning

Location	Initial 3-13-00	2nd Insp. 01-11-01	Delta
R/H 1	2.1	5.8	3.7
R/H 2	2.7	4.4	1.7
R/H 3	2.7	6.1	3.4
R/H 4	2.2	2.8	0.6
L/H 1	2.6	3.1	0.5
L/H 2	2.7	3.6	0.9
L/H 3	2.1	5.6	3.5
L/H 4	2.4	6.9	4.5

4. SUMMARY

This aircraft has been in the field for 10 months since it was painted and has accumulated 111 flight hours. There were only minor coating defects such as chipped paint on fastener heads and peeling paint adjacent to sealant joints that appear to be due to pre-paint contamination. The aircraft had just undergone inspections with removal of access covers and multiple areas of sealant had been replaced.

The aircraft will be inspected at six-month intervals through 2001 with the next inspection planned for midyear 2001.