

**Field Evaluation Report
of Nonchromate Primer Performance
on Exterior Mold Line Skins
of C-17 Aircraft**

**Inspection Date
01-22-03**

Altus AFB, FL

TABLE OF CONTENTS

	Page
1.0 Background.....	2
2.0 Inspection results	2
2.1 Left-hand wing chromate control	3
2.2 Right-hand wing with nonchrome primer.....	3
3.0 Inspection summary	6

LIST OF FIGURES

Figure 1. Left-Hand Wing Looking Down	4
Figure 2. Right Hand Wing Looking Down	5

TABLES

Table 1, Flight hours.....	5
----------------------------	---

PHOTOGRAPHS

Photo # 1	6
Photo # 2	7
Photo # 3	7
Photo # 4	8
Photo # 5	8
Photo # 6	9
Photo # 7	9
Photo # 8	10
Photo # 9	10

1. BACKGROUND

The following text and sketches document the results of the PRC-DeSoto nonchromate primer evaluation on aircraft #93-0602. The aircraft was painted at the Boeing Aerospace Support Center (BASC), Kelly AFB, TX in July 2000. The nonchrome primer test area consists of the upper surface of the right-hand wing, the engine nacelles on the right-hand wing and the emergency crew door on the forward fuselage. The remainder of the aircraft was primed with the original production chromated primer, Akzo Nobel 10P20-12, and opposite hand surfaces on the left side serve as the control.

Two fuel cell covers on the upper surface of each wing and the emergency crew door were stripped to the substrate to evaluate the primer on bare metal surfaces. Fuel cell covers that were stripped are identified in the inspection sketches as "Test Covers." All of the painted exterior surfaces of the aircraft were scuff sanded to remove loose and oxidized topcoat prior to moving the aircraft to the paint hangar. Paint around locations where the substrate was exposed, primarily fasteners, was sanded to remove any loose paint and feathered at the edges. After sanding, the aircraft was detergent washed and rinsed with tap water. All of the bare metal surfaces, including the fuel cell test covers and emergency door, were chromate conversion coated with Alodine 1200S and rinsed with tap water.

In addition to inspecting the aircraft for the list of paint defects outlined in the JG-PP joint test protocol the C-17 was also monitored for color and gloss changes at previous inspections. The topcoat used on the C-17 is an advanced performance topcoat that has improved ultraviolet (UV) resistance to reduce chalking. Laboratory testing has shown that primer may affect UV resistance performance of the topcoat and it was deemed important to monitor in the operational environment. Initial readings were taken after painting to serve as the base line for subsequent inspections.

The aircraft was initially stationed at McChord AFB near Tacoma WA and is currently assigned to Altus AFB, Oklahoma. The inspection prior to this was performed at San Antonio, TX while at the BASC facility for scheduled modification work.

2. INSPECTION RESULTS

The following text and sketches document the field evaluation inspection results for the most recent inspection performed on January 22, 2003 at Altus AFB, OK.

Altus contacts for this inspection was:

Floyd Laney, 580-481-5742

Wayne Cain, 580-481-7504

TSgt. Terry Locke, 580-481-7728

Individuals performing this inspection were:

2.1 Left-Hand Wing Chromate Control

Most defects documented at this inspection were not related to the coating applied for this test. (Ref. Figure 1) Since this aircraft was over coated with a coat of primer and topcoat specimens of paint chips could easily be inspected to determine the location of failure. In most cases the failure mode was original factory applied primer to substrate or original topcoat to primer.

There were numerous locations of cracked and/or peeling paint that were approximately 0.3 to 0.5" diameter. (Ref Photo #1 for typical defect) Many of the sites were noted at the last inspection but additional locations were found at this inspection. Most of the sites initiated as cracked paint that begins to lift after prolonged exposure to moisture. Failure points were either original factory applied chromate primer to substrate or topcoat to original primer and in all cases the failure was the initial coat of primer for this type of defect. The chromate control primer was identified in multiple paint chips between the two layers of topcoat indicating the adhesion failures to be at the original primer surface.

Other defects included peeling paint along the trailing edges of the wing to flap seals. Some of the failures were at the original factory applied primer and some were at the test primer to substrate. (Ref. Photo #2)

An adhesion failure noted on the top of inboard flap at the last inspection has been repaired. The size of the defect at the last inspection was approximately three square feet and after the repair peeling has continued exposing the composite substrate. (Ref. Photo #3) The composite substrate exposed on the top of the #2 engine pylon has not been touched up and has not changed significantly in size since the last inspection. (Ref. Photo #4)

Peeling paint on the titanium engine supports have increased slightly but the failure mode continues to be the factory-applied primer peeling from the substrate. (Ref. Photo #5)

2.2 Right-Hand Wing with Nonchrome Primer

Defects seen on the upper surface of the right-hand wing were multiple locations of minor chipped and peeling paint. (Ref. Figure 2).

As seen on the left wing multiple locations of cracked and/or peeling paint, approximately 0.3 to 0.5" diameter, were noted in the same area on the right-hand wing. Many of the sites were noted at the last inspection but additional locations were found at this inspection. Failure points were the same as on the chromate

control wing, either factory applied chromate primer to substrate or topcoat to primer and in all cases the failure was the initial coat of primer. The nonchrome primer applied for the test was identified in multiple paint chips between two layers of topcoat indicating the failure to be at the original primer surface.

Primer to titanium substrate failure up to approximately 2 x 3" was noted on the #4 engine to wing support. (Ref. Photo #6) The failure mode of the peeling paint areas was the original factory applied primer to substrate. Based on the color, the primer on the engine support was identified as DMS 2144 primer.

There were multiple areas of peeling paint to the substrate along the aft edges of the flap seals as noted at the last inspection. (Ref. Photo #9) The largest location was approximately 0.8 x 14 inches long. Some of the peeling paint was test primer to substrate and some is original factory applied primer to substrate.

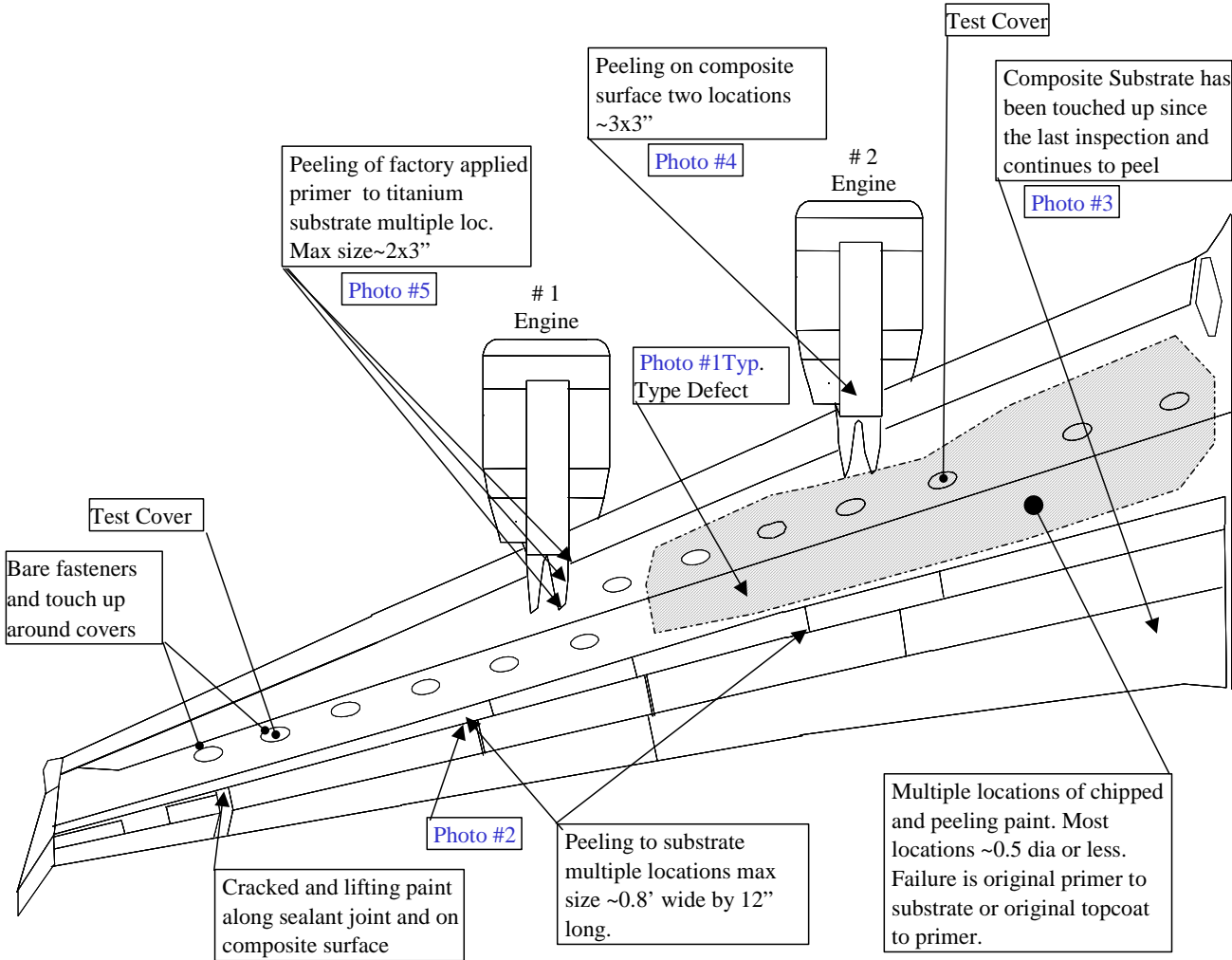


Figure 1. Left-Hand Wing Looking Down

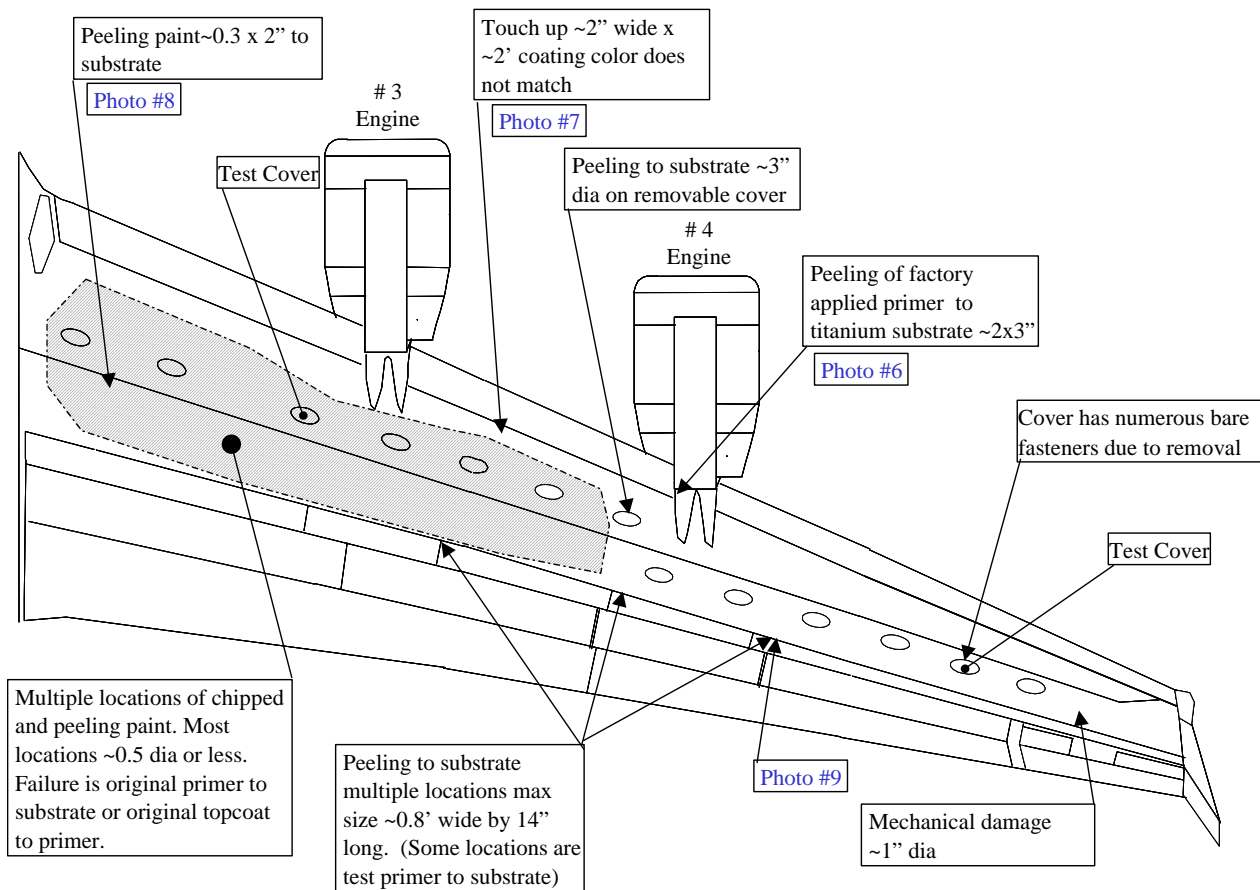


Figure 2. Right Hand Wing Looking Down

Emergency Door

There were no significant changes to the emergency door noted at this inspection.

Table 1, Flight hours

Aircraft #	Date Painted	Aircraft Location	Flight Hrs when painted	Flight Hours at insp.	Flight Hours Since Painted
93-0602	Jul. 2000	Altus AFB	5332.2	7486.7	2154.5

3. INSPECTION SUMMARY

Most of the new defects noted at this inspection were additional sites of chipped or peeling paint near the inboard center of each wing. Most of the defect sites were small approximately 0.3 to 0.5" diameter and were associated with the original factory applied primer. Similar defects were observed on the right-hand test side and left-hand control side of the aircraft. All of the paint chips examined from the small defect areas indicated that the failure was not at the interface of the test or control primer applied in July 2000.

Color and gloss readings were not recorded at this inspection due to equipment problems but the visual evaluation of the color did not indicate that there were differences between the test and control side.

There have been no systemic failures of the coating system during the thirty months since application in July 2000. Some of the peeling on the trailing edge seals was found to be test primer to substrate but the defects are approximately equal on the test and control side. The largest defect area was peeling paint on the composite inboard flap on the left-hand, chromate control side, which grew to approximately four square feet in area when inspected Jan. 2002. Between the 2002 inspection and this inspection the composite flap has been touched up but additional areas continue to peel exposing small areas of composite substrate.

No corrosion has been found on either side during any of the inspections.

Leading edge surfaces of the wings continue to be in excellent condition for the number of flight hours with only minor erosion and no significant differences between the control and test sides.

It was previously stated that the cracking and peeling of the coating on the center wing planks of upper wing surfaces may become more problematic as the coating system ages. As expected additional locations have appeared since the last inspection but they are not related to the test coatings.



Photo #1



Photo #2



Photo #3



Photo #4



Photo #5



Photo #6



Photo #7



Photo #8



Photo #9