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LARGE AIRCRAFT COATINGS FLIGHT TESTING

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The reason for this project is to field-test systems that "exceed" current Mil-Spec coating systems. All tested coatings comply with the 1998 National Emissions Standard for Hazardous Air Pollutants (NESHAP). This project provided a tool for ALCs to implement the best performing commercial "off the shelf" (COTS) coating system available, utilizing the results of these KC-135 flights tests.

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Large Aircraft Coatings Flight Testing

EXECUTIVE SUMMARY

The advent of the National Emission Standard for Hazardous Air Pollutants (NESHAP) and the concomitant requirements for minimal release of hazardous air pollutants have compelled the U.S. Air Force to adopt the use of paints with reduced Volatile Organic Compounds (VOCs). Self Priming Topcoat, TT-P-2756, formerly used on the exterior of the KC-135s was not performing satisfactorily with regards to adhesion, corrosion resistance, weatherability, and cleanability.

The High Performance Aerospace Coating System (HPACS) project conducted by Battelle identified four paint systems which offer improved film properties: System 23 from US Paint, System 6 from PRC-DeSoto (Courtaulds Aerospace), System 14 from Spraylat, and System 3 from Sherwin-Williams. The objective of this study was to monitor the performance of these improved systems when applied to aircraft. The Deft system from GSA, MIL-P-23377G and MIL-PRF-85285C, was used as a control. APC, urethane fluoropolymer topcoat from Deft, and applique were added to the monitoring.

Two KC-135s were painted at OC-ALC. One was coated with a system from US Paints and is based at MacDill AFB, FL; the other one had the upper surface of the left wing coated with APC (urethane fluoropolymer topcoat from Deft). Applique was applied over topcoat to areas of the right wing and a portion of the fuselage of this KC-135. It is assigned to Kadena AB, Japan. Two KC-135s were divided in the middle of the fuselage and refinished with different paint systems on each side at SM-ALC. One aircraft was coated with paint systems from Deft and PRC-DeSoto (Courtaulds); the other KC-135 was coated with paint systems from Spraylat and Sherwin-Williams. These aircraft are based at Hickam AFB, HI.

The latest inspection of the MacDill AFB test aircraft was accomplished in February, 1999. This KC-135 had logged 737.2 flight hours and 21 months environmental exposure since being painted. The aircraft had recorded 408.9 flight hours and 12 months Florida exposure between the initial and latest inspection. Visually, little corrosion and paint defects were noted. Considering the months of exposure, it is considered performing the best, although it exhibited fading and moderate chalking.

The latest inspection of the KC-135s at Hickam AFB, HI, shows the Sherwin-Williams (10 months, 328.7 flight hours) coating system to possess the best appearance, visually, followed by Deft (17 months, 612.9 flight hours), Spraylat (10 months, 328.7 flight hours), and PRC-DeSoto (Courtaulds) (17 months, 612.9 flight hours). The PRC-DeSoto (Courtaulds) system has exhibited unacceptable chalking.

The APC system (8 months) has the best appearance, but the least amount of exposure.

Preliminary data show the US Paints system to exhibit improved weatherability over the Deft control judged by the gloss and color stability as well as appearance. Limited exposure data shows Sherwin-Williams to possess improved appearance over the Deft control, but experience has shown exposure of 18 to 24 months is required to differentiate between coating systems.

Continued monitoring of these paint systems is recommended.

1.0 PROJECT DESCRIPTION

The objective of this task was to monitor the flight testing of coating systems identified by the High Performance Aerospace Coating System (HPACS) project conducted by Battelle to offer improved film properties of weatherability and cleanability. GSA coating system served as a control. APC (Advanced Performance Coating) and applique have also been included.

2.0 INTRODUCTION

The reason for this project is to field-test coating systems that "exceed" current Mil-Spec coating systems. All tested coatings comply with the 1998 National Emissions Standard for Hazardous Air Pollutants (NESHAP). This project will provide a tool for ALCs to implement the best performing commercial "off the shelf" (COTS) coating system available, utilizing the results of these flights tests.

3.0 BACKGROUND

TT-P-2756, Polyurethane Coating: Self Priming Topcoat coating system used formerly on the exterior moldline of the KC-135 aircraft was not meeting performance requirements over the full Programmed Depot Maintenance (PDM) cycle. The coating exhibits fading, chalking, and lack of corrosion protection.

The laboratory test and evaluation for a NESHAP compliant system with improved performance was accomplished via the HPACS contractual program managed by AFRL/MLSS. Four promising coating systems were identified by the HPACS program as being worthy for flight test consideration. The Deft coating system on the GSA contract was included to serve as a control because of its extensive use on other weapon systems. APC, a urethane fluoropolymer topcoat from Deft, was utilized on the wing of a test aircraft. Patches of paintless film (applique) from 3M was applied to portions of this test aircraft over topcoat to test the barrier properties of applique for corrosion protection. CTIO gathered other data on applique because of the opportunity. This technology is far from being implemented. The test coating systems (primer and topcoat) are tabulated below:

Table 1

Vendor	HPACS	Epoxy Primer	Polyurethane Topcoat
Deft	GSA*	02-Y-40	03-GY-321
PRC-DeSoto (Courtaulds)	System 6**	513X423C/530K015/ 930K118	832G062/930G052
Sherwin-Williams	System 3	E90G203/V93V230	F93A27/V93V26/V93V1
Spraylat	System 14	EEAE 145A/B	EUBC 105B
US Paints	System 23	S9800/K8032	Awlgrip H.S.
Deft	APC (Advanced Performance Coating)	02-Y-40	99-GY-1
3M	Applique	02-Y-40	03-GY-321 + Applique

*Deft reformulated their MIL-P-85285 topcoat in May, 1996 to give better performance
**PRC-DeSoto (Courtaulds) has added UV absorbers to their previous version topcoat to give better performance.

4.0 TECHNICAL APPROACH

The coating systems were tested as drop-in replacements for MIL-P-23377G + TT-P-2756 for use on the outer moldline of KC-135 aircraft. Self Priming Topcoat (SPT) was tried and failed as a unicoat, therefore Tinker AFB and McClellan AFB started using primer (MIL-P-23377G) on selected areas of the aircraft under the SPT.

Operational test sites were selected which represent environments that are severely corrosive, marine, and receive high UV radiation. Two test aircraft were provided by Air Mobility Command (AMC); one is stationed at MacDill AFB, FL, and the other at Kadena AB, Japan. Two test aircraft were provided by Air National Guard (ANG) and are based at Hickam AFB, HI. These bases are designated as severe corrosive environments in T.O. 1-1-691, requiring a clear water rinse after the last flight of the day and a wash every 30 days for aircraft stationed at these locations. The AMC aircraft were coated at Tinker AFB, OK (OC-ALC) and the ANG aircraft were painted at McClellan AFB, CA (SM-ALC).

Testing was conducted as outlined in the Operational Test Plan dated August 1997, during the inspections by the CTIO team. The tests included:

Table 2

TEST	REFERENCE	LOCATIONS
PATTI adhesion (modified)	ASTM D 5179	5-10 per coating system*
Pencil Hardness	ASTM D 3363	5-10 per coating system*
Wet Tape Adhesion	FTMS 141, Method 6301	5 per coating system*
Chalking (modified)	ASTM D 4214, Test Method C	5 per coating system**
Dry Film Thickness		≅ 45 per aircraft***
Gloss, 60° and 85°	ASTM D 523	≅ 45 per aircraft***
CIELab Color (10° observer, D65 illuminant, specular exclusive)	ASTM D 2244	≅ 45 per aircraft***

*Test locations, as indicated in the Aerospace Coating Service Test Technical Evaluation Team Inspection Sheet, Appendix VIII, assess fluid resistance on the belly; locations on the wings determine UV degradation. Subsequent values obtained during later inspections were from nearby locations.
**Test locations on wing, as noted in Appendix VIII, measure UV degradation.
***Test locations, as mapped in Appendix VIII, were chosen to represent different sections of the aircraft, the wings and fuselage. The locations are numbered to enable subsequent values obtained during later inspections to be near the same area.

The test plan identified three Critical Operational Issues (COIs) with attendant Measures of Effectiveness (MOE) and Measures of Performance (MOP).

The first Critical Operational Issue (COI) questions if the test coating provides equal or improved corrosion protection compared with the control coating system. In order to ensure the test coating systems show corrosion protection characteristics, the test coating systems shall be flight tested on test aircraft stationed in a severely corrosive, high UV marine environment for a minimum of 20 months. The test coating systems shall show equal or improved performance as compared to the Mil-Spec qualified Deft coating system in order to pass this COI. The Deft coating system will be used as the control coating system.

The Measures of Effectiveness (MOE) are a comparison of the test coating with the control coating for corrosion protection, film integrity around fasteners, and adhesion of coating system.

The Measures of Performance (MOP) are visual inspection for corrosion and film integrity and adhesion values from the wet tape test and modified PATTI Test.

The second COI questions if the test coating offers equal or superior film performance compared with the control coating system. Per MIL-C-85285B, the specular gloss of camouflage topcoats at 60° angle of incidence shall have a reading of 5 or less. MIL-C-85285B topcoats have not been able to maintain the 5 or less reading over time and after many wash cycles. The test coating systems shall show improved performance in maintaining camouflage gloss measured at 60° and 85° over the control coating system in order to pass this COI.

The MOE includes evaluating gloss stability, cleanability and fluid resistance. The MOP uses the gloss meter and color spectrophotometer values to determine depth of change objectively and pencil hardness test to evaluate fluid resistance.

The third COI questions the appearance of the coating system compared with the control coating system. Appearance characteristics are comprised of cleanability of the coating system, color, and gloss stability of the coating system over time and after touch-up and repair, and lastly fluid resistance of the coating system. The test coating systems shall show improved performance in these areas over the control coating system in order to pass this COI.

The MOE includes evaluating the cleanability, gloss and color stability, fluid resistance and color/gloss matching of repaired areas. The MOP uses the gloss meter and color spectrophotometer values to assign numerical values relating to visual differences and pencil hardness test to evaluate fluid resistance.

Flight-testing is on going. Test aircraft are monitored at approximately 6-month intervals.

5.0 TEST OBSERVATIONS

The coating application and inspections of the test aircraft are tabulated in Table 3. The values of each test and calculations of differences between the initial and subsequent tests are tabulated. Details of the laboratory test results are attached in:

Appendix I	Deft	Control
Appendix II	PRC-DeSoto (Courtaulds)	System 6
Appendix III	Sherwin-Williams	System 3
Appendix IV	Spraylat	System 14
Appendix V	US Paints	System 23
Appendix VI	Deft	APC

KC-135
Summary of Paint Application and Inspection

Tail No.	Paint Vendor	Date Painted	Location Painted	Date Inspected	Assigned	Flight Hours	Months Exposed
64-14838	US Paints	5 May 97	OC-ALC	Jan. , 1998 July, 1998 February, 1999	MacDill AFB, FL AMC	328.3 496.6 737.2	6 – McConnell AFB, KS 2 – MacDill AFB, FL 8 - MacDill AFB, FL 15 - MacDill AFB, FL
64-14832	Deft–Left Side PRC-DeSoto (Courtaulds)–Right Side	23-26 Sept. 1997	SM-ALC	July, 1998 January, 1999	Hickam AFB, HI ANG	323.8 612.9	9 – Hickam AFB, HI 16 - Hickam AFB, HI
59-1472	Spraylat- Left Side Sherwin-Williams-Right Side	11-14 March 1998	SM-ALC	July, 1998 January, 1999	Hickam AFB, HI ANG	145.2 328.7	4 – Hickam AFB, HI 10 - Hickam AFB, HI
63-8040	Deft Fluoropolymer Topcoat-Top Of Left Wing Applique-Top Of Right Wing And Fuselage	29 May 1998	OC-ALC	February, 1999	Kadena AB, Japan AMC		8 – Kadena AB, Japan

Table 3

5.1 Deft (Control) was first inspected at 10 months and 323.8 flight hours. It exhibited no chalking. The aircraft was undergoing isochronal inspection; therefore it had been washed and was in the hangar.

Witness panels had been placed on the aircraft at locations stated in Appendix I during paint application. "Initial values" had been obtained from these panels. Only small color changes were noted, showing a slightly lighter color on the wing and a slightly darker color on the fuselage. The delta L* on the wing was 0.3 and negative 1.0 on the fuselage resulting in a delta E* of 1.0 on both the wing and fuselage. The 60° gloss value was lower on the wing and slightly higher on the fuselage resulting in a reduced 60° gloss reading average (0.4) for the aircraft. The 85° gloss value was higher for both the wing and the fuselage, averaging 1.0 increase for the aircraft.

The modified PATTI values averaged 1764 psi on the belly and were very consistent. Modified PATTI values on the wing ranged from 1225 to 1862 psi averaging 1544 psi.

Corrosion was noted around fasteners, on the wing trailing edge, and on the doors of the front landing gear. Paint peeling was noted fasteners, engine cowling, and the leading edge.

At 17 months and 612.9 flight hours the color had changed showing the wing to be lighter and the fuselage to be very slightly darker. Comparison with the initial readings gave a delta L* of 3.2 on the wing and negative .3 on the fuselage calculating to a delta E* of 3.2 on the wing and .9 on the fuselage. The 60° gloss was reduced on the wing and increased slightly on the fuselage netting a slight loss of gloss (0.2). The 85° gloss was higher on both the wing and fuselage, average increase for the aircraft was 0.8 units. Chalking was moderate, rating from 5 to 8 per Photographic Reference Standard on ASTM D 659. (The higher the number the less the chalking.)

The modified PATTI test values averaged 1343 psi on the fuselage and 1493 psi on top of the wings. The values were very consistent. More details are listed in Appendix I.

Peeling was noted on the underside and leading edge of the wing, panel edges, on the sealant, and around the windshield. More details are noted in Appendix VII, Comments from Mike Sneed, OC-ALC/CRA.

5.2 PRC-DeSoto (Courtaulds) System was first inspected at 10 months and 323.8 flight hours. The chalking was moderate and rated an 8. The aircraft was undergoing isochronical inspection; therefore it had been washed and was in the hangar.

Witness panels had been placed on the aircraft at locations stated in Appendix II during paint application. Initial values were taken from these panels. Both the wing and the fuselage were lighter in color with a delta L* of 3.4 on the wing and .9 on the fuselage resulting in a delta E* of 3.5 on the wing and 0.9 on the fuselage. The 60° gloss was lowest of all of the test coatings and remained unchanged (1.0). The 85° gloss was slightly higher than the initial values (0.8 increase).

PATTI values for the fuselage ranged from 784 psi to 1470 psi averaging 1176 psi. The top of the wings ranged from 686 psi to 1176 psi averaging 931 psi.

Paint peeling was noted on fasteners on the leading edge and spoilers. Paint loss was noted on the leading edge of the horizontal stabilizer. Corrosion was noted on the trailing edges, fuselage, and doors of the front landing gear.

When inspected at 17 months and 612.9 flight hours, the color was even lighter with a delta L* of 4.7 on the wing and 3.5 for the fuselage resulting in a delta E* of 4.8 on the wing and 3.6 on the fuselage calculated from the initial color values. The 60° and 85° gloss values were slightly higher (60° - 0.4 increase, 85° - 1.1 increase). Chalking was severe, rating a 4.

Values for modified PATTI test ranged from 597 psi to 1343 psi on the fuselage averaging 1028 psi. The top of the wings ranged from 746 psi to 1194 psi averaging 888 psi. More details are explained in Appendix II.

Paint peeling was noted on the underside of the wings, on the Oklahoma Door, and around the Radome. Bare metal was apparent around the windshield and on the leading edge. More details are recorded in Appendix VII, Comments from Mike Sneed, OC-ALC/CRA.

5.3 Sherwin-Williams system was first inspected at 4 months and 145.2 flight hours. The finish exhibited no chalking. It was inspected on the flight line and the last wash was indeterminate. Hickam AFB wash rack was closed and a waiver had been requested.

Initial values that were obtained from the aircraft surface the day after the topcoat was applied utilizing the locations mapped in Appendix VIII were determined to be incorrect due to equipment malfunction. Calculations were made utilizing average readings for Fed. Standard 595B 36173. Little change in color was noted. The delta L* on the wing was negative .83 and .45 on the fuselage computing to a delta E* of .84 on the wing and 1.3 on the fuselage. Both the 60° and 85° gloss readings were slightly higher (0.6 unit increase for both 60° and 85° angle of incidence).

Pull values on the belly using the modified PATTI test ranged from 1274 psi to 1813 psi averaging 1519 psi. The top of the wings ranged from 1078 to 1862 psi averaging 1470 psi.

Paint loss was noted around fasteners on the aft end of the filler flap. Corrosion was seen around fasteners on the bottom of the fuselage.

At 10 months and 328.7 flight hours, little additional color change was noted. The aircraft was inspected on the flight line. The delta L* was 1.1 on the wing and negative .45 on the fuselage; the delta E* was 1.9 on the wing and 1.1 on the fuselage as calculated from the assumed initial values. Neither 60° nor 85° gloss values differed significantly from the initial values (60° 0.1 unit loss, 85° 0.1 gain). Chalking was moderate, ranging from 6 to 7.

PATTI pulls on the belly ranged from 697 to 746 psi averaging 713 psi. The top of the wings ranged from 1393 to 1691 psi averaging 1559 psi. More details are available in Appendix III.

Repaired areas include fasteners on upper wing, along fuselage seams, and leading edges. Peeling and cracking was noted on panel rivets, on cowling leading edges, and Beaver Tail. More details are recorded in Appendix VII, Comments from Mike Sneed, OC-ALC/CRA.

5.4 Spraylat system was first inspected at 4 months and 145.2 flight hours. No chalking was noted at that time. It was inspected on the flight line and the last wash was indeterminate. Hickam AFB wash rack was closed and a waiver had been requested.

The initial values obtained from the aircraft after painting were found to be erroneous due to equipment malfunction. Calculations were accomplished utilizing average expected color values for Fed standard 595 36173. Both the wing and the fuselage registered lighter in color with a delta L* of .36 on the wing and .37 on the fuselage. This computed to a delta E* of 1.1 on the wing and 1.4 on the fuselage. Both the 60° and 85° gloss values were slightly higher (60°-1.7 increase, 85°-0.6 increase).

Pull values on the belly utilizing the modified PATTI test ranged from 490 to 1078 psi averaging 865 psi. Values for the top of the wings ranged from 882 to 1421 psi averaging 1152 psi.

Paint peeling with corrosion was noted on fasteners on the wing tip. Paint was chipped below the cargo door.

At 10 months and 328.7 flight hours, little additional color change was recorded. The aircraft was inspected on the flight line. The delta L* was .26 on the wing and negative .19 on the fuselage leading to a delta E* of 1.8 on the wing and 1.2 on the fuselage as calculated from the assumed initial values. 60° gloss had increased 0.4 units from initial values and 85° gloss was unchanged. Chalking was moderate, ranging from 6 to 8.

Modified PATTI values for the belly ranged from 398 to 945 psi, averaging 713 psi. The top of the wings ranged from 796 to 945 psi averaging 879 psi. Greater details are available in Appendix IV.

Rework was observed on the wing, around fasteners, along fuselage seams, on the leading edge and underside of wing. Primer was showing in boom area. Paint was peeling and cracking along rivet rows and around Radome. More details are recorded in Appendix VII, Comments from Mike Sneed, OC-ALC/CRA.

5.5 US Paints system was first inspected at 8 months and 328.3 flight hours. At that time the aircraft had been assigned to McConnell AFB, KS, for six months and MacDill AFB, FL, for 2 months. Since this was the first inspection by CTIO and the aircraft had been stationed at a mild corrosion environment, the first readings were considered "initial readings". When the aircraft was transferred to MacDill AFB, FL, from McConnell AFB KS, blisters were noted on the fuselage above the horizontal stabilizer. When probed, a large (approximately 13 inches by 3 feet) area was discovered to be peeling between the primer and the chromate conversion coating.

The area was repaired. The repair was noticeable at a later date. The aircraft had been washed and was located in a hangar. The magnesium main landing gear follow-up doors exhibited moderate to severe corrosion and were later replaced by aluminum doors. There were a few spots of chipped paint in several areas around sealant and fasteners.

The next inspection 6 months and 168.3 flight hours later showed little change in color with delta L* less than 1 for both the fuselage and the wings. The delta E* was 1.2. The 60° gloss was lower (1.6 unit loss) and the 85° gloss was slightly higher (0.9 units). No chalking was observed.

Modified PATTI values for the belly ranged from 980 to 1274 psi averaging 1094 psi. The top of the wings ranged from 784 to 1421 psi averaging 1103 psi.

Chipped paint was observed on the leading edges of the wings and the horizontal stabilizers, along with the boom attachment points. Other areas include the engine cowlings, under the wing, and above the co-pilot window. Overall comments report most of the coating defects may be due to wear from maintenance, impact chips and broken coating around edges.

The following inspection, one year from the first "initial" inspection, showed a lighter color value with a delta L* 2.6 on the wings and 3.3 on the fuselage calculating to a delta E* of 2.0 on the wings and 2.3 on the fuselage, compared with the "initial" values. The 60° gloss was lower totaling a reduction of 2.8 units. The 85° gloss decreased slightly (0.4 units) from the "initial" values. Chalking was rated moderate, ranging from 6 on top of the wings to 8 under the wings.

Values on the belly for the modified PATTI test ranged from 597 to 1592 psi averaging 1055 psi. The top of the wings ranged from 1940 to 2587 averaging 2279 psi. This aircraft had accumulated a total of 737.2 flight hours since being painted, including 240.6 since the last inspection. Details are tabulated in Appendix V.

Some peeling on the leading edges and around doors and access panels was observed. More details are noted in Appendix VII, Comments from Mike Sneed, OC-ALC/CRA.

5.6 APC from Deft was first inspected at 8 months. The color was slightly darker from when initially painted, with delta L* of negative 1.4 and delta E* of 1.6. The 60° gloss decreased by 0.2 units and the 85° gloss increased by 1.7 units.

Modified PATTI values ranged from 1194 to 1791 psi averaging 1572 psi. Only the top of the wing was coated with APC. Greater detail is offered in Appendix VI.

Corrosion on fasteners was starting. More details are recorded in Appendix VII, Comments from Mike Sneed, OC-ALC/CRA.

5.7 The applique presented a good appearance. When it was removed, no corrosion was observed underneath, but a sticky residue remained that was difficult to dislodge. The gloss value IAW MIL-PRF-85285C was too high (60°= 9.9, 85°=52) initially, but it was not measured on the inspection trip.

5.8 Table 4 tabulates the values observed for gloss (60° and 85°) and CIEL (lightness) color data. The calculated values for delta L* and delta E* are also given for each inspection. The appendix for each coating system gives detailed data including individual dry film thickness readings, CIELab color readings, gloss values, and delta calculations for specific areas on the aircraft. PATTI and wet tape adhesion results, pencil hardness, chalking ratings at specific locations on the aircraft are tabulated.

Comparison of Color and Gloss Values of Flight Tested Systems

	Deft			PRC-DeSoto (Courtaulds)			Sherwin-Williams			Spraylat		
	initial	10 mo	17 mo	initial	10 mo	17 mo	initial	4 mo	10 mo	initial	4 mo	10 mo
L* Total	49.712	49.336	51.145	48.776	50.682	52.576	49.959	49.818	50.182	49.959	49.644	49.947
L* Wing	49.577	49.867	52.896	48.557	52.006	53.257		49.130	51.058		49.598	50.227
L* Fuselage	49.728	48.783	49.705	48.823	49.718	52.280		50.406	49.512		49.585	49.696
Δ L* Total		-0.440	1.338		1.996	3.890		-0.141	0.223		-0.315	0.029
Δ L* Wing		0.258	3.209		3.449	4.700		-0.829	1.099		-0.361	0.268
Δ L* Fuselage		-1.002	-0.330		0.902	3.464		0.447	-0.447		-0.374	-0.186
Δ E* Total		1.105	2.099		2.142	4.023		1.001	1.399		1.178	1.472
Δ E* Wing		0.912	3.254		3.535	4.763		0.843	1.901		1.101	1.794
Δ E* Fuselage		1.341	0.987		1.089	3.647		1.308	1.078		1.353	1.183
60 degree gloss	2.0	1.6	2.6	0.9	1.0	1.3	1.2	1.8	1.1	1.1	2.8	1.6
85 degree gloss	2.2	3.2	3.3	3.1	3.9	4.2	4.9	4.9	4.3	4.9	4.9	4.3

	US Paints			APC		
	initial	6 mo	13 mo	initial	10 mo	17 mo
L* Total	49.689	50.509	52.822			
L* Wing	49.497	50.420	52.242	50.468	49.053	
L* Fuselage	49.702	50.379	52.653			
Δ L* Total		0.821	3.125			
Δ L* Wing		0.939	2.629		1.415	
Δ L* Fuselage		0.864	3.316			
Δ E* Total		1.292	2.245			
Δ E* Wing		1.243	2.017		1.558	
Δ E* Fuselage		1.464	2.323			
60 degree gloss	5.0	3.7	2.2	2.5	2.2	
85 degree gloss	6.2	6.9	5.8	2.7	3.9	

Table 4

No gloss readings (60° or 85°) were higher than specified in MIL-PRF-85285C. No wet tape failures occurred. The pencil hardness has increased on the finish from PRC-DeSoto (Courtaulds). The Spraylat system remains the softest of the finishes, but is increasing in hardness. The coating systems from Sherwin-Williams and Deft control present constant pencil hardness. The US Paint system was initially very hard and these values have remained constant. No significant changes have been noted from the modified PATTI test values.

6.0 OPERATIONAL TEST AND EVALUATION TEST PLAN RESPONSE

COI-1: Do the test coating systems provide equal or improved protection against corrosion compared with control coating system?

MOE 1-1: The corrosion protection of the test coating systems shall be equal to or show an improvement over the currently used coating systems.

MOP 1-1-1: Upon visual inspection the test coated skins shall show no more exfoliation corrosion around fastener countersinks and panel edges than on the control coated skins.

Visual inspection observed no more exfoliation corrosion on any of the test aircraft than on the Deft control.

MOP 1-1-2: Upon visual inspection the test coated skins shall show no more filiform corrosion than on the control coated skins.

Visual inspection showed no more filiform corrosion on any of the test aircraft than on the Deft control.

MOE 1-2: The degree of compatibility (adhesion) of primer with the substrate and topcoat with the primer.

MOP 1-2-1: Upon visual inspection the degree of adhesion on the test side shall be equal to or better than the control side for all interfaces.

No more paint loss or peeling was observed on the test coatings than on the Deft control.

MOP 1-2-2: Modified Adhesion PATTI testing per ASTM 5179 shall measure a minimum of 1000 psi.

- Deft control - All values were in excess of 1000 psi.
- PRC-DeSoto (Courtaulds) – The pull values averaged 1000 psi; some pull values were less.
- Sherwin-Williams – Pull values on the wing averaged 1559 psi, but pull values on the belly averaged 700 psi.
- Spraylat – Pull values averaged 800 on the aircraft.

- US Paints – All values but 2 were in excess of 1000, averaging the values equals over 1600.
- APC – all values were over 1000, but only the top of the wing was tested, which normally gives greater values.

MOE 1-3: The integrity of the test coating system on and around upper and lower wing skin fasteners shall be equal or show an improvement over the currently used coating system.

MOP 1-3-1: Upon visual inspection and using the evaluation criteria stated in this test plan the test coating shall score an equal or higher value than the control coating.

Due to time constraints and difficulty to inspect the entire aircraft closely, the detailed rating system was not employed. In general, the integrity of the test coating systems was equal or higher than the control coating.

COI-2: Do the test coating systems provide equal or improved performance in the area of visible detection?

MOE 2-1: The gloss stability of the test coating systems shall be an improvement over the currently used coating systems.

MOP 2-1-1: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control showed little gloss change, negative 0.2. Sherwin-Williams – 0.1, Spraylat and PRC-DeSoto (Courtaulds) 0.4, APC – negative 0.2, and US Paints negative 2.3. Only Sherwin-Williams showed less change in gloss and APC exhibited the same change.

MOP 2-1-2: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control displayed a change of gloss equal to 0.8 units. PRC-DeSoto (Courtaulds) was higher with 1.1 and APC with 1.7. The other coating systems registered less change in gloss. Sherwin-Williams registered no change.

MOP 2-1-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

MOE 2-2: The cleanability of the test coating systems shall be an improvement over the currently used systems.

MOP 2-2-1: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control showed little gloss change, negative 0.2. Sherwin-Williams – 0.1, Spraylat and PRC-DeSoto (Courtaulds) 0.4, APC – negative 0.2, and US Paints negative 2.3. Only Sherwin-Williams showed less change in gloss and APC exhibited the same change.

MOP 2-2-2: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control displayed a change of gloss equal to 0.8 units. PRC-DeSoto (Courtaulds) was higher with 1.1 and APC with 1.7. The other coating systems registered less change in gloss. Sherwin-Williams registered no change.

MOP 2-2-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

MOE 2-3: The fluid resistance stability of the test coating systems shall be an improvement over the currently used coating systems.

MOP 2-3-1: Using the pencil hardness technique in accordance with FTMS-141, the change in hardness of the test coating shall be less than the change in hardness on the control coating.

The pencil hardness of the Deft control remained the same between the two inspections. The other test coatings remained the same or increased in hardness except one area of Sherwin-Williams exhibited one pencil hardness unit softer. The APC coating system has only been inspected once. No initial values could be obtained for any coating system.

MOP 2-3-2: Upon visual inspection the degree of adhesion on the test side shall be equal to or better than the control side for all interfaces.

No differences were recorded for adhesion differences as observed between the control coating system and the test coating systems.

MOP 2-3-3: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than 1.0 (i.e. delta E of test coating/delta E of control).

The only calculated ratio less than 1 was APC. The others ranged from 1.1 for US Paints, to 1.9 for Spraylat and PRC-DeSoto (Courtaulds), to 2.1 for Sherwin-Williams.

MOP 2-3-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

COI-3 Do the test coating systems provide equal or improved appearance characteristics over the control coating system?

MOE 3-1: The cleanability of the test coating systems shall be an improvement over the currently used systems.

MOP 3-1-1: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control showed little gloss change, negative 0.2. Sherwin-Williams – 0.1, Spraylat and PRC-DeSoto (Courtaulds) 0.4, APC – negative 0.2, and US Paints negative 2.3. Only Sherwin-Williams showed less change in gloss and APC exhibited the same change.

MOP 3-1-2: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control displayed a change of gloss equal to 0.8 units. PRC-DeSoto (Courtaulds) was higher with 1.1 and APC with 1.7. The other coating systems registered less change in gloss. Sherwin-Williams registered no change.

MOP 3-1-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

MOE 3-2 The color stability of the test coating shall be an improvement over the currently used coating system.

MOP 3-2-1: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control displayed a change of gloss equal to 0.8 units. PRC-DeSoto (Courtaulds) was higher with 1.1 and APC with 1.7. The other coating systems registered less change in gloss. Sherwin-Williams registered no change.

MOP 3-2-2 Use of a black velvet cloth in accordance with ASTM D 4214, Test Method C shall show no evidence of chalking.

The APC exhibited no chalking, but it had endured the least exposure. Deft control was rated 7 as were US Paints and Spraylat. Sherwin-Williams was rated 6 and PRC-DeSoto (Courtaulds) was rated 4. (The coating systems with the higher numbers are rated the most resistance to chalking.)

MOP 3-2-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

MOE 3-3: The gloss stability of the test coating system shall be an improvement over the currently used coating systems.

MOP 3-3-1: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control showed little gloss change, negative 0.2. Sherwin-Williams – 0.1, Spraylat and PRC-DeSoto (Courtaulds) 0.4, APC – negative 0.2, and US Paints negative 2.3. Only Sherwin-Williams showed less change in gloss and APC exhibited the same change.

MOP 3-3-2: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

Deft control displayed a change of gloss equal to 0.8 units. PRC-DeSoto (Courtaulds) was higher with 1.1 and APC with 1.7. The other coating systems registered less change in gloss. Sherwin-Williams registered no change.

MOP 3-3-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

MOE 3-4: The fluid resistance of the test coating systems shall be an improvement over the currently used coating systems

MOP 3-4-1: Using the pencil hardness technique in accordance with FTMS-141, the change in hardness of the test coating shall be less than the change in hardness on the control coating.

The pencil hardness of the Deft control remained the same between the two inspections. The other test coatings remained the same or increased in hardness except one area of Sherwin-Williams exhibited one pencil hardness unit softer. The APC coating system has only been inspected once. No initial values could be obtained for any coating system.

MOP 3-4-2: Upon visual inspection the degree of adhesion on the test side shall be equal to or better than the control side for all interfaces.

No more paint loss or peeling was observed on the test coatings than on the Deft control.

MOP 3-4-3: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than 1.0 (i.e. delta E of test coating/delta E of control).

The only calculated ratio less than 1 was APC. The others ranged from 1.1 for US Paints, to 1.9 for Spraylat and PRC-DeSoto (Courtaulds), to 2.1 for Sherwin-Williams.

MOP 3-4-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

MOE 3-5: The The touch-up/repaired area shall an improvement relative to color and gloss over the currently used coating system.

MOP 3-5-1: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than 1.0 (i.e. delta E of test coating/delta E of control).

CTIO was unable to obtain color readings of repaired areas and calculate values.

MOP 3-5-2: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

CTIO was unable to obtain gloss readings of repaired areas and calculate values.

MOP 3-5-3: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

CTIO was unable to obtain gloss readings of repaired areas and calculate values.

MOP 3-5-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical properties changes.

CTIO was unable to collect any chips.

7.0 TEST SUMMARY

The appearance and values of the APC are excellent at this time, but it has less environmental exposure. There is no chalking and the PATTI adhesion tests are excellent. The US Paint system and Deft control exhibited similar values after the same exposure time.

The US Paint system has exhibited good exposure resistance. The aircraft has been painted for 20 months. The values obtained a year apart have shown moderate fading and little loss of 60° gloss. The aircraft had undergone 8 months exposure before inspections were initiated, but this was in a "mild corrosive environment."

Comparing all of the coating systems, they all possessed a better appearance than the other KC-135s that had been painted with TT-P-2756, Self-Priming Topcoat, at the respective bases. At this time, the APC looks excellent, but it does not have as much exposure as the other aircraft. Experience confirms that it takes 18 to 24 months exposure to obtain meaningful data to judge weathering resistance. The US Paints system was painted first and has accumulated 21 months exposure. It has exhibited moderate weatherability.

Visual observations of the KC-135s at Hickam AFB, HI, have ranked Sherwin-Williams to have the best appearance, followed by Deft control, Spraylat and PRC-DeSoto (Courtaulds). The PRC-DeSoto (Courtaulds) system has displayed unacceptable chalking.

All observed corrosion has been around fastener heads and rivets. This probably indicates the general need for a more flexible primer for larger aircraft like the KC-135. Corrosion under antennae was evident, but not coating system related.

8.0 COMPARISON OF LABORATORY DATA WITH FLIGHT DATA

Laboratory testing was accomplished by Battelle for the HPACS Program for AFRL/MLSS. Table 5 summarizes data from Page 27 of the RELIABILITY AND MAINTAINABILITY IMPROVEMENT, HIGH PERFORMANCE AEROSPACE COATING SYSTEM PROGRAM. Final Report. The final overall composite desirability index conducted ranks the test coating systems in the following manner:

Table 5

Category	System 3 Sherwin-Williams	System 6 PRC-DeSoto (Courtaulds)	System 14 Spraylat	System 23 US Paints	System 26 Deft control	System 17 Deft TT-P-2756 (SPT)
Survivability	.05	.01	.17	.05	.05	.03
Corrosion	.88	.93	.97	1.0	1.0	.20
Appearance	.65	.76	.59	.78	.57	.75
General	.63	.50	.56	.45	.43	.63
Flow Time	.63	.79	.79	.72	.79	.70
Composite	.59	.60	.59	.66	.53	.54

The larger number represents greater desirability.

All of the test systems were rated high for corrosion resistance as tested, utilizing Salt Fog, Filiform, and EIS (Electrochemical Impedance Spectroscopy).

Artificial weathering data is summarized from this report, Appendix H.

Table 6 compares the laboratory test data for artificial weathering of the four systems judged to be worthy of flight testing, the GSA control and SPT (TT-P-2756):

Table 6

Test		System 4	System 6	System 14	System 23	System 26	System 17
		Sherwin-Williams	PRC-DeSoto (Courtaulds)	Spraylat	US Paints	Deft control	Deft TT-P-2756 (SPT)
Xenon Arc Weather-ometer – 1000 hours	ΔL*	0.2	2.1	-0.2	0.6	0.2	1.6
	ΔE*	0.3	2.0	0.3	0.6	0.2	1.6
	Δ60°	-0.4	-0.8	0.0	+0.3	+0.1	-1.6
	Δ85°	+1.0	-0.3	+0.3	+1.3	+0.3	+3.2
QUV – 40 Cycles	ΔL*	0.8	1.5	0.2	0.1	0.5	1.6
	ΔE*	1.0	1.5	0.3	0.2	0.5	1.6
	Δ60°	-0.4	-0.7	+0.1	-0.2	+0.1	-2.3
	Δ85°	+0.4	-0.5	+0.8	0.0	+0.5	+1.3

After 1000 hours exposure in the Xenon Arc Weatherometer (ASTM G 26), PRC-DeSoto (Courtaulds) exhibited the greatest change of color. The loss of 60° gloss was more than the other test systems in this matrix with the exception of SPT. Following 40 cycles in the QUV (ASTM G 53), PRC-DeSoto (Courtaulds) showed the greatest color difference with the exception of SPT, which is known to have poor color stability in the field. SPT also exhibited the greatest loss of gloss at 60° and the greatest increase of gloss at 85°.

The laboratory artificial weathering predicted the fading and gloss loss of the PRC-DeSoto (Courtaulds) system. The other systems tested were nearly equivalent to each other and marginally better than the GSA control and the "unacceptable" SPT.

The desirability index ranks US Paints the best overall and best appearance attribute, which seems to be the observation of this flight testing. The ranking of PRC-DeSoto (Courtaulds) next with a high appearance attribute seems at odds with artificial weathering data, but the initial appearance was very good, for both laboratory testing and when applied at the ALC. The desirability of the other test coatings were ranked nearly equal, which appears to be appropriate after flight testing.

9.0 CONCLUSIONS

All of the tested paint systems have shown significantly improved weatherability over TT-P-2756, Self-Priming Topcoat. Casual observation noted that other KC-135s assigned to these same bases display a "patch work quilt" appearance.

Each coating system tested provided equal or improved protection against corrosion compared with the control coating system. The integrity of each coating system tested was equal or greater than the control coating system. The appearance of each coating system tested, with the exception of PRC-DeSoto, exhibited equal or greater stability of gloss and color than the control coating system.

US Paints system has endured the greatest exposure time of this test matrix and appears to perform better than the Deft control. Sherwin-Williams presents a better appearance than the control, but has been subjected to fewer months of exposure. Presently the Deft APC coating system offers promise, but the control performed equally with similar exposure and is known fade with additional exposure.

At this time US Paints has shown improved performance over the control. Sherwin-Williams may offer improved resistance to weathering over the Deft control and the others appear to be equal to the control at this time. Experience has shown exposure of 18 to 24 months is required to differentiate between coating systems.

Additional evaluations of these coating systems would be valuable to track weatherability as a function of time, flight hours, and missions. It is recommended that these inspections be continued at yearly intervals.

APPENDIX I

Painted McClellan AFB, September 1997, LEFT SIDE

KC-135, Tail No. 64-14832

Location		Sep-97			Jul-98			Jan-99		
		initial L*	initial a*	initial b*	test L*	test a*	test b*	test L*	test a*	test b*
Left Wing, Upper Surface	43	49.479	-1.273	-3.716	49.552	-1.480	-3.367	52.170	-1.600	-3.870
	44				49.725	-1.496	-3.979	51.770	-1.590	-3.110
	45				48.770	-1.447	-2.204	52.420	-1.600	-3.900
	46	49.675	-1.320	-3.860	48.554	-1.344	-3.315	52.790	-2.230	-3.360
	40				51.067	-1.594	-4.015	51.930	-1.620	-3.670
	39				50.686	-1.631	-4.129	54.000	-1.730	-3.860
	38				50.369	-1.595	-4.273	53.610	-1.730	-4.030
	37				49.883	-1.549	-4.167	53.740	-1.690	-4.050
	36				50.199	-1.529	-4.158	53.630	-1.680	-4.010
LH Motors	35				49.434	-1.422	-3.916	53.630	-1.680	-4.010
	49	49.922	-1.330	-3.884	48.876	-1.328	-3.608	48.730	-1.340	-3.760
Left Fuselage	50				49.316	-1.349	-3.813	49.100	-1.310	-3.850
	32	49.828	-1.313	-3.684	49.037	-1.287	-3.720	51.870	-2.150	-3.620
	31	49.439	-1.234	-3.745	48.887	-1.319	-3.721	48.980	-1.450	-3.880
	34									
	33	49.822	-1.289	-3.755	48.754	-1.292	-3.731	48.640	-1.320	-3.870
	42							52.580	-1.660	-4.040
	41				48.509	-1.285	-3.470	49.960	-1.430	-3.850
	30				49.142	-1.310	-3.750	49.400	-1.380	-3.870
	29				48.844	-1.290	-3.703	49.400	-1.380	-3.870
	28				48.463	-1.221	-3.589	48.810	-1.340	-3.950
	27	49.822	-1.289	-3.755	48.646	-1.239	-3.632	48.310	-1.280	-3.670
	47									
	48				48.227	-1.228	-3.044			
Average		49.712	-1.293	-3.771	49.336	-1.400	-3.713	51.145	-1.577	-3.803
Left Wing		49.577	-1.297	-3.788	49.867	-1.518	-3.734	52.896	-1.719	-3.762
Left Fuselage		49.728	-1.281	-3.735	48.783	-1.282	-3.617	49.705	-1.470	-3.847

Initial values obtained from witness panels

Painted McClellan AFB, September 97, LEFT SIDE

KC-135, Tail No. 64-14832

		7/98-initial				1/99-7/98				1/99-initial			
Location		delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*
Left Wing, Upper Surface	43	0.073	-0.207	0.349	0.412	2.618	-0.120	-0.503	2.669	2.691	-0.207	-0.154	2.703
	44	0.246	-0.223	-0.263	0.424	2.045	-0.094	0.869	2.224	2.291	-0.317	0.606	2.391
	45	-0.709	-0.174	1.512	1.679	3.650	-0.153	-1.696	4.028	3.115	-0.327	-0.184	3.138
	46	-1.121	-0.024	0.545	1.247	4.236	-0.886	-0.045	4.328	3.115	-0.910	0.190	3.251
	40	1.392	-0.274	-0.155	1.427	0.863	-0.026	0.345	0.930	1.392	-0.300	0.190	1.437
	39	1.011	-0.311	-0.269	1.091	3.314	-0.099	0.269	3.326	4.325	-0.410	0.000	4.344
	38	0.694	-0.275	-0.413	0.853	3.241	-0.135	0.243	3.253	3.935	-0.410	-0.170	3.960
	37	0.208	-0.229	-0.307	0.436	3.857	-0.141	0.117	3.861	4.065	-0.370	-0.190	4.086
	36	0.524	-0.209	-0.298	0.638	3.431	-0.151	0.148	3.438	3.955	-0.360	-0.150	3.974
LH Motors	35	-0.488	-0.092	-0.032	0.498	4.196	-0.258	-0.094	4.205	3.708	-0.350	-0.126	3.727
	49	-1.046	0.002	0.276	1.082	-0.146	-0.012	-0.152	0.211	-1.192	-0.010	0.124	1.198
Left Fuselage	50	-0.512	-0.036	-0.129	0.529	-0.216	0.039	-0.037	0.223	-0.728	0.003	-0.166	0.747
	32	-0.791	0.026	-0.036	0.792	2.833	-0.863	0.100	2.963	-0.459	-0.837	0.064	0.957
	31	-0.552	-0.085	0.024	0.559	0.093	-0.131	-0.159	0.226	-0.459	-0.216	-0.135	0.525
	34												
	33	-1.068	-0.003	0.024	1.068	-0.114	-0.028	-0.139	0.182	-1.182	-0.031	-0.115	1.188
	42									2.758	-0.371	-0.285	2.797
	41	-1.313	0.004	0.285	1.344	1.451	-0.145	-0.380	1.507	0.138	-0.141	-0.095	0.219
	30	-0.680	-0.021	0.005	0.680	0.258	-0.070	-0.120	0.293	-0.422	-0.091	-0.115	0.447
	29	-0.978	-0.001	0.052	0.979	0.556	-0.090	-0.167	0.587	-0.422	-0.091	-0.115	0.447
	28	-1.359	0.068	0.166	1.371	0.347	-0.119	-0.361	0.515	-1.012	-0.051	-0.195	1.032
	27	-1.176	0.050	0.123	1.183	-0.336	-0.041	-0.038	0.341	-1.512	0.009	0.085	1.514
	47												
	48	-1.595	0.061	0.711	1.747								
Average		-0.440	-0.093	0.103	0.954	1.809	-0.176	-0.090	1.965	1.338	-0.276	-0.045	2.099
Left Wing		0.258	-0.214	0.078	0.912	3.028	-0.201	-0.028	3.117	3.209	-0.401	0.015	3.254
Left Fuselage		-1.002	0.006	0.123	1.025	0.541	-0.161	-0.145	0.760	-0.330	-0.182	-0.107	0.987

Initial values obtained from witness panels

Painted McClellan AFB, September 97, LEFT SIDE

KC-135, Tail No. 64-14832

Location		9/97 initial DFT mils	7/98 test DFT mils	1/99 test DFT mils	9/97 initial 60 degree Gloss	7/98 test 60 degree Gloss	1/99 test 60 degree Gloss	total delta 60 degree Gloss	9/97 initial 85 degree Gloss	7/98 test 85 degree Gloss	1/99 test 85 degree Gloss	total delta 85 degree Gloss
Left Wing, Upper Surface	43	1.8	4.0	3.1	2.0	1.5	1.7	-0.3	1.9	3.4	4.1	2.2
	44		6.7	5.6		1.2	1.4	-0.6		2.7	3.9	2.0
	45		4.0	4.5		1.3	1.6	-0.4		2.8	3.5	1.6
	46	5.1	4.3	3.4	2.6	1.4	1.6	-1.0	3.1	1.2	4.0	0.9
	40		4.1	3.4		1.9	1.4	-1.2		3.6	4.0	0.9
	39		4.8	4.0		1.3	1.3	-1.3		3.0	3.1	0.0
	38		3.7	6.2		1.3	1.3	-1.3		3.5	2.8	-0.3
	37		5.6	4.6		1.3	1.5	-1.1		3.1	3.2	0.1
	36		4.2	4.9		1.3	1.5	-1.1		3.2	2.9	-0.2
	35		4.4	4.1		1.7	1.6	-1.0		3.0	2.4	-0.7
LH Motors	49		10.7	9.6	2.5	0.9	2.8	1.9	3.3	3.8	3.2	-0.1
	50		13.1	10.7		0.8	~~11*~~			3.9	5.3	2.0
Left Fuselage	32	3.3	5.5	5.4	1.7	2.2	1.9	0.2	1.5	3.6	2.4	-1.2
	31	3.6	3.5	12.4	2.0	2.2	2.1	-0.1	1.6	3.2	2.6	1.0
	34											
	33	2.9	3.5	5.3	1.7	2.3	2.6	0.9	1.9	3.4	3.2	1.3
	42		4.4	5.2		1.6	3.2	1.5		2.5	2.7	0.8
	41		4.9	4.9		1.5	~~8*~~			3.2	3.8	1.9
	30		3.5	4.4		2.3	2.1	0.4		4.4	3.6	1.7
	29		4.0	3.3		2.2	1.9	0.2		3.5	3	1.1
	28		3.6	3.1		2.1	2.2	0.5		3.0	3.1	1.2
	27	3.8	4.0	3.0	1.6	2.3	1.6	0.0	1.8	3.6	2.5	0.7
	47		3.4			1.9				4.5		
	48		3.3			2.2				3.6		
Average		3.4	5.1	5.3	2.0	1.6	1.8	-0.2	2.2	3.2	3.3	0.8
Wing		3.5	4.6	4.4	2.3	1.4	1.5	-0.9	2.5	3.0	3.4	0.7
Fuselage		3.4	4.0	5.2	1.8	2.1	2.2	0.5	1.7	3.5	3.0	0.9

Initial values obtained from witness panels
DFT = Dry Film Thickness

Appendix I

KC-135, Tail Number 64-14832

Courtaulds -- (Right Side)

	1	Fuselage		2	Fuselage		3	Fuselage		4	Leading Edge		5	Wing Tip		?	Upper Wing 3&4 Engines	
		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test
Pencil Hardness		F	2H		F	2H		F	H		F	2H		B	H		-	2H
Modified PATTI		784 psi	597 psi		1274 psi	1144 psi		1470 psi	1343 psi		1176 psi	746 psi		686 psi	1194 psi		-	995 psi
Failure Mode: AG			5 %			5 %			15 %			45 %			55 %			45 %
AP			10 %															
ATP																		
CP																		
CT			85 %			95 %			85 %			55 %			45 %			55 %
Wet Tape		Pass	-		Pass	-		Pass	-		Pass	-		Pass	-		-	-
	1	Wing Tip		2	Wing		3	Wing		4	Wing		5	Fuselage		?		
Chalking		Moderate (8*)	4		Moderate (8*)	4		Moderate (8*)	4		Moderate (8*)	4		Moderate (8*)	4			

Deft -- (Left Side)

	6	Fuselage		7	Fuselage		8	Fuselage		9	Leading Edge		10	Wing Tip		?	Upper Wing 1&2 Engines	
		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test		7/98 test	1/99 test
Pencil Hardness		2H	2H		2H	2H		2H+	2H		H	H		2H+	2H		-	2H
Modified PATTI		1764 psi	1293 psi		1764 psi	1293 psi		1764 psi	1443 psi		1862 psi	1493 psi		1225 psi	1493 psi		-	1493 psi
Failure Mode: AG			5 %			20 %			15 %			25 %			20 %			35 %
AP						75 %												
ATP																		
CP			75 %															
CT			20 %			5 %			85 %			75 %			80 %			65 %
Wet Tape		Pass	-		Pass	-		Pass	-		Pass	-		Pass	-		-	-
	1	Wing Tip		2	Wing		3	Wing		4	Wing		5	Fuselage		?		
Chalking		None	6		None	5		None	6		None	8		None	8			

Right Side - Courtaulds
Left Side - Deft
Pencil Hardness (Soft to Hard): 5b-4b-3b-2b-b-Hb-F-H-2H-3H-4H-5H-6H-7H-8H-9H

* = ASTM D 659 Photographic Reference Standard

AG = Adhesion of glue to stud or topcoat
AP = Adhesion of Primer to substrate
ATP = Adhesion of Topcoat to Primer
CP = Cohesion of Primer
CT = Cohesion of Topcoat

Appendix I

APPENDIX II

Painted McClellan AFB, September 97, RIGHT SIDE

KC-135, Tail No. 64-14832

Location		9/97 initial DFT mils	7/98 test DFT mils	1/99 test DFT mils	9/97 initial 60 degree Gloss	7/98 test 60 degree Gloss	1/99 test 60 degree Gloss	total delta 60 degree Gloss	9/97 initial 85 degree Gloss	7/98 test 85 degree Gloss	1/99 test 85 degree Gloss	total delta 85 degree Gloss
Right Wing, Upper Surface	3		3.5	4.6		0.9	1.0	0.1		5.5	5.6	2.3
	4	1.6	3.8	3.0	0.9	0.9	0.9	0.0	3.3	5.6	4.9	1.6
	5		3.4	4.0		0.8	0.9	0.0		4.5	4.2	0.9
	6		3.6	3.1		0.9	0.9	0.0		3.8	4.4	1.1
	7		4.9	3.2		0.9	0.9	0.0		4.3	4.8	1.5
	8		4.9	2.5		0.9	1.2	0.3		5.6	4.3	1.0
	9		4.0	4.2		1.0	0.9	0.0		5.0	4.6	1.3
	10		3.2	4.0		0.9	1.0	0.1		4.4	3.7	0.4
	11		3.7	4.2		1.1	1.0	0.1		4.6	3.8	0.5
RH Motors	14		10.2	4.3		2.3	1.0	0.1		3.5	3.2	0.2
	15		9.4	11.3	0.9	2.7	1.9	1.0	3.0	3.5	4.8	1.8
Right Fuselage	19	5.1	5.5	4.1	0.8	0.8	0.9	0.1	3.7	3.8	3.9	0.2
	18	4.6	5.8	3.2	0.9	0.8	1.2	0.3	3.1	3.7	4.1	1.0
	17	4.5	3.9	4.7	0.9	0.8	1.2	0.3	3.5	3.4	4.5	1.0
	16		3.7	3.2		0.8	3.1	2.2		3.5	4.9	1.4
	12	3.8	3.7	4.9	0.9	0.7	2.7	1.8	3.1	0.9	4.5	1.4
	13		4.1	3.3		0.8	1.3	0.4		3.9	3.4	0,3
	20	5.1	3.1	3.1	0.8	0.8	1.1	0.3	3.4	3.3	4.2	0.8
	21	3.2	4.3	2.4	0.9	0.8	1.2	0.3	3.5	3.3	4.4	0.9
	23	4.2	3.5	3.0	0.9	0.8	2.4	1.5	2.1	3.9	3.7	1.6
	22	3.3	4.3	2.7	0.8	1.0	1.0	0.2	2.4	2.7	3.3	0.9
Average		3.9	4.6	4.0	0.9	1.0	1.3	0.4	3.1	3.9	4.2	1.1
Wing		1.6	3.9	3.6	0.9	0.9	1.0	0.1	3.3	4.8	4.5	1.2
Fuselage		4.2	4.2	3.5	0.9	0.8	1.6	0.7	3.1	3.2	4.1	1.0

Initial values obtained from witness panels
DFT = Dry Film Thickness

Appendix II

Painted McClellan AFB, September 97, RIGHT SIDE

KC-135, Tail No. 64-14832

Location		Sep-97			Jul-98			Jan-99		
		initial L*	initial a*	initial b*	test L*	test a*	test b*	test L*	test a*	test b*
Right Wing, Upper Surface	3				51.514	-2.031	-3.226	52.170	-1.600	-3.870
	4	48.557	-1.616	-4.027	51.885	-2.203	-3.774	53.310	-2.240	-2.860
	5				50.526	-2.014	-3.065	53.240	-2.280	-3.570
	6				51.664	-2.067	-3.564	51.290	-1.990	-3.800
	7				52.042	-2.150	-3.760	54.180	-2.310	-3.610
	8				52.385	-2.177	-3.794	53.220	-2.300	-3.690
	9				52.418	-2.252	-3.963	53.600	-2.300	-3.680
	10				53.209	-2.243	-3.800	54.010	-2.300	-3.690
	11				52.412	-2.219	-3.871	54.290	-2.270	-3.590
RH Motors	14				49.007	-1.804	-3.687	53.110	-2.150	-3.700
	15	48.617	-1.585	-4.230	50.091	-1.976	-3.853	48.870	-1.320	-3.780
Right Fuselage	19	48.897	-1.667	-4.106	49.201	-1.828	-3.723	52.490	-2.190	-3.590
	18	48.830	-1.633	-4.144	48.979	-1.849	-3.843	52.930	-2.250	-3.610
	17	48.931	-1.587	-4.108	49.718	-1.959	-3.860	53.390	-2.270	-3.500
	16				49.102	-1.851	-3.791	53.820	-2.210	-3.520
	12	48.644	-1.572	-4.159	51.309	-2.247	-3.794	50.490	-1.510	-4.070
	13				51.478	-2.213	-3.927	54.190	-2.280	-3.360
	20	48.888	-1.566	-4.159	49.995	-1.912	-3.874	53.290	-2.190	-3.390
	21	48.884	-1.535	-4.211	49.896	-1.858	-3.791	52.300	-2.140	-3.720
	23	48.778	-1.636	-4.040	48.670	-1.778	-3.837	51.590	-1.940	-3.550
	22	48.735	-1.671	-4.100	48.829	-1.736	-3.787	48.310	-1.280	-3.670
Average		48.776	-1.607	-4.128	50.682	-2.017	-3.742	52.576	-2.063	-3.610
Right Wing		48.557	-1.616	-4.027	52.006	-2.151	-3.646	53.257	-2.177	-3.596
Right Fuselag		48.823	-1.608	-4.128	49.718	-1.923	-3.823	52.280	-2.026	-3.598

Initial values obtained from witness panels

Painted McClellan AFB, September, 1997, RIGHT Side

KC-135, Tail No. 64-14832

		7/98-initial				1/99-7/98				1/99-initial			
Location		delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*
Right Wing, Upper Surface	3	2.957	-0.415	0.801	3.092	0.656	0.431	-0.644	1.015	3.613	0.016	0.157	3.616
	4	3.328	-0.587	0.253	3.389	1.425	-0.037	0.914	1.693	4.753	-0.624	1.167	4.934
	5	1.969	-0.398	0.962	2.227	2.714	-0.266	-0.505	2.773	4.683	-0.664	0.457	4.752
	6	3.107	-0.451	0.463	3.174	-0.374	0.077	-0.236	0.449	2.733	-0.374	0.227	2.768
	7	3.485	-0.534	0.267	3.536	2.138	-0.160	0.150	2.149	5.623	-0.694	0.417	5.681
	8	3.828	-0.561	0.233	3.876	0.835	-0.123	0.104	0.850	4.663	-0.684	0.337	4.725
	9	3.861	-0.636	0.064	3.914	1.182	-0.048	0.283	1.216	5.043	-0.684	0.347	5.101
	10	4.652	-0.627	0.227	4.700	0.801	-0.057	0.110	0.811	5.453	-0.684	0.337	5.506
	11	3.855	-0.603	0.156	3.905	1.878	-0.051	0.281	1.900	5.733	-0.654	0.437	5.787
RH Motors	14	0.390	-0.219	0.543	0.703	4.103	-0.346	-0.013	4.118	4.493	-0.565	0.530	4.559
	15	1.474	-0.391	0.377	1.571	-1.221	0.656	0.073	1.388	0.253	0.265	0.450	0.580
Right Fuselage	19	0.304	-0.161	0.383	0.515	3.289	-0.362	0.133	3.312	3.593	-0.523	0.516	3.667
	18	0.149	-0.216	0.301	0.399	3.951	-0.401	0.233	3.978	4.100	-0.617	0.534	4.180
	17	0.787	-0.372	0.248	0.905	3.672	-0.311	0.360	3.703	4.459	-0.683	0.608	4.552
	16	0.171	-0.264	0.317	0.447	4.718	-0.359	0.271	4.739	4.889	-0.623	0.588	4.963
	12	2.665	-0.675	0.365	2.773	-0.819	0.737	-0.276	1.136	1.846	0.062	0.089	1.849
	13	2.834	-0.641	0.232	2.915	2.712	-0.067	0.567	2.771	5.546	-0.708	0.799	5.648
	20	1.107	-0.346	0.285	1.194	3.295	-0.278	0.484	3.342	4.402	-0.624	0.769	4.512
	21	1.012	-0.323	0.420	1.142	2.404	-0.282	0.071	2.422	3.416	-0.605	0.491	3.504
	23	-0.108	-0.142	0.203	0.270	2.920	-0.162	0.287	2.939	2.812	-0.304	0.490	2.871
	22	0.094	-0.065	0.313	0.333	-0.519	0.456	0.117	0.701	-0.425	0.391	0.430	0.720
Average		1.996	-0.411	0.353	2.142	1.893	-0.045	0.132	1.898	3.890	-0.456	0.485	4.023
Right Wing		3.449	-0.535	0.381	3.535	1.251	-0.026	0.051	1.429	4.700	-0.561	0.431	4.763
Right Fuselage		0.902	-0.321	0.307	1.089	2.562	-0.103	0.225	2.904	3.464	-0.423	0.531	3.647

Initial values obtained from witness panels

APPENDIX III

Painted McClellan AFB, March 98, RIGHT SIDE

KC-135, Tail Number 59-1472

Location		3/98 initial DFT mils	7/98 test DFT mils	1/99 test DFT mils	3/98 initial 60 degree Gloss	7/98 test 60 degree Gloss	1/99 test 60 degree Gloss	total delta 60 degree Gloss	3/98 initial 85 degree Gloss	7/98 test 85 degree Gloss	1/99 test 85 degree Gloss	total delta 85 degree Gloss
Right Wing, Upper Surface	3	4.0	4.1	5.6	1.2	2.0	1.1	-0.9	2.6	2.9	2.9	0.0
	4	2.8	3.2	2.7	1.1	0.9	0.9	0.0	2.3	2.3	2.6	0.3
	5	4.0	2.5	3.7	1.1	1.2	1.1	-0.1	2.3	3.5	2.9	-0.6
	6	4.0	2.9	3.7	1.0	1.0	0.9	-0.1	2.1	2.4	2.5	0.1
	7	3.7	4.0	3.4	1.1	0.8	1.2	0.4	2.4	2.8	3.0	0.2
	8	4.5	4.1	3.7	1.2	1.0	0.9	-0.1	2.5	3.3	2.4	-0.9
	9	5.0	4.2	3.6	1.1	1.0	1.1	0.1	2.5	3.0	2.5	-0.5
	10	3.7	3.1	3.6	1.1	0.8	1.0	0.2	2.5	2.5	2.8	0.3
	11	4.5	3.1	3.3	1.1	1.0	1.9	0.9	2.4	2.5	2.4	-0.1
RH Motors	14	11.5	9.6	11.5	1.0	3.4	0.9	-2.5	2.4	2.9	2.2	-0.7
	15	14.6	8.7	11.1	1.2	5.1	0.9	-4.2	2.7	4.3	2.2	-2.1
Right Fuselage	19	3.7	4.0	3.9	1.2	1.3	0.8	-0.5	2.5	2.6	2.2	-0.4
	18	5.1	3.7	4.7	1.2	1.8	0.9	-0.9	2.6	2.7	2.1	-0.6
	17	5.1	5.2	4.9	1.3	1.9	0.9	-1.0	2.3	3.3	2.1	-1.2
	16	5.1	5.2	4.2	1.2	3.0	0.9	-2.1	2.5	3.4	2.4	-1.0
	12	5.2	4.0	4.5	1.3	0.9	1.2	0.3	2.2	2.8	2.4	-0.4
	13	4.7	5.3	4.8	1.4	1.4	1.1	-0.3	2.2	2.3	2.1	-0.2
	20	5.1	5.4	4.2	1.2	1.6	1.2	-0.4	2.5	2.6	2.2	-0.4
	21	4.4	4.7	4.0	1.3	2.1	1.1	-1.0	2.1	3.0	2.2	-0.8
	23	5.2	5.4	4.9	1.3	1.3	0.9	-0.4	2.1	2.7	2.2	-0.5
	22	4.8	5.0	4.9	1.2	4.4	1.6	-2.8	1.5	2.2	1.9	-0.3
Average		5.3	4.6	4.8	1.2	1.8	1.1	-0.7	2.3	2.9	2.4	-0.5

DFT = Dry Film Thickness

Painted McClellan AFB, March 1998, RIGHT SIDE

KC-135, Tail Number 59-1472

		Mar-98			Jul-98			Jan-99		
Location		initial L*	initial a*	initial b*	test L*	test a*	test b*	test L*	test a*	test b*
Right Wing, Upper Surface	3	49.959	-1.513	-4.086	48.877	-1.485	-4.018	50.060	-1.670	-4.470
	4				49.517	-1.445	-4.003	49.640	-1.640	-4.060
	5				49.022	-1.393	-3.697	49.110	-1.630	-4.390
	6				48.903	-1.412	-4.033	48.960	-1.430	-4.290
	7				49.399	-1.462	-4.123	52.720	-2.010	-4.460
	8				49.269	-1.444	-4.090	53.420	-2.070	-4.450
	9				49.157	-1.455	-4.070	53.940	-2.110	-4.350
	10				48.981	-1.408	-4.017	52.320	-1.960	-4.500
	11				49.041	-1.440	-4.097	49.350	-0.940	-2.750
RH Motors	14				50.384	-1.423	-4.077	49.130	-1.450	-4.260
	15				50.149	-1.415	-4.002	50.060	-1.130	-3.580
Right Fuselage	19				49.927	-1.448	-4.035	49.290	-1.440	-4.340
	18							49.090	-1.550	-4.490
	17				49.870	-1.427	-4.047	48.930	-1.500	-4.260
	16				49.870	-1.427	-4.047	49.050	-1.420	-4.300
	12				49.870	-1.427	-4.047	49.630	-1.580	-4.290
	13				49.870	-1.427	-4.047	52.670	-1.990	-4.190
	20				49.569	-1.416	-3.978	49.020	-1.420	-4.230
	21				49.612	-1.422	-3.878	49.000	-1.440	-4.180
	23				52.502	-0.500	0.300	49.080	-1.360	-4.250
	22				52.568	-0.501	0.251	49.360	-1.110	-3.200
Average		49.959	-1.513	-4.086	49.818	-1.339	-3.588	50.237	-1.564	-4.157
Right Wing					49.130	-1.438	-4.016	51.058	-1.718	-4.191
Right Fuselage					50.406	-1.222	-3.059	49.512	-1.481	-4.173

Painted McClellan AFB, March 98, RIGHT SIDE

KC-135, Tail Number 59-1472

		7/98-initial				1/99-7/98				1/99-initial			
Location		Delta L*	Delta a*	Delta b*	Delta E*	Delta L*	Delta a*	Delta b*	Delta E*	Delta L*	Delta a*	Delta b*	Delta E*
Right Wing, Upper Surface	3	-1.082	0.028	0.068	1.084	1.183	-0.185	-0.452	1.280	0.101	-0.157	-0.384	0.427
	4	-0.442	0.068	0.083	0.455	0.123	-0.195	-0.057	0.237	-0.319	-0.127	0.026	0.344
	5	-0.937	0.120	0.389	1.022	0.088	-0.237	-0.693	0.738	-0.849	-0.117	-0.304	0.909
	6	-1.056	0.101	0.053	1.062	0.057	-0.018	-0.257	0.264	-0.999	0.083	-0.204	1.023
	7	-0.560	0.051	-0.037	0.564	3.321	-0.548	-0.337	3.383	2.761	-0.497	-0.374	2.830
	8	-0.690	0.069	-0.004	0.693	4.151	-0.626	-0.360	4.213	3.461	-0.557	-0.364	3.524
	9	-0.802	0.058	0.016	0.804	4.783	-0.655	-0.280	4.836	3.981	-0.597	-0.264	4.034
	10	-0.978	0.105	0.069	0.986	3.339	-0.552	-0.483	3.419	2.361	-0.447	-0.414	2.438
	11	-0.918	0.073	-0.011	0.921	0.309	0.500	1.347	1.470	-0.609	0.573	1.336	1.576
RH Motors	14	0.425	0.090	0.009	0.435	-1.254	-0.027	-0.183	1.268	-0.829	0.063	-0.174	0.849
	15	0.190	0.098	0.084	0.230	-0.089	0.285	0.422	0.517	0.101	0.383	0.506	0.643
Right Fuselage	19	-0.032	0.065	0.051	0.089	-0.637	0.008	-0.305	0.706	-0.669	0.073	-0.254	0.719
	18									-0.869	-0.037	-0.404	0.959
	17	-0.089	0.086	0.039	0.130	-0.940	-0.073	-0.213	0.967	-1.029	0.013	-0.174	1.044
	16	-0.089	0.086	0.039	0.130	-0.820	0.007	-0.253	0.858	-0.909	0.093	-0.214	0.938
	12	-0.089	0.086	0.039	0.130	-0.240	-0.153	-0.243	0.374	-0.329	-0.067	-0.204	0.393
	13	-0.089	0.086	0.039	0.130	2.800	-0.563	-0.143	2.860	2.711	-0.477	-0.104	2.755
	20	-0.390	0.097	0.108	0.416	-0.549	-0.004	-0.252	0.604	-0.939	0.093	-0.144	0.955
	21	-0.347	0.091	0.208	0.415	-0.612	-0.018	-0.302	0.683	-0.959	0.073	-0.094	0.966
	23	2.543	1.013	4.386	5.170	-3.422	-0.860	-4.550	5.758	-0.879	0.153	-0.164	0.907
	22	2.609	1.012	4.337	5.161	-3.208	-0.609	-3.451	4.751	-0.599	0.403	0.886	1.143
Average		-0.141	0.174	0.498	1.001	0.419	-0.226	-0.552	1.959	0.223	-0.051	-0.071	1.399
Right Wing		-0.829	0.075	0.070	0.843	1.928	-0.280	-0.175	2.204	1.099	-0.205	-0.105	1.901
Right Fuselage		0.447	0.291	1.027	1.308	-0.848	-0.252	-1.079	1.951	-0.447	0.032	-0.087	1.078

Painted McClellan AFB, March 98

KC-135, Tail Number 59-1472

Sherwin-Williams -- (Right Side)

	1 Fuselage		2 Fuselage		3 Fuselage		4 Upper Wing		? Upper Wing 3&4 Engines		5 Upper Wing Tip	
	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test
Pencil Hardness	F	H	F	HB	F	F	2H	2H		2H	2H	2H
Modified PATTI	1274 psi	746 psi	1470 psi	697 psi	1813 psi	697 psi	1862 psi	1691 psi		1592 psi	1078 psi	1393 psi
Failure Mode: AG	40 %		5 %	30 %	10 %	10 %		50 %		40 %	15 %	30 %
AP		100 %		50 %						5 %		
ATP												
CP						60 %						
CT	60 %		95 %	20 %	90 %	30 %	100 %	50 %		55 %	85 %	70 %
Wet Tape	Pass	-	Pass	-	Pass	-	Pass	-		-	Pass	-

	1 Wing Tip		2 Wing		3 Wing		4 Wing		5 Fuselage	
Chalking	None	7	None	7	None	6	None	6	None	6

Spraylat -- (Left Side)

	6 Fuselage		7 Fuselage		8 Fuselage		9 Upper Wing		? Upper Wing 1&2 Engines		10 Upper Wing Tip	
	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test	7/98 test	1/99 test
Pencil Hardness	4B	B	2B	B	2B	B	2B	HB		2H	HB	H
Modified PATTI	490 psi	398 psi	1078 psi	796 psi	1029 psi	945 psi	1421 psi	896 psi		945 psi	882 psi	796 psi
Failure Mode: AG		5 %		10 %	75 %	20 %	10 %	50 %		5 %	5 %	5 %
AP		85 %	45 %	35 %						20 %	5 %	
ATP												
CP												
CT		10 %	55 %	55 %	25 %	80 %	90 %	50 %		75 %	90 %	95 %
Wet Tape	Pass	-	Pass	-	Pass	-	Pass	-		-	Pass	-

	1 Wing Tip		2 Wing		3 Wing		4 Wing		5 Fuselage	
Chalking	None	7	None	6	None	7	None	8	None	8

Pencil Hardness (Soft to Hard): 5b-4b-3b-2b-b-Hb-F-H-2H-3H-4H-5H-6H-7H-8H-9H

Right Side - Sherwin-Williams

Left Side - Spraylat

AG = Adhesion of glue to stud or topcoat

AP = Adhesion of Primer to substrate

ATP = Adhesion of Topcoat to Primer

CP = Cohesion of Primer

CT = Cohesion of Topcoat

Appendix III

APPENDIX IV

KC-135, Tail Number 59-1472

Location		1/98 initial DFT mils	7/98 test DFT mils	1/99 test DFT mils	1/98 initial 60 degree Gloss	7/98 test 60 degree Gloss	1/99 test 60 degree Gloss	total delta 60 degree Gloss	1/98 initial 85 degree Gloss	7/98 test 85 degree Gloss	1/99 test 85 degree Gloss	total delta 85 degree Gloss
Left Wing, Upper Surface	43	3.9	4.0	3.3	1.1	1.9	1.4	-0.5	4.2	5.2	5.4	0.2
	44	3.6	3.4	3.8	1.1	2.0	1.9	-0.1	4.9	6.0	8.0	2.0
	45	2.7	2.6	2.7	1.0	1.4	1.1	-0.3	4.2	4.3	4.0	-0.3
	46	4	2.6	3.3	1.1	2.6	1.2	-1.4	4.8	5.3	4.5	-0.8
	40	3.8	2.8	2.0	1.2	2.8	1.2	-1.6	5.3	5.1	4.5	-0.6
	39	2.7	3.2	2.2	1.2	1.1	1.8	0.7	5.2	5.9	4.5	-1.4
	38	4.6	2.8	3.2	1.2	2.2	1.9	-0.3	5.2	5.9	5.9	0.0
	37	3.9	2.9	3.6	1.1	1.0	0.9	-0.1	4.8	5.5	4.2	-1.3
	36	2.7	2.6	2.6	1.1	1.5	1.0	-0.5	4.6	5.6	4.2	-1.4
	35	4.2	5.8	2.3	1.1	1.0	2.0	1.0	5.0	5.5	4.4	-1.1
LH Motors	49	11	9.7	9.6	1.1	11.2	2.1	-9.1	5.4	7.0	5.6	-1.4
	50	11.6	10.7	9.6	1.1	5.5	1.6	-3.9	5.1	6.2	4.7	-1.5
Left Fuselage	32	6.8	4.4	5.4	1.4	5.4	1.7	-3.7	7.3	7.0	4.6	-2.4
	31	6.4	5.1	5.1	1.2	4.1	1.6	-2.5	5.4	6.6	4.4	-2.2
	34	5.8	4.7		1.2	4.5			4.8	5.8		
	33	4.6	5.8		1.2	2.2			4.5	5.8		
	42	4.2	5.9	5.3	1.0	1.8	2.7	0.9	3.5	4.0	3.7	-0.3
	41	4.5	5.3	2.9	1.0	1.9	2.3	0.4	4.7	5.1	3.9	-1.2
	30	4.3	4.0	3.6	1.0	2.4	1.6	-0.8	3.2	3.5	2.4	-1.1
	29	5.4	4.0	4.3	0.9	1.2	1.3	0.1	1.8	4.9	2.8	-2.1
	28	5.4	4.0	3.8	0.8	0.9	1.8	0.9	0.6	1.3	1.6	0.3
	27	4.4	3.0	3.5	0.9	1.6	1.6	0.0	1.1	2.1	1.9	-0.2
	47		2.7			6.8				3.1		
	48		2.7			1.2				1.7		
Average		5.0	4.5	4.1	1.1	2.7	1.6	-1.0	4.3	5.2	4.3	-0.8
Left Wing		3.61										
Left Fuselage												

DFT = Dry Film Thickness

Painted McClellan AFB, March 1998, LEFT SIDE

KC-135, Tail Number 59-1472

Location		Mar-98			Jul-98			Jan-99		
		initial L*	initial a*	initial b*	test L*	test a*	test b*	test L*	test a*	test b*
Left Wing, Upper Surface	43	49.959	-1.513	-4.086	49.516	-1.090	-3.228	49.040	-0.750	-1.370
	44				49.124	-0.906	-2.073	50.410	-0.570	-1.440
	45				48.800	-1.022	-2.591	49.610	-0.790	-2.590
	46				49.235	-1.089	-3.269	49.850	-1.650	-4.500
	40				50.298	-1.229	-3.661	51.690	-0.840	-2.760
	39				50.112	-1.190	-3.563	50.610	-1.020	-2.690
	38				49.991	-1.206	-3.580	50.870	-1.000	-2.900
	37				49.829	-1.197	-3.498	50.210	-0.900	-2.670
	36				49.602	-1.085	-3.274	49.990	-0.970	-2.720
	35				49.477	-1.030	-3.276	49.990	-0.970	-2.720
LH Motors	49				50.256	-1.146	-3.800	49.850	-0.930	-3.300
	50				50.141	-1.058	-3.663	49.250	-1.480	-4.440
Left Fuselage	32				50.155	-1.057	-3.512	49.880	-0.920	-3.190
	31				50.207	-1.023	-3.515	49.970	-1.650	-4.240
	34				50.207	-1.023	-3.515			
	33				49.902	-0.927	-3.041			
	42				49.503	-0.973	-3.224	51.140	-1.090	-2.980
	41				49.503	-0.973	-3.224	49.260	-0.890	-2.650
	30									
	29				49.382	-1.032	-3.448	49.870	-0.930	-3.200
	28				49.525	-1.162	-3.576	49.130	-1.210	-3.360
	27				49.773	-1.374	-3.831	49.160	-0.920	-3.100
	47				47.156	0.464	1.217			
	48				50.117	-1.002	-3.584			
Average		49.959	-1.513	-4.086	49.644	-1.085	-3.351	49.988	-1.025	-2.991
Left Wing					49.598	-1.104	-3.201	50.227	-0.946	-2.636
Left Fuselage					49.585	-0.917	-3.023	49.773	-1.087	-3.246

Painted McClellan AFB, March 98, LEFT SIDE

KC-135, Tail Number 59-1472

Location		7/98-initial				1/99-7/98				1/99-initial			
		Delta L*	Delta a*	Delta b*	Delta E*	Delta L*	Delta a*	Delta b*	Delta E*	Delta L*	Delta a*	Delta b*	Delta E*
Left Wing, Upper Surface	43	-0.443	0.423	0.858	1.054	-0.476	0.340	1.858	1.948	-0.919	0.763	2.716	2.967
	44	-0.835	0.607	2.013	2.262	1.286	0.336	0.633	1.472	0.451	0.943	2.646	2.845
	45	-1.159	0.491	1.495	1.954	0.810	0.232	0.001	0.843	-0.349	0.723	1.496	1.698
	46	-0.724	0.424	0.817	1.171	0.615	-0.561	-1.231	1.486	-0.109	-0.137	-0.414	0.449
	40	0.339	0.284	0.425	0.613	1.392	0.389	0.901	1.703	1.731	0.673	1.326	2.282
	39	0.153	0.323	0.523	0.633	0.498	0.170	0.873	1.019	0.651	0.493	1.396	1.617
	38	0.032	0.307	0.506	0.593	0.879	0.206	0.680	1.130	0.911	0.513	1.186	1.581
	37	-0.130	0.316	0.588	0.680	0.381	0.297	0.828	0.959	0.251	0.613	1.416	1.563
	36	-0.357	0.428	0.812	0.985	0.388	0.115	0.554	0.686	0.031	0.543	1.366	1.470
	35	-0.482	0.483	0.810	1.059	0.513	0.060	0.556	0.759	0.031	0.543	1.366	1.470
LH Motors	49	0.297	0.367	0.286	0.552	-0.406	0.216	0.500	0.679	-0.109	0.543	0.786	0.962
	50	0.182	0.455	0.423	0.647	-0.891	-0.422	-0.777	1.255	-0.709	0.033	-0.354	0.793
Left Fuselage	32	0.196	0.456	0.574	0.759	-0.275	0.137	0.322	0.445	-0.079	0.593	0.896	1.077
	31	0.248	0.456	0.571	0.772	-0.237	-0.627	-0.725	0.987	0.011	-0.137	-0.154	0.206
	34	0.248	0.490	0.571	0.792								
	33	-0.057	0.586	1.045	1.199								
	42	-0.456	0.540	0.862	1.115	1.637	-0.117	0.244	1.659	1.181	0.423	1.106	1.672
	41	-0.456	0.540	0.862	1.115	-0.243	0.083	0.574	0.629	-0.699	0.623	1.436	1.714
	30												
	29	-0.577	0.481	0.638	0.986	0.488	0.102	0.248	0.557	-0.089	0.583	0.886	1.064
	28	-0.434	0.351	0.510	0.756	-0.395	-0.048	0.216	0.453	-0.829	0.303	0.726	1.143
	27	-0.186	0.139	0.255	0.345	-0.613	0.454	0.731	1.057	-0.799	0.593	0.986	1.401
	47	-2.803	1.977	5.303	6.316								
	48	0.158	0.511	0.502	0.734								
Average		-0.315	0.497	0.924	1.178	0.282	0.072	0.368	1.038	0.029	0.486	1.095	1.472
Left Wing		-0.361	0.409	0.885	1.101	0.629	0.158	0.565	1.201	0.268	0.567	1.450	1.794
Left Fuselage		-0.374	0.593	1.063	1.353	0.052	-0.002	0.230	0.827	-0.186	0.426	0.831	1.183

APPENDIX V

Painted Tinker AFB, May 97, RIGHT SIDE

KC-135, Tail No. 64-14838

Location		1/98 initial DFT mils	7/98 test DFT mils	2/99 test DFT mils	1/98 initial 60 degree Gloss	7/98 test 60 degree Gloss	2/99 test 60 degree Gloss	total delta 60 degree Gloss	1/98 initial 85 degree Gloss	7/98 test 85 degree Gloss	2/99 test 85 degree Gloss	total delta 85 degree Gloss
Right Wing, Upper Surface	3	3.6	3.6	3.3	4.0	3.2	2.7	-1.3	5.7	9.6	8.8	3.1
	4	4.0	3.6	3.8	4.7	4.0	2.9	-1.8	7.9	11.8	11.5	3.6
	5	3.7	2.9	3.5	4.4	3.3	2.0	-2.4	6.5	10.0	5.7	-0.8
	6	4.3	4.5	3.3	4.4	3.7	3.9	-0.5	8.2	11.1	7.4	-0.8
	7	4.1	4.5	4.6	4.7	3.7	1.9	-2.8	7.3	7.7	6.8	-0.5
	8	3.9	4.4	4.3	5.3	3.2	2.2	-3.1	7.0	6.5	6.2	-0.8
	9	3.9	4.3	3.6	4.7	2.6	1.9	-2.8	5.6	5.2	5.6	0.0
	10	4.5	5.0	4.5	5.1	3.1	1.9	-3.2	6.9	6.4	4.5	-2.4
	11	3.0	4.1	3.6	4.5	2.7	1.9	-2.6	6.2	6.3	6.1	-0.1
RH Motors	14	9.5	8.6	9.8	6.7	4.9	2.4	-4.3	6.1	8.3	5.5	-0.6
	15	10.3	10.7	9.7	4.0	3.4	2.5	-1.5	3.9	6.7	6.1	2.2
Right Fuselage	19	5.4	5.5	4.4	4.1	3.0	1.9	-2.2	4.5	3.9	3.7	-0.8
	18	5.7	6.2	4.7	4.7	3.3	1.9	-2.8	4.4	5.2	3.3	-1.1
	17	5.3	5.0	4.0	4.3	2.6	1.8	-2.5	5.9	4.1	4.0	-1.9
	16	5.8	5.0	4.1	7.1	3.6	2.0	-5.1	7.5	6.9	4.8	-2.7
	12	6.4	4.1	6.2	5.8	3.7	1.9	-3.9	6.9	6.9	5.7	-1.2
	13	7.1	8.1	8.0	7.9	4.0	2.4	-5.5	9.5	7.5	8.6	-0.9
	20	5.2	6.9	5.6	6.2	6.1	2.6	-3.6	5.3	10.1	6.5	1.2
	21	5.9	5.5	5.1	5.4	5.6	2.5	-2.9	4.8	8.5	7.3	2,5
	23	6.2	5.5	5.6	8.9	4.9	2.9	-6.0	9.1	9.3	6.5	-2.6
	22	6.1	4.4	5.4	10.4	8.4	2.6	-7.8	10.5	8.6	5.8	-4.7
Average		5.4	5.4	5.1	5.6	4.0	2.3	-3.3	6.7	7.6	6.2	-0.4
Wing		3.9	4.1	3.8	4.6	3.3	2.4	-2.3	6.8	8.3	7.0	0.1
Fuselage		5.9	5.6	5.3	6.5	4.5	2.3	-4.2	6.8	7.1	5.6	-1.2

DFT = Dry Film Thickness

Painted Tinker AFB, May 97, LEFT SIDE

KC-135, Tail No. 64-14838

Location		1/98 initial DFT mils	7/98 test DFT mils	2/99 test DFT mils	1/98 initial 60 degree Gloss	7/98 test 60 degree Gloss	2/99 test 60 degree Gloss	total delta 60 degree Gloss	1/98 initial 85 degree Gloss	7/98 test 85 degree Gloss	2/99 test 85 degree Gloss	total delta 85 degree Gloss
Left Wing, Upper Surface	43	5.9	5.7	2.9	4.1	3.2	2.3	-1.8	9.8	6.0	6.9	-2.9
	44	3.1	5.7	3.2	4.5	3.6	3.2	-1.3	7.6	10.4	12.0	4.4
	45	2.6	3.0	2.5	3.8	3.7	2.3	-1.5	9.0	12.3	7.1	-1.9
	46	2.9	3.0	2.5	3.8	3.7	2.2	-1.6	5.0	9.4	7.8	2.8
	40	2.8	2.3	2.2	4.0	2.4	1.6	-2.4	5.3	5.4	5.3	0.0
	39	2.5	2.6	1.9	4.0	2.5	2.1	-1.9	5.1	5.8	7.7	2.6
	38	2.8	2.8	2.4	4.6	2.6	1.8	-2.8	6.4	6.2	6.0	-0.4
	37	2.8	2.7	2.5	4.4	2.6	1.8	-2.6	5.3	5.7	4.9	-0.4
	36	3.4	3.6	3.3	4.7	2.9	1.9	-2.8	5.8	6.4	5.9	0.1
	35	3.6	4.0	3.4	5.8	3.1	2.2	-3.6	7.9	6.9	2.8	-5.1
LH Motors	49	9.0	10.0	9.2	4.6	3.9	2.3	-2.3	5.1	6.4	5.6	0.5
	50	9.8	10.0	10.7	3.8	3.1	2.0	-1.8	4.2	5.8	4.7	0.5
Left Fuselage	32	3.6	4.3	4.0	3.8	3.5	2.0	-1.8	4.8	5.9	3.2	-1.6
	31	4.0	4.0	4.1	4.0	3.0	2.5	-1.5	4.5	4.6	4.5	0.0
	34	3.2	4.3	4.0	4.0	3.1	1.8	-2.2	4.4	5.2	3.2	-1.2
	33	4.3	5.0	5.7	4.3	3.8	2.8	-1.5	4.5	5.0	5.5	1.0
	42	5.9	5.7	5.5	5.7	2.8	2.1	-3.6	6.0	4.3	5.2	-0.8
	41	5.0	6.0	5.6	5.9	3.4	1.8	-4.1	5.6	6.4	3.8	-1.8
	30	3.0	3.5	3.6	3.9	2.8	1.9	-2.0	3.9	2.9	3.7	-0.2
	29	4.5	4.0	4.0	3.1	2.9	1.7	-1.4	3.4	3.3	2.4	-1.0
	28	3.4	3.7	4.6	4.5	5.3	2.1	-2.4	5.2	5.6	3.6	-1.6
	27	3.4	3.5	4.2	3.8	3.7	2.5	-1.3	5.9	5.3	5.2	-0.7
	47		2.3		6.2	5.0			8.9	6.3		
	48		2.2		3.5	3.1			7.4	5.3		
Average		4.2	4.5	4.2	4.3	3.3	2.1	-2.2	5.7	6.1	5.3	-0.4
Wing		3.2	3.5	2.7	4.4	3.0	2.1	-2.2	6.7	7.5	6.6	-0.1
Fuselage		4.0	4.0	4.5	4.4	3.5	2.1	-2.2	5.4	5.0	4.0	-0.8

DFT = Dry Film Thickness

Painted Tinker AFB, May 97, RIGHT SIDE

KC-135, Tail No. 64-14838

Location		Jan-98 initial L*	Jan-98 initial a*	Jan-98 initial b*	Jul-98 test L*	Jul-98 test a*	Jul-98 test b*	Feb-99 test L*	Feb-99 test a*	Feb-99 test b*
Right Wing, Upper Surface	3	49.331	-1.368	-3.818	49.254	-1.522	-3.911	51.440	-1.940	-4.260
	4	49.316	-1.368	-3.696	48.319	-1.579	-3.692	52.880	-1.940	-4.060
	5	48.665	-1.347	-3.645	48.614	-1.697	-3.792	51.940	-1.970	-4.330
	6				48.757	-1.582	-3.799	52.100	-1.980	-4.390
	7	49.952	-1.472	-3.931	51.517	-1.859	-4.222	52.300	-1.940	-4.130
	8	50.018	-1.375	-3.806	51.653	-1.816	-4.386	51.700	-1.880	-4.080
	9	49.716	-1.422	-3.812	51.458	-1.810	-4.220	51.940	-1.880	-4.100
	10	49.875	-1.393	-3.758	51.465	-1.846	-4.322	52.720	-1.920	-4.100
	11				51.613	-1.866	-4.331	54.260	-2.040	-4.270
RH Motors	14	50.157	-1.393	-3.640	50.096	-1.574	-4.158	53.180	-2.100	-4.510
	15	49.895	-1.375	-3.744	49.904	-1.603	-4.240	55.210	-2.290	-4.420
Right Fuselage	19	49.821	-1.350	-3.648	50.674	-1.692	-4.183	52.730	-2.030	-4.300
	18	49.844	-1.353	-3.664	50.673	-1.705	-4.118	53.790	-2.130	-4.550
	17	49.844	-1.313	-3.674	50.679	-1.780	-4.288	54.050	-2.080	-4.390
	16	49.895	-1.375	-3.744	50.565	-1.811	-4.337	54.070	-2.090	-4.350
	12	49.884	-1.364	-3.628	51.488	-1.882	-4.263	54.220	-2.030	-4.070
	13	50.157	-1.393	-3.640	51.488	-1.882	-4.263	54.300	-2.060	-4.180
	20	49.801	-1.363	-3.652	50.960	-1.764	-4.185	54.280	-2.040	-4.350
	21	49.801	-1.363	-3.652	51.077	-1.789	-4.171	53.280	-2.010	-4.390
	23	50.198	-1.364	-3.533	51.077	-1.789	-4.171	53.460	-2.080	-4.490
	22	49.803	-1.378	-3.573	51.260	-1.775	-4.153	51.550	-1.800	-4.280
Average		49.788	-1.375	-3.698	50.643	-1.746	-4.162	53.114	-2.011	-4.286
Right Wing		49.553	-1.392	-3.781	50.294	-1.731	-4.075	52.364	-1.943	-4.191
Right Fuselage		49.671	-1.396	-3.755	50.388	-1.737	-4.102	52.558	-1.961	-4.219

Painted Tinker AFB, May 97, RIGHT SIDE

KC-135, Tail No. 64-14838

		7/98-initial				2/99-7/98				2/99-initial			
Location		delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*
Right Wing, Upper Surface	3	-0.077	-0.154	-0.093	0.196	2.186	-0.418	-0.349	2.253	2.109	-0.572	-0.442	1.046
	4	-0.997	-0.211	0.004	1.019	4.561	-0.361	-0.368	4.590	3.564	-0.572	-0.364	1.621
	5	-0.051	-0.350	-0.147	0.383	3.326	-0.273	-0.538	3.380	3.275	-0.623	-0.685	1.402
	6					3.343	-0.398	-0.591	3.418				
	7	1.565	-0.387	-0.291	1.638	0.783	-0.081	0.092	0.793	2.348	-0.468	-0.199	1.297
	8	1.635	-0.441	-0.580	1.790	0.047	-0.064	0.306	0.316	1.682	-0.505	-0.274	0.950
	9	1.742	-0.388	-0.408	1.831	0.482	-0.070	0.120	0.502	2.224	-0.458	-0.288	1.216
	10	1.590	-0.453	-0.564	1.747	1.255	-0.074	0.222	1.277	2.845	-0.527	-0.342	1.406
	11					2.647	-0.174	0.061	2.653				
RH Motors	14	-0.061	-0.181	-0.518	0.552	3.084	-0.526	-0.352	3.148	3.023	-0.707	-0.870	1.202
	15	0.009	-0.228	-0.496	0.546	5.306	-0.687	-0.180	5.353	5.315	-0.915	-0.676	1.930
Right Fuselage	19	0.853	-0.342	-0.535	1.063	2.056	-0.338	-0.117	2.087	2.909	-0.680	-0.652	1.256
	18	0.829	-0.352	-0.454	1.009	3.117	-0.425	-0.432	3.175	3.946	-0.777	-0.886	1.511
	17	0.835	-0.467	-0.614	1.137	3.371	-0.300	-0.102	3.386	4.206	-0.767	-0.716	1.650
	16	0.670	-0.436	-0.593	0.995	3.505	-0.279	-0.013	3.516	4.175	-0.715	-0.606	1.689
	12	1.604	-0.518	-0.635	1.801	2.732	-0.148	0.193	2.743	4.336	-0.666	-0.442	1.797
	13	1.331	-0.489	-0.623	1.549	2.812	-0.178	0.083	2.819	4.143	-0.667	-0.540	1.713
	20	1.159	-0.401	-0.533	1.337	3.320	-0.276	-0.165	3.336	4.479	-0.677	-0.698	1.762
	21	1.276	-0.426	-0.519	1.442	2.203	-0.221	-0.219	2.225	3.479	-0.647	-0.738	1.447
	23	0.879	-0.425	-0.638	1.166	2.383	-0.291	-0.319	2.422	3.262	-0.716	-0.957	1.261
	22	1.457	-0.397	-0.580	1.618	0.290	-0.025	-0.127	0.318	1.747	-0.422	-0.707	0.786
Average		0.855	-0.371	-0.464	1.201	2.515	-0.267	-0.133	2.558	3.319	-0.636	-0.583	1.418
Right Wing		0.772	-0.341	-0.297	1.229	2.070	-0.213	-0.116	2.131	2.578	-0.532	-0.371	1.277
Right Fuselage		1.089	-0.425	-0.572	1.312	2.579	-0.248	-0.122	2.603	3.668	-0.673	-0.694	1.487

Painted Tinker AFB, May 97, LEFT SIDE

KC-135, Tail No. 64-14838

Location		Jan-98 initial L*	Jan-98 initial a*	Jan-98 initial b*	Jul-98 test L*	Jul-98 test a*	Jul-98 test b*	Feb-99 test L*	Feb-99 test a*	Feb-99 test b*
Left Wing, Upper Surface	43	48.803	-1.456	-3.990	49.037	-1.680	-4.018	50.480	-1.840	-4.120
	44	48.710	-1.433	-3.823	48.649	-1.581	-3.858	52.110	-2.040	-4.390
	45	47.816	-1.398	-3.671	49.126	-1.705	-4.159	52.170	-2.010	-4.380
	46	48.289	-1.299	-3.432	48.916	-1.632	-4.046	50.410	-1.810	-4.060
	40	49.930	-1.459	-3.995	51.774	-1.856	-4.429	51.680	-1.880	-4.030
	39	50.312	-1.452	-4.051	51.997	-1.981	-4.229	52.690	-1.950	-4.120
	38	50.048	-1.435	-4.012	51.614	-1.839	-4.340	53.350	-1.990	-4.140
	37	50.187	-1.443	-3.916	51.919	-1.872	-4.420	52.290	-1.850	-4.200
	36	50.187	-1.443	-3.916	51.210	-1.822	-4.404	52.220	-1.890	-4.240
	35	50.125	-1.410	-3.797	51.214	-1.779	-4.397	53.800	-2.040	-4.260
LH Motors	49	49.439	-1.335	-3.675	49.435	-1.533	-4.161	55.210	-2.290	-4.420
	50	49.502	-1.314	-3.668	49.672	-1.632	-4.297	51.760	-1.970	-4.550
Left Fuselage	32	50.100	-1.358	-3.777	50.491	-1.677	-4.288	52.190	-1.960	-4.460
	31	50.026	-1.350	-3.738	50.642	-1.742	-4.287	51.860	-1.980	-4.360
	34	49.845	-1.342	-3.719	51.064	-1.849	-4.378	52.670	-1.950	-4.430
	33	49.945	-1.347	-3.639	50.817	-1.783	-4.226	51.620	-1.910	-4.440
	42	49.865	-1.370	-3.684	51.241	-1.789	-4.177	54.870	-2.210	-4.510
	41	49.690	-1.387	-3.768	51.354	-1.780	-4.151	53.820	-2.170	-4.520
	30	49.759	-1.401	-3.753	51.574	-1.920	-4.469	50.510	-1.950	-4.260
	29	49.669	-1.350	-3.649	51.227	-1.882	-4.397	52.430	-1.980	-4.500
	28	49.481	-1.313	-3.633	51.015	-1.814	-4.345	53.440	-2.160	-4.550
	27	49.458	-1.338	-3.725	50.743	-1.790	-4.377	54.070	-2.220	-4.630
	47	49.439	-1.335	-3.675	46.427	-1.275	-3.105			
	48	49.502	-1.314	-3.668	47.848	-1.296	-3.301			
Average		49.589	-1.378	-3.766	50.375	-1.730	-4.177	52.530	-2.002	-4.344
Left Wing		49.441	-1.423	-3.860	50.546	-1.775	-4.230	52.120	-1.930	-4.194
Left Fuselage		49.732	-1.350	-3.702	50.370	-1.716	-4.125	52.748	-2.049	-4.466

Painted Tinker AFB, May 97, LEFT SIDE

KC-135, Tail No. 64-14838

		7/98-initial				2/99-7/98				2/99-initial			
Location		delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*	delta L*	delta a*	delta b*	delta E*
Left Wing, Upper Surface	43	0.234	-0.224	-0.028	0.325	1.443	-0.160	-0.102	1.455	1.677	-0.384	-0.130	1.725
	44	-0.061	-0.148	-0.035	0.164	3.461	-0.459	-0.532	3.532	3.400	-0.607	-0.567	3.500
	45	1.310	-0.307	-0.488	1.431	3.044	-0.305	-0.221	3.067	4.354	-0.612	-0.709	4.454
	46	0.627	-0.333	-0.614	0.939	1.494	-0.178	-0.014	1.505	2.121	-0.511	-0.628	2.270
	40	1.844	-0.397	-0.434	1.936	-0.094	-0.024	0.399	0.411	1.750	-0.421	-0.035	1.800
	39	1.685	-0.529	-0.178	1.775	0.693	0.031	0.109	0.702	2.378	-0.498	-0.069	2.431
	38	1.566	-0.404	-0.328	1.650	1.736	-0.151	0.200	1.754	3.302	-0.555	-0.128	3.351
	37	1.732	-0.429	-0.504	1.854	0.371	0.022	0.220	0.432	2.103	-0.407	-0.284	2.161
	36	1.023	-0.379	-0.488	1.195	1.010	-0.068	0.164	1.025	2.033	-0.447	-0.324	2.107
	35	1.089	-0.369	-0.600	1.297	2.586	-0.261	0.137	2.603	3.675	-0.630	-0.463	3.757
LH Motors	49	-0.004	-0.198	-0.486	0.525	5.775	-0.757	-0.259	5.830	5.771	-0.955	-0.745	5.897
	50	0.170	-0.318	-0.629	0.725	2.088	-0.338	-0.253	2.130	2.258	-0.656	-0.882	2.511
Left Fuselage	32	0.391	-0.319	-0.511	0.718	1.699	-0.283	-0.172	1.731	2.090	-0.602	-0.683	2.280
	31	0.616	-0.392	-0.549	0.914	1.218	-0.238	-0.073	1.243	1.834	-0.630	-0.622	2.037
	34	1.219	-0.507	-0.659	1.476	1.606	-0.101	-0.052	1.610	2.825	-0.608	-0.711	2.976
	33	0.872	-0.436	-0.587	1.138	0.803	-0.127	-0.214	0.841	1.675	-0.563	-0.801	1.940
	42	1.376	-0.419	-0.493	1.521	3.629	-0.421	-0.333	3.668	5.005	-0.840	-0.826	5.142
	41	1.664	-0.393	-0.383	1.752	2.466	-0.390	-0.369	2.524	4.130	-0.783	-0.752	4.270
	30	1.815	-0.519	-0.716	2.019	-1.064	-0.030	0.209	1.085	0.751	-0.549	-0.507	1.059
	29	1.558	-0.532	-0.748	1.808	1.203	-0.098	-0.103	1.211	2.761	-0.630	-0.851	2.957
	28	1.534	-0.501	-0.712	1.764	2.425	-0.346	-0.205	2.458	3.959	-0.847	-0.917	4.151
	27	1.285	-0.452	-0.652	1.510	3.327	-0.430	-0.253	3.364	4.612	-0.882	-0.905	4.782
	47	-3.012	0.060	0.570	3.066								
	48	-1.654	0.018	0.367	1.694								
verage		0.787	-0.351	-0.412	1.383	1.860	-0.232	-0.078	2.008	2.930	-0.619	-0.570	3.071
Left Wing		1.105	-0.352	-0.370	1.257	1.574	-0.155	0.036	1.649	2.679	-0.507	-0.334	2.756
Left Fuselage		0.639	-0.366	-0.423	1.615	1.731	-0.246	-0.157	1.974	2.964	-0.693	-0.758	3.159

KC-135, Tail Number 64-14838
Painted Tinker AFB, May 97

US Paint -- (Both Sides)

	1			2			3			4			5		
			Fuselage(1)	Fuselage(2)			Fuselage(1)		Fuselage(3)	Fuselage(3)		Fuselage(4)			Fuselage(5)
			2/99 Test	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test			2/99 Test
Pencil Hardness			5H	2H	H	3H	2H	F	3H	2H	3H	5H			5H
Modified PATTI			697 psi	800 psi	1029 psi	597 psi	700 psi	980 psi	1592 psi	550 psi	1274 psi	995 psi			1393 psi
Mode of Failure: AG				15 %	10 %	5 %	25 %	20 %	10 %	80 %	70 %	65 %			50 %
AP						10 %		5 %		20 %	10 %				
ATP															
CP			35 %			85 %	25 %		45 %			30 %			45 %
CT			65 %	85 %	90 %		50 %	75 %	45 %		20 %	5 %			5 %
Wet Tape			-	-	Pass	-	-	Pass	-	-	Pass	-			-

	1			2			3			4			5		
	Right Top Wing Tip		Left Top Wing	Right Top Wing		Left Bottom Wing	Right Top Wing			Right Top Wing (Fuselage)		Right Bottom Wing	Right Fuselage		
	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test
Chalking	None	None	6	None	None	8-	None	None	6	None	None	8-	None	None	6

	1			2			3			4			5		
	Right Upper Wing (fuselage)			Right Upper Wing			Right Upper Wing			Right Upper Wing			Right Upper Wing Tip		
			2/99 Test			2/99 Test			2/99 Test	1/98 test	7/98 test	2/99 Test	1/98 test	7/98 test	2/99 Test
Pencil Hardness			5H			3H			3H		5H	5H	5H	5H	5H
Modified PATTI			2239 psi			2289 psi			2587 psi	2300 psi	1421 psi	2338 psi	550 psi	784 psi	1940 psi
Mode of Failure: AG			10 %			40 %			15 %	20 %	70 %	25 %	10 %	10 %	10 %
AP			90 %			60 %			85 %			75 %	90 %	80 %	90 %
ATP															
CP										25 %	20 %			10 %	
CT										55 %	10 %				
Wet Tape			-			-			-	-	Pass	-	-	Pass	-

Pencil Hardness (Soft to Hard): 5b-4b-3b-2b-b-Hb-F-H-2H-3H-4H-5H-6H-7H-8H-9H (ASTM-D-3363)

Chalking: None - 8 - 6 - 4 - 2 (ASTM-D-4214)

AG = Adhesion of glue to stud or topcoat
AP = Adhesion of Primer to substrate
ATP = Adhesion of Topcoat to Primer
CP = Cohesion of Primer
CT = Cohesion of Topcoat

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APPENDIX VI

Painted Tinker AFB, May 98

KC-135, Tail No. 63-8040

Location		5/98 initial DFT mils	1/99 test DFT mils	5/98 initial 60 degree Gloss	1/99 test 60 degree Gloss	delta 60 degree Gloss	5/98 initial 85 degree Gloss	1/99 test 85 degree Gloss	delta 85 degree Gloss
Left Wing, Upper Surface	43	3.0		2.3			2.3		
	44	2.9		2.0			2.6		
	45	3.2		1.4			2.3		
	46	3.2		1.4			2.5		
	40	2.9	2.8	1.9	1.8	-0.1	2.0	1.7	-0.3
	39	4.0	3.1	1.9	1.0	-0.9	1.4	1.3	-0.1
	38	4.2	4.1	2.1	2.2	0.1	1.4	2.2	0.8
	37	4.4	3.7	2.1	3.1	1.0	3.9	7.3	3.4
	36	5.7	4.0	3.5	2.3	-1.2	3.9	8.5	4.6
	35	3.6	4.0	3.5	2.5	-1.0	3.6	2.4	-1.2
LH Motors	49	16.7		1.8			3.0		
	50	19.0		1.5			2.4		
Left Fuselage	42	4.1		2.0			1.3		
	41	3.0		2.4			2.2		
Right Wing, Upper Surface	3	2.9		1.5			0.8		
	4	2.4		1.9			1.9		
	5	2.9		2.4			1.9		
	6	2.2		2.1			2.3		
	7	1.9		1.7			3.6		
	8	2.3		2.1			1.7		
	9	2.7		2.0			1.4		
	10	3.3		1.7			1.2		
	11	3.0		2.1			1.7		
		3.0		2.1			1.5		
	AP*	9.0		11.0			54.0		
	AP*			11.0			54.0		
	AP*			8.2			47.0		
RH Motors	14	12.2		2.2			3.0		
	15	16.3		2.2			2.7		
Right Fuselage	AP*			9.5			52.9		
	12	5.4		2.5			2.3		
	13	6.2		2.5			2.2		
Average		4.1	3.6	2.5	2.2	-0.2	2.7	3.9	1.7

Deft MIL-P-23377G Primer
Deft MIL-PRF-85285C Topcoat

AP* = Applique

Painted Tinker AFB, May 98

KC-135, Tail Number 64-8040

APC --(Left Side)

	1 Wing Tip		2 Lift Point		3 Inboard #1 Engine		4 Outboard #2 Engine		5 Inboard #2 Engine	
		1/99 test		1/99 test		1/99 test		1/99 test		1/99 test
Pencil Hardness	-	2H	-	HB	-	2H	-	H	-	2H
Modified PATTI	-	1692 psi	-	1194 psi	-	1592 psi	-	1592 psi	-	1791 psi
Failure Mode: AG		25 %		10 %		100 %		100 %		95 %
AP		40 %								
ATP										
CP										
CT		35 %		90 %						5 %
Wet Tape	-	-	-	-	-	-	-	-	-	-
Chalking		None		None		None		None		None

Left Side - Deft APC
* = ASTM D 659 Photographic Reference Standard
Pencil Hardness (Soft to Hard): 5b-4b-3b-2b-b-Hb-F-H-2H-3H-4H-5H-6H-7H-8H-9H

AG = Adhesion of glue to stud or topcoat
AP = Adhesion of Primer to substrate
ATP = Adhesion of Topcoat to Primer
CP = Cohesion of Primer
CT = Cohesion of Topcoat

Painted Tinker AFB, May 98

KC-135, Tail No. 63-8040

Location		initial L*	initial a*	initial b*	1/99 test L*	1/99 test a*	1/99 test b*	delta L*	delta a*	delta b*	delta E*
APC Left Wing, Upper Surface	43	48.977	-1.388	-3.928							
	44	49.245	-1.346	-3.904							
	45	46.942	-1.121	-3.205							
	46	46.748	-1.183	-3.246							
	40	50.748	-1.746	-4.487	47.720	-1.370	-3.540	-3.028	0.376	0.947	3.195
	39	49.933	-1.759	-4.529	48.880	-1.720	-4.120	-1.053	0.039	0.409	1.130
	38	49.694	-1.689	-4.428	48.350	-1.680	-3.880	-1.344	0.009	0.548	1.451
	37	50.801	-1.704	-4.346	49.520	-1.650	-3.670	-1.281	0.054	0.676	1.449
	36	50.801	-1.704	-4.346	49.920	-1.620	-3.770	-0.881	0.084	0.576	1.056
	35	50.831	-1.771	-4.368	49.930	-1.680	-3.800	-0.901	0.091	0.568	1.069
LH Motors	49	49.231	-1.367	-3.927							
	50	48.554	-1.295	-3.770							
Left Fuselage	42	48.591	-1.300	-3.844							
	41	49.370	-1.510	-3.685							
Right Wing, Upper Surface	3	47.738	-1.249	-3.280							
	4	49.031	-1.397	-3.855							
	5	49.230	-1.316	-3.698							
	6	49.164	-1.339	-3.775							
	7	50.954	-1.787	-4.367							
	8	48.479	-1.265	-3.076							
	9	49.004	-1.282	-3.321							
	10	49.360	-1.307	-3.679							
	11	49.146	-1.366	-3.130							
		49.122	-1.365	-3.587							
	AP*	49.145	-1.347	-3.493							
	AP*	48.881	-1.496	-4.261							
	AP*	47.859	-1.494	-4.080							
RH Motors	14	48.723	-1.303	-3.717							
	15	48.933	-1.267	-3.665							
Right Fuselage	AP*	49.259	-1.529	-3.872							
	12	49.235	-1.341	-3.753							
	13	48.672	-1.339	-3.845							
Average		50.468	-1.729	-4.417	49.053	-1.620	-3.797	-1.415	0.109	0.621	1.558

Deft MIL-P-23377G Primer
Deft MIL-PRF-85285C Topcoat

AP* = Applique

APPENDIX VII

Notes from Mr. Sneed:

DEFT

1.) Worse than Courtauld's on flaps and in lesser exposed areas
2.) Peeling worse than on Courtauld's side
   a.) Underside of wing
   b.) Panel edges
   c.) Leading edges (peeling/touchup)
   d.) Around windshield (touched up)
3.) Appeared to be chalking
4.) Paint not sticking to sealant in a number of places

COURTAULDS

1.) Peeling
   a.) Bad underside of wings
   b.) Oklahoma Door
   c.) Around Radome
   d.) Bare metal around windshield
   e.) Leading edge fastener row, upper wing, to bare metal -- fastener's showing
   f.) Along sealant
2.) Touchup -- more rework
3.) Chalky appearance

SPRAYLAT

1.) Lot of rework near fuselage on upper wing
2.) More touchup around fasteners than rest of test aircraft
3.) Paint peeling/cracking along rivet rows and sealant
4.) Fuselage rework along fuselage seams
5.) Leading edge touchup and small amount of peeling to bare metal
6.) Touchup underside of wing
7.) Boom area under fuselage had primer showing
8.) Flight controls faded worse than Sherwin-Williams
9.) Peeling to bare metal around Radome
10.) Less peeling around windows than other Hickam paints

SHERWIN-WILLIAMS

1.) Rework over fasteners on upper wing
2.) Fuel staining along front fastener row (see 1. Above)
3.) Some touchup on upper wing
4.) Spot peeled to primer on upper wing

Appendix VII

5.) Fuselage rework along fuselage seams
6.) Peeling/Cracking around and on panel rivets upper wing
7.) Visually better than Spraylat
8.) Formulated to Gunship luster
9.) Fasteners peeling to bare metal on Beaver Tail
10.) Rework spread over aircraft in general
11.) Leading edge touchup about the same as Spraylat side, maybe slightly more
12.) Cowling Leading edges peeling both to metal and primer
13.) Less fading and smoother surface than other aircraft

ADVANCED PERFORMANCE COATINGS (APC)

1.) Noticeable color difference between GSA Topcoat
  a.) Depending on angle of sun, appears to be darker than Deft
  b.) Smoothest paint to the touch
2.) Fasteners starting to corrode center of wing
3.) Chipped paint in one Spot
4.) Very little cracking around fasteners
5.) Test indicate Gunship luster. It appears to have a sheen

US PAINT

1.) Very little Radome leading edge peeling noted
2.) Possible touchup around pilots window
  a.) Very hard to discern at close distance
  b.) No peeling at time of inspection
3.) Typical nicks and peeling on and around doors and access panels
4.) Peeling to bare metal around 1 & 2 Engine cowling leading edges
  a.) Nothing longer than 1-2 mm
  b.) Looked better than some of the Hickam aircraft
5.) Very little RH wing leading edge peeling
  a.) Two nicks to bare metal
6.) Number 3 engine cowling leading edge had no peeling
7.) Number 4 engine cowling leading edge had almost no peeling
8.) LH leading edge between number 1 and 2 engines had small amount of peeling
9.) LH leading edge outside of number 1 engine had some peeling
10.) No peeling evident on vertical and horizontal leading edges from ground view
11.) Sporadic touchup over aircraft fuselage
  a.) Touchup appeared to be good match
  b.) Low light in hanger, which may hide imperfections and chalking, makes it difficult to tell how well paint matched up
12.) All in all, the aircraft is in great shape for 22 months of service life
13.) Field units report aircraft looks better in direct sunlight than old Mil-C-85285 painted aircraft

APPENDIX VIII

KC-135 Exterior Coating System
Operational Test and Evaluation
Test Plan
August 1997

Prepared by: Mike Spicer — Coatings Technology Integration Office

Reviewed by: Maj Kevin Kuhn — Coatings Technology Integration Office

Submitted by: OC-ALC/LAPEP, HQ AMC/LGBEF, HQ ANG/LGMM

Approved by: KC-135 SPD

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ABBREVIATIONS AND ACRONYMS

AFB	Air Force Base
AMC	Air Mobility Command
ANG	Air National Guard
COI	Critical Operational Issue
COTS	Commercial Off The Shelf
CTIO	Coatings Technology Integration Office
GSA	Government Supply
HPACS	High Performance Aerospace Coating System
HQ	Head Quarters
MAJCOM	MAJor COMmand
NCOIC	Non Commissioned Officer In Charge
NESHAP	National Emission Standards for Hazardous Air Pollutants
OC-ALC	Oklahoma City-Air Logistics Center
PDM	Programmed Depot Maintenance
QOT&E	Qualification Operational Test and Evaluation
QPL	Qualified Products List
SM-ALC	SacraMento-Air Logistics Center
SPD	Systems Program Director
T.O.	Technical Order
UV	UltraViolet
VOC	Volatile Organic Compound

SECTION I INTRODUCTION

1.0 GENERAL. Oklahoma City Air Logistics Command (OC-ALC) in conjunction with Air Mobility Command (AMC) and Air National Guard (ANG) will conduct a Qualification Operational Test and Evaluation (QOT&E) of 1998 National Emission Standards for Hazardous Air Pollutants (NESHAP) compliant coating systems in the KC-135 operational environment using a current MIL-SPEC qualified coating system as a control and select the best performing coating system to be utilized on the KC-135 fleet.

1.1 SYSTEM INFORMATION

1.1.1 Background. The current TT-P-2756 coating system used on the exterior moldline of the KC-135 aircraft is not meeting performance requirements over the full Programmed Depot Maintenance (PDM) cycle. The KC-135 Systems Program Director (SPD) has directed that TT-P-2756 type material will no longer be used on KC-135 aircraft that have gone through depot and are stripped to bare metal. TT-P-2756 is a 1998 NESHAP compliant coating and as a result of this directive the depots(OC-ALC and SM-ALC) are faced with using non-NESHAP compliant coating systems until a NESHAP compliant coating system is tested, qualified and approved. The laboratory test and evaluation phase for an improved NESHAP compliant coating system was accomplished via the "High Performance Aerospace Coating System" (HPACS) contractual program managed by WL/MLSS. Four promising coating systems were identified by the HPACS program as being worthy for flight test consideration.

1.1.2 Description All coating systems being tested are commercial off the shelf(COTS) products that meet 1998 NESHAP requirements. A "coating system", as referred to in this plan, is a primer and a topcoat combination. All primers being tested are a high-solids epoxy chromated primer with a VOC rating of 340 g/L or less. All topcoats being tested are a high-solids polyurethane topcoat with a VOC rating of 420 g/L or less.

The coating systems evaluated in this QOT&E are listed in the table below.

Manufacturer	Primer	Topcoat	Aircraft @ Station
US Paint	S9800-K13	Awlgrip	KC-135 @ Macdill AFB, Tampa Bay Fl.
Courtaulds	513X423C/930K118/ 530K015	832G062/930G052 UV Improved*	KC-135 @ Hickham AFB, Oahu Ha.
Deft	Mil-C-23377G TI CC 02Y40	Mil-C-85285B T1 03GY321**	Same Aircraft
Pratt & Lambert Sherwin-Williams	724-500/724-501 E90G203/V93V230	785-637/785-000/ 785-118 F93A26/V93V26/V93V1	KC-135 @ Hickham AFB, Oahu Ha.
Spraylat	EEAE-154 A/B	EUBG167 A/B	Same Aircraft

* Courtaulds has added UV absorbers to their previous version topcoat to give better performance.
** In May 96 Deft reformulated their MIL-C-85285 topcoat to give better performance.

The test coating systems are expected to provide increased performance over the TT-P-2756 in the areas of weatherability, adhesion to the substrate, cleanability, and protection against corrosion.

1.2 OPERATIONAL ENVIRONMENT

1.2.1 Threat Summary Not applicable for this project

1.2.2 Operational Concept The coating systems are being tested as a drop-in replacement of TT-P-2756 for use on the outer moldlines of KC-135 aircraft. Therefore, part of this QOT&E is to check the compatibility with surface preparation materials and processes as well as spray equipment being utilized at the ALCs and field units. No major equipment changes are expected but, minor process changes could be realized

To ensure the performance of the coating systems is realized, severely corrosive, high UV, marine environments were selected as operational test sites. Also, this QOT&E project requires the normal KC-135 operating environment for testing. Special ranges, test facilities, and equipment are not required.

1.2.3 Maintenance Concept Normal touch-up and repair of the coating systems on the test aircraft by the field units will be the same procedure as for non-test aircraft, i.e. in accordance with T.O. 1-1-8, except appropriate test coating materials will be used. Adequate quantities of test coatings will be provided when the aircraft is delivered from the ALC and upon owning unit request. Evaluation forms will be provided to the selected POC.

Some destructive testing will be performed by the engineering team when conducting a local assessment of the test coating systems. The engineering team will be responsible for repairing the destroyed coating system. The method for repair is as follows: feather the edges of the area under repair by hand sanding with 150 grit sand paper, apply a Mil-P-23377G T1 CC primer or a Mil-P-85582 T1 C2 primer using a SEMPEN applicator, allow the coating to cure 2 hours, apply a Mil-C-85285B T1 topcoat in color 36173 using a SEMPEN applicator. The SEMPEN applicator and materials in side are products of Courtaulds Aerospace. The materials in the SEMPENS are Mil Spec qualified and have been incorporated into T.O. 1-1-8.

1.2.4 Training Concept The coating system selected from this QOT&E project for use on the KC-135 fleet will undergo a battery of tests by CTIO. The tests are designed to characterize the use of the coating system under different temperatures, humidities, and spray equipment. CTIO will take the results of the tests and working with the coating system manufacturer create a users guide for that particular coating system. The users guide will define the operating window for which the coating system can be used. Suggestions and consequences for using the coating system outside of the window will also be incorporated in the users guide. The users guide can be used by painters at the ALCs and field units as a starting point for setting up their spray equipment based on their given situation. Any problems that can not be solved with the use of the users guide can be directed to CTIO.

1.3 PROGRAM STRUCTURE At the point in time when a coating system(s) is selected for utilization on the KC-135 fleet, CTIO will work with GSA in setting up a vehicle for the procurement of the coating system(s). Performance data, characterizing the coating system(s), obtained from the HPACS program will be used to create a Purchase Description or Specification with a qualified products list (QPL). Quality assurance testing of the material for successive batches will be tested by CTIO and stated in the Purchase Description or Specification.

SECTION II QOT&E OUTLINE

2.0 OBJECTIVE AND CRITICAL OPERATIONAL ISSUES

The objective of this QOT&E is to conduct a flight test of NESHAP compliant coating systems with a Mil Spec coating system as a control and evaluate the performance characteristics of all coating systems per the COIs mentioned. The best performing coating system will be utilized on the KC-135 fleet.

The following COIs are derived from the Mission Need Statement, CAF/AMC/AETC/AFSOC/AFMC 812-97 (DRAFT).

Current Mil Spec coating systems(Mil-P-23377G CC, Mil-P-85285) provide adequate corrosion protection. Therefore, the test coating systems must provide equal or improved performance in the area of protection against corrosion compared to the current Mil-Spec coating system.

COI-1: Do the test coating systems provide equal or improved protection against corrosion compared with the control coating system.

The majority of the scuff sand and overcoat, and touch-up and repair activities performed at field units are a result of poor weathering and appearance characteristics of the Mil Spec coating systems. As a result, the test coating systems will have to show an improvement over the current Mil Spec coating system (Mil-P-23377G CC, Mil-P-85285).

COI-2: Do the test coating systems provide improved performance in the area of apperance.

COI-3: Do the test coating systems provide improved appearance characteristics over the control coating system.

2.1 SCOPE AND TEST CONCEPT HQ AMC is the lead organization in identifying aircraft for this QOT&E project. The three test aircraft identified are one AMC KC-135 tail number 64-14838 stationed at MacDill AFB and two ANG KC-135s, tail numbers 64-14832 and 59-1472, stationed at Hickam AFB.

The AMC KC-135 will go through PDM at OC-ALC and will be coated with a test coating system from U.S. Paint (primer S9800/K8032; topcoat Awlgrip H.S. Polyurethane) on 12 May 97.

The two ANG KC-135s will go through PDM at SM-ALC in the August/September 1997 timeframe. Tail number 64-14832 will be coated with a coating system from Courtaulds (primer 513X423C/930K118/530K015; topcoat 832G062/930G052) on the righthand side and a coating system from Deft (primer 02Y40; topcoat 03GY321) utilized as the control on the lefthand side of the aircraft. Tail number 59-1472 will be coated with a coating system from Spraylat (primer EEAE-154A; topcoat EUBG167 A/B) on the righthand side and the Pratt & Lambert (Sherwin-Williams) (primer E90G203/V93V230, topcoat F93A26/V93V26/V93V1) on the lefthand side of the aircraft.

Deft was selected as the control because of its extensive use on other weapon systems. An Application Data Sheet will be supplied to the ALC applying the coating systems and shall be completed at the time the coating systems are applied. Appendix A is a copy of the Application Data Sheet form.

Each aircraft will be evaluated after every wash cycle by the unit POC. Appendix B is a copy of the evaluation form that should be used by that field level person and sent to AMC/LGBEF, OC-ALC/LAPEP and CTIO upon completion.

On six month intervals an engineering team will conduct a local assessment of the coating systems in conjunction with local corrosion control and crew chief personnel. The engineering team will consist of engineers from the KC-135 SPD, corrosion control monitors of the participating MAJCOMs, and engineers from WL/MLSS-CTIO.

Appendix C is a copy of the evaluation form the engineering team will use to gather data to provide input to the Interim Test Event Report.

A decision point has been established 18 months from when the last KC-135 aircraft will be coated. At that point a decision between OC-ALC/LCR, OC-ALC/LAP, HQ AMC/LGM and HQ ANG/LG will be made as to the best performing coating but, the test coatings will be left on the aircraft a full PDM cycle for further evaluation.

2.2 PLANNING CONSIDERATIONS AND LIMITATIONS

2.2.1 Planning Considerations The ideal flight test procedure for coating systems is to apply the test coating system on one side of the test aircraft and apply the control coating system on the other side of the same test aircraft. The reasons for this paint scheme is stated in a letter issued March 1996 to all MAJCOM Corrosion Managers and authored by Gary Stevenson on behalf of WL/MLSS.

Do to circumstances out of our control, aircraft tail number 64-14838 and possibly aircraft tail number 59-1472 will not receive this paint scheme. Steps are being taken in order to ensure meaningful data will be collected from the two test aircraft.

Aircraft, tail number 64-14838 which will coated with the US Paint coating system will be stationed at MacDill AFB.

Aircraft, tail number 59-1472 which will be coated with the Spraylat coating system on one side and the Pratt & Lambert (Sherwin-Williams) coating system on the other side will be stationed at Hickham AFB. The other test aircraft, tail number 64-14832 that has the Deft coating system on one side of the aircraft will be used as the control coating system for comparing data collected from aircraft tail number 59-1472.

The variables associated with the work arounds will be noted in the reports.

2.2.1.1 Aircraft Availability The test aircraft are regularly scheduled for routine depot maintenance and will be operating in a severely corrosive, high UV marine environment. It is desired that test aircraft shall not be retired or transferred to another environment for the period of testing (a full PDM cycle).

2.2.1.2 Operational Support The respective MAJCOMs shall brief their operational field units about the QOT&E plan and their expected duties. The operational field units shall complete the evaluation forms provided, use the appropriate test coatings supplied for touch-up and repair when needed, and give the same attention to the test aircraft as would be given to any normal operating aircraft. No more, no less. A complete scuff sand and overcoat shall not be performed on the test aircraft without approval from the appropriate MAJCOM representative.

2.2.1.3 Equipment, Materials, and Processes All aspects in applying the test coatings shall be in accordance with T.O. 1-1-8 and T.O. 1-1-691.

2.2.2 Estimated Cost All coating systems will be purchased by AFMC TTO/TTP through WL/MLSS and delivered to the appropriate ALC. One gallon kit of the coating systems will accompany the respective test aircraft for touch-up and repair purposes. The ALCs will absorb any additional costs involved with the application of the test and control coatings. In the unlikely event that catastrophic failure should occur, the appropriate MAJCOM will provide funding for the removal of test materials and the refinishing of the aircraft. Each organization participating in the evaluation of the coating systems is responsible for their TDY funding to the test site. Costs associated with test plan development, Interim and final reports, and their distribution will be absorbed by WL/MLSS-CTIO.

2.3 QOT&E SCHEDULE AND READINESS REQUIREMENTS

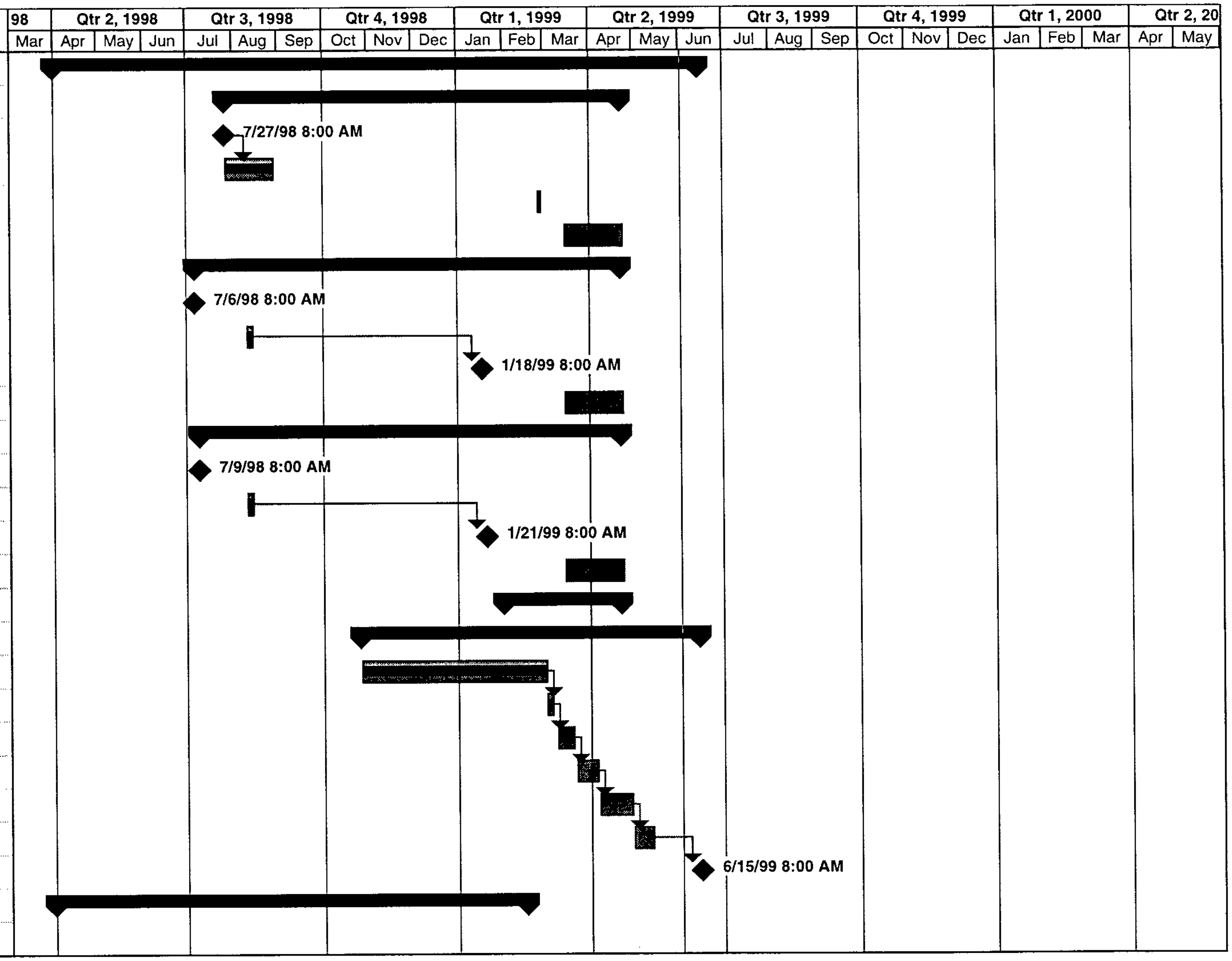
Ref. page 11

SCHEDULE GOES HERE

LARGE AIRCRAFT COATING SYSTEM

ZHTV98WL23 - ZHTV99CT88

ID	Task Name
1	
2	**Monitor First A/C (System 23)**
3	12 month Inspection
4	Interim Test Event Report
5	18 month Inspection
6	Final Test Event Report
7	**Monitor 2nd A/C (System 6 & Mil C 85285)**
8	6 month Inspection
9	Interim Test Event Report
10	12 month Inspection
11	Final Test Event Report
12	**Monitor 3rd A/C (Systems 3 &14)**
13	6 month Inspection
14	Interim Test Event Report
15	12 month Inspection
16	Final Test Event Report
17	**Monitor 4th A/C (Fluoropolymer & Applique)**
20	**Report to USAF**
21	Compile test data
22	Submit compilation and recommendation
23	SwRI Review
24	USAF Review
25	Revise Report
26	SwRI Review
27	Submit Final Report
28	**Project Documentation**
93	



Jun 99 CEVV PMR

COI	MOE	MOP
		MOP3-1-3: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 3-1-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
	MOE 3-2: The color stability of the test coating systems shall be an improvement over the currently used coating systems.	MOP 3-2-1: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than1.0 (i.e. delta E of test coating / delta E of control
		MOP 3-2-2: Use of a black velvet cloth in accordance with ASTM ???? shall not show evidence of chalking
		MOP 3-2-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
	MOE 3-3: The gloss stability of the test coating systems shall be an improvement over the currently used coating systems.	MOP 3-3-1: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 3-3-2: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 3-3-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
	MOE 3-4: The fluid resistance stability of the test coating systems shall be an improvement over the currently used coating systems.	MOP 3-4-1: Using the pencil hardness technique in accordance with FTMS-141, the change in hardness of the test coating shall be less than the change in hardness on the control coating.
		MOP 3-4-2: Upon visual inspection the degree of adhesion on the test side shall be equal to or better than the control side for all interfaces
		MOP 3-4-3: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than1.0 (i.e. delta E of test coating / delta E of control
		MOP 3-4-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
	MOE 3-5: The touch-up/repaired area shall show an improvment relative to color and gloss over the currently used coating system.	MOP 3-5-1: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than1.0 (i.e. delta E of test coating / delta E of control
		MOP 3-5-2: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 3-5-3: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 3-5-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.

COI	MOE	MOP
COI-1: Do the test coating systems provide equal or improved protection against corrosion compared with the control coating system?	MOE 1-1: The corrosion protection of the test coating systems shall be equal to or show an improvement over the currently used coating systems.	MOP 1-1-1: Upon visual inspection the test coated skins shall show no more exfoliation corrosion around fastener countersinks and panel edges than on the control coated skins.
		MOP 1-1-2: Upon visual inspection the test coated skins shall show no more filiform corrosion than on the control coated skins.
	MOE 1-2: The degree of compatibility (adhesion) of primer with the substrate and topcoat with the primer.	MOP 1-2-1: Upon visual inspection the degree of adhesion on the test side shall be equal to or better than the control side for all interfaces
		MOP 1-2-2: Modified Adhesion Patti testing per ASTM 5179 shall measure a minimum of 1000 psi.
	MOE 1-3: The integrity of the test coating system on and around upper and lower wing skin fasteners shall be equal or show an improvment over the currently used coating system.	MOP 1-3-1: Upon visual inspection and using the evaluation criteria stated in this test plan the test coating shall score an equal or higher value than the control coating.
		MOP 1-3-2: Paint chips from the point of failure for the test coating or control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
COI-2: Do the test coating systems provide equal or improved performance in the area of visibile detection?	MOE 2-1: The gloss stability of the test coating systems shall be an improvement over the currently used coating systems.	MOP 2-1-1: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 2-1-2: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 2-1-3: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
	MOE 2-2: The cleanability of the test coating systems shall be an improvment over the currently used coating systems.	MOP 2-2-1: Use of a 45 degree/0 degree reflectometer in accordance with ASTM D523 shall show an increase of at least 5 percentage points over the control side.
		MOP 2-2-2: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 2-2-3: Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.
		MOP 2-2-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
	MOE 2-3: The fluid resistance stability of the test coating systems shall be an improvement over the currently used coating systems.	MOP 2-3-1: Using the pencil hardness technique in accordance with FTMS-141, the change in hardness of the test coating shall be less than the change in hardness on the control coating.
		MOP 2-3-2: Upon visual inspection the degree of adhesion on the test side shall be equal to or better than the control side for all interfaces
		MOP2-3-3: Use of a portable colorimeter in accordance with ASTM D2244 shall show a delta E ratio of test coating system to control coating system of less than1.0 (i.e. delta E of test coating / delta E of control
		MOP 2-3-4: Paint chips from the test coating and control coating shall be collected and analyzed in the laboratory to determine physical and chemical property changes.
COI-3: Do the test coating systems provide equal or improved appearance characteristics over the control coating system?	MOE 3-1: The cleanability of the test coating systems shall be an improvment over the currently used coating systems.	MOP 3-1-1: Use of a 45 degree/0 degree reflectometer in accordance with ASTM D523 shall show an increase of at least 5 percentage points over the control side.
		MOP 3-1-2: Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

SECTION III METHODOLOGY

3.0 GENERAL

3.0.1 COI and MOE/MOP Matrix Ref. page 12-13

3.1 COI-1: Do the test coating systems provide equal or improved protection against corrosion compared with the control coating system?

3.1.1 Scope In order to ensure the test coating systems show corrosion protection characteristics, the test coating systems shall be flight tested on test aircraft stationed in a severely corrosive, high UV marine environment for a minimum of 20 months. The test coating systems shall show equal or improved performance as compared to the Mil Spec qualified Deft coating system in order to pass this COI. The Deft coating system will be used as the control coating system.

3.1.2 Measures of Effectiveness/Performance and Evaluation Criteria

3.1.2.1 MOE 1-1 The corrosion protection of the test coating system shall be equal to or show an improvement over the currently used coating systems

3.1.2.1.1 MOP 1-1-1 Upon visual inspection, the test coated skins shall show no more exfoliation corrosion around fastener countersinks and panel edges than on the control coated skins.

3.1.2.1.2 MOP 1-1-2 Upon visual inspection, the test coated skins shall show no more filliform corrosion than on the control side for all interfaces.

3.1.2.2 MOE 1-2 The degree of compatibility (adhesion) of primer with the substrate and topcoat with the primer.

3.1.2.2.1 MOP 1-2-1 Upon visual inspection, the degree of adhesion on the test side shall be equal to or an improvement to the control side for all interfaces.

3.1.2.2.2 MOP 1-2-2 Using the Modified Adhesion testing per ASTM 5179, the test and control coating systems shall measure a minimum of 1000 psi. This test shall be performed on two areas of the test aircraft per coating system. The first area is the upper section of the fuselage just past the wing root. The second area is the lower section of the fuselage just past the wing root. This is a destructive test method for the coating system in the localized area. Repair of the coating system is referenced in section 1.2.3 Maintenance Concept, second paragraph.

3.1.2.3 MOE 1-3 The integrity of the test coating system on and around upper and lower wing skin fasteners shall be equal or show improvement over the currently used coating system.

3.1.2.3.1 MOP 1-3-1 Upon visual inspection and using the evaluation criteria stated, the test coating system shall score an equal or higher value than the control coating system based on the criteria below.

No evidense of cracking or adhesion loss	4
Cracked circumferential in counter sink	3
Cracked and 1/4 moon adhesion loss around counter sink and fastener	2
Cracked and 1/2 moon adhesion loss around counter sink and fastener	1
Cracked and full moon adhesion loss around counter sink and fastener	0

3.2 COI-2: Do the test coating systems provide improved performance in the area of visible detection?

3.2.1 Scope Per Mil-C-85285B the specular gloss of camouflage topcoats at 60 degrees angle of incidence shall have a reading of 5 or less. Mil-C-85285B topcoats have not been able to maintain the 5 or less reading over time and after many wash cycles. The test coating systems shall show improved performance in maintaining camouflage gloss measured at 60 degrees and 85 degrees over the control coating system in order to pass this COI.

3.2.2 Measures of Effectiveness/Performance and Evaluation Criteria

3.2.2.1 MOE 2-1 The gloss stability of the test coating system shall be an improvement over the currently used coating systems.

3.2.2.1.1 MOP 2-1-1 Use of a portable gloss meter of 60 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

At the time when the test and control coating systems have been applied, a gloss reading shall be recorded for each coating system. On 6 month intervals, the gloss reading shall be recorded for each coating system. The delta of the test coating system shall be less than the delta of the control coating system in order to pass.

3.2.2.1.2 MOP 2-1-2 Use of a portable gloss meter of 85 degree geometry in accordance with ASTM D523 shall show less change in gloss on the test side as compared to the control side.

At the time when the test and control coating systems have been applied, a gloss reading shall be recorded for each coating system. On 6 month intervals, the gloss reading shall be recorded for each coating system. The delta of the test coating system shall be less than the delta of the control coating system in order to pass.

3.2.2.1.3 MOP 2-1-3 Paint chips from the test and control coating systems shall be collected and analyzed in the laboratory to determine physical and chemical property changes.

3.2.2.2 MOE 2-2 The cleanability of the test coating systems shall be an improvement over the currently used coating systems.

3.2.2.2.1 MOP 2-2-1 Use of a 45 degree/0 degree reflectometer in accordance with ASTM D523 shall show an increase of at least 5 percentage points over the control side.

3.2.2.2.2 MOP 2-2-2 Same as MOP 2-1-1

3.2.2.2.3 MOP 2-2-3 Same as MOP 2-1-2

3.2.2.2.4 MOP 2-2-4 Same as MOP 2-1-3

3.2.2.3 MOE 2-3 The fluid resistance stability of the test coating system shall be an improvement over the currently used coating systems.

3.2.2.3.1 MOP 2-3-1 Using the pencil hardness technique in accordance with FTMS-141, the change in hardness of the test coating shall be less than the change in hardness on the control coating.

3.2.2.3.2 MOP 2-3-3 Same as MOP 1-2-1

3.2.2.3.3 MOP 2-3-4 Same as MOP 2-1-3

3.3 COI-3: Do the test coating systems provide improved appearance characteristics over the control coating system?

3.3.1 Scope Appearance characteristics is comprised of cleanability of the coating system, color and gloss stability of the coating system over time and after touch-up and repair, and lastly fluid resistance of the coating system. The test coating systems shall show improved performance in these areas over the control coating system in order to pass this COI.

3.3.2 Measures of Effectiveness/Performance and Evaluation Criteria

3.3.2.1 MOE 3-1 The cleanability of the test coating systems shall be an improvement over the currently used coating systems.

3.3.2.1.1 MOP 3-1-1 Same as MOP 2-2-1

3.3.2.1.2 MOP 3-1-2 Same as MOP 2-1-1

3.3.2.1.3 MOP 3-1-3 Same as MOP 2-1-2

3.3.2.1.4 MOP 3-1-4 Same as MOP 2-1-3

3.3.2.2 MOE 3-2 The color stability of the test coating systems shall be an improvement over the currently used coating systems.

3.3.2.2.1 MOP 3-2-1 Same as MOP 2-3-3

3.3.2.2.2 MOP 3-2-2 Use of a black velvet cloth in accordance with ASTM ??? shall not show evidence of chalking.

3.3.2.2.3 MOP 3-2-3 Same as MOP 2-1-3

3.3.2.3 MOE 3-3 The gloss stability of the test coating systems shall be an improvement over the currently used coating systems.

3.3.2.3.1 MOP 3-3-1 Same as MOP 2-1-1

3.3.2.3.2 MOP 3-3-2 Same as MOP 2-1-2

3.3.2.3.3 MOP 3-3-3 Same as MOP 2-1-3

3.3.2.4 MOE 3-4 The fluid resistance stability of the test coating systems shall be an improvement over the currently used coating systems.

3.3.2.4.1 MOP 3-4-1 Same as MOP 2-3-1

3.3.2.4.2 MOP 3-4-2 Same as MOP 1-2-1

3.3.2.4.3 MOP 3-4-3 Same as MOP 2-3-3

3.3.2.4.4 MOP 3-4-4 Same as MOP 2-1-3

3.3.2.5 MOE 3-5 The touch-up/repaired area shall show an improvement relative to color and gloss over the currently used coating systems.

3.3.2.5.1 MOP 3-5-1 Same as MOP 2-3-3

3.3.2.5.2 MOP 3-5-2 Same as MOP 2-1-1

3.3.2.5.3 MOP 3-5-3 Same as MOP 2-1-2

3.3.2.5.4 MOP 3-5-4 Same as MOP 2-1-3

SECTION IV ADMINISTRATION

4.0 TEST MANAGEMENT

4.1 TASKING

Coatings Technology Integration Office (CTIO) shall:

1.) Develop a Test Plan for conduct of QOT&E
2.) Fund and coordinate delivery of test coating systems to ALCs

3.) Lead the engineering team in performing tests and collecting data on the test aircraft on the six month technical evaluation of the test coating systems.
4.) Draft and coordinate the Interim Test Reports 30 days after the six month technical evaluations.

OC/ALC shall:
1.) Appoint a Test Manager/Director (Donna Ballard, OC/ALC/LAPEP, (405)736-5986)
2.) Apply US Paint test coating system on KC-135 aircraft, tail number 64-14838
3.) Coordinate with SM-ALC the application of remaining test coating systems on KC-135 aircraft, tail numbers 64-14832 and 59-1472.

SM/ALC shall:
1.) Apply Deft control coating system and Courtaulds test coating system on KC-135 aircraft, tail number 64-14832.
2.) Apply Pratt & Lambert (Sherwin-Williams) test coating system and Spraylat test coating system on KC-135 aircraft, tail number 59-1472

HQ AMC/LGBEF shall:
1.) Coordinate use of one KC-135 aircraft, tail number 64-14838
2.) Coordinate with HQ ANG/LGMM the providing of two KC-135 aircraft, tail numbers 64-14832 and 59-1472
3.) Coordinate with the field unit at MacDill AFB on responsibilities
4.) Coordinate with the field unit at Hickam AFB on responsibilities

HQ ANG/LGMM shall:
1.) Provide two KC-135 aircraft, tail numbers 64-14832 and 59-1472

6th MXS/LGMF, MacDill AFB shall:
1.) Complete "Post Wash Evaluation Form" and send to CTIO.
2.) Coordinate with local bio environmental engineering office for the use of the test coating systems.

POC: Jerry Chaplin
6th MXS/LGMF
7607 Hanger Loop Drive
MacDill AFB, FL. 33621
DSN 968-7436

154 MXS/LGMF, Hickham AFB shall:
1.) Complete "Post Wash Evaluation From" and send to CTIO.
2.) Coordinate with local bio environmental engineering office for the use of the test coating systems.

POC: Gary Cera
MSG/E-7
154 MXS/LGMF

360 Harbor Drive, Bldg. 1055
Hickham AFB, Hi. 96853-5517
DSN

4.2 TRAINING REQUIREMENTS.

Coating system manufacturers will be present to monitor the application process and instruct maintenance personnel on the application procedures.

4.3 SAFETY and ENVIRONMENTAL IMPACT

All equipment and coating systems used in this test plan meet 1998 NESHAP requirements.

Material Safety Data Sheet (MSDS) for the test and control coating systems will be provided along with the materials to the using organizations.

4.4 SECURITY All aspects of this QOT&E project is **UNCLASSIFIED**; however, technical papers and reports generated from this project will comply with distribution statement B stated in AFI 61-204.

SECTION V REPORTING

5.0 REPORTS

5.0.1 Inspection Sheets: Post Wash Evaluation Sheets will be accomplished by MacDill AFB and Hickam AFB after each wash cycle and sent to the HQ AMC/LGBEF, OC-ALC/LAPEP, and CTIO.

5.0.2 Interim Test Event Report: Interim Test Event Report will be issued by CTIO 30 days after each technical evaluation. A technical evaluation will be performed by the technical engineering team on 6 month cycles starting from when the last test aircraft is coated.

5.0.3 Final Test Report: Final Test Report will be issued by CTIO 60 days after the completion of the project.

5.1 BRIEFINGS

Status briefings will be given to the CTSC on a quarterly basis by the CTIO.

AEROSPACE COATING SERVICE TEST
APPLICATION DATA SHEET

Location:____Date:______________

Personnel:_____________________________Phone Number:_________________________

Type Aircraft:________________________________Tail Number:_____________

Depaint Method Used: (Include Manu. and Product ID of Chemicals, Dwell Times, etc.)

____

____

Describe pre-treatment steps of aircraft after depaint and prior to prime:(Include Manu. and Product ID of Chemicals, Mix Ratios, Dwell Times, etc.)

____

____

____

____

____

____

____

____

Describe problems experienced with pre-treatment, if any:

____

____

____

____

____

AEROSPACE COATING SERVICE TEST
APPLICATION DATA SHEET

Primer

Manufacturer Name/Product Number:______________________________

Batch Number:____________________

Was Primer Allowed to Achieve Spray Booth Temp Prior to Mixing: YES NO

Mixing Time:_______________(min) Viscosity:______________________

Time After Mixing before Spraying Begins:__________(min)

How Long to Spray this Batch:__________________(min)

Temperature:____________________Humidity:__________________

Other Comments:____

____

Topcoat

Manufacturer Name/Product Number:______________________________

Batch Number:____________________

Was Topcoat Allowed to Achieve Spray Booth Temp Prior to Mixing: YES NO

Mixing Time:_______________(min) Viscosity:______________________

Time After Mixing before Spraying Begins:__________(min)

How Long to Spray this Batch:__________________(min)

Temperature:____________________Humidity:__________________

Other Comments:____

____

AEROSPACE COATING SERVICE TEST
APPLICATION DATA SHEET

Painting Equipment

Type Paint Guns (HVLP, Electrostatic, etc.):________________________________

Manufacturer/Model of Paint Guns:________________________________

Number of Tip and Aircap: ________________________________

Size/Type Paint Gun Heads:________________________________

Inside Dimensions of Hoses: Air____________________Fluid______________

Hose Length: Air____________________Fluid:______________________________

Pressure Pots YES NO Plural Mix YES NO

Auto Stirring in Cups/Pots YES NO

Shop Air Pressure: (PSI)__________________(CFM)______________

Air Pressure (at Gun): ______________________Nozzle: ______________________

Water/Oil Separator Installed: YES NO ☐

AEROSPACE COATING SERVICE TEST
CURE TIMES DATA SHEET

Primer

Tack-free Time ______________________________ Hours

Cure Time Before Overcoating: ______________________________ Hours

During Cure – Temperature ____________ Humidity ____________

Dry Film Thickness: ______________________________ Mils

Appearance of Primer: ______________________________

Topcoat

Tack-free Time: ______________________________ Hours

Cure Time Before Flight: ______________________________ Hours

During Cure – Temperature ____________ Humidity ____________

Wet Tape Test: ______________________________

Dry Film Thickness: ______________________________ Mils

Appearance of Topcoat: ______________________________

AEROSPACE COATING SERVICE TEST
POST WASH INSPECTION SHEET

General Information	
Today's Date	Aircraft Type
Inspector	Tail No.
Parked in: Hanger ☐ or on Flight Line ☐	Total Flight Hours

Coating Information		
Painted by	Location	Date
Surface Preparation		
Primer	Manufacturer	Batch No.
Topcoat	Manufacturer	Batch No.

Exposure Conditions this Reporting Period			
Avg. Ground Temp.	>80° F. ☐	50° -80° F. ☐	<50° F. ☐
Avg. Ground Humidity	> 80% RH ☐	50 % - 80% RH ☐	<50% RH ☐
Avg. Ground Light	Outside ☐	Hanger ☐	Mixed ☐

Chemical Exposure					
Chemical Type		Coating Degradation Observed		Comments
	Yes	No	Yes	No	
Hydraulic					
Fuel					
De-Icing Fluid					
Engine Oil					

Aircraft - Wash		
Area Washed	Date	Wash Chem. - Mil Spec, Type, Mfg., Product No., Name, Mix Ratio
Exterior Hot Water Used: Yes ☐ No ☐		
Other (Exhaust Tracks, APU Track, Gun Port, etc)		

AEROSPACE COATING SERVICE TEST

POST WASH INSPECTION SHEET

Maintenance - Touch-Up Painting				
Area Touched-Up	Date	Primer: Mil Spec /Mfg. Topcoat: Mil Spec /Mfg.	Application Method	Reason for Repair
Wing, Upper Surface				
Wing, Lower Surface				
Wing, Leading Edge				
Fuselage, Top				
Fuselage, Sides				
Fuselage, Bottom				
Empennage				
Stabs, Vertical				
Stabs, Horizontal				

Visual Inspection			
Area	Defect	Cause	Size (sq. in.)
Wing, Right, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Wing, Right, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Wing, Right, Leading Edge	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Wing, Left, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Wing, Left, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Wing, Left, Leading Edge	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Fuselage, Right, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other______	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	

AEROSPACE COATING SERVICE TEST

POST WASH INSPECTION SHEET

Fuselage, Right, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Fuselage, Left, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Fuselage, Left, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Empennage	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Vertical, Right Side	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Vertical, Left Side	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Right Horizontal, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Right Horizontal, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Left Horizontal, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Left Horizontal, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
#1 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
#2 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
#3 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
#4 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	

AEROSPACE COATING SERVICE TEST

POST WASH INSPECTION SHEET

Overall Comments

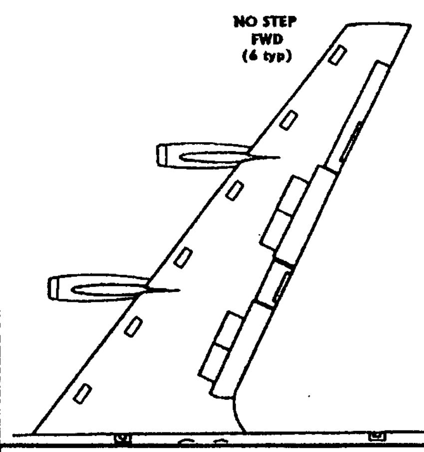
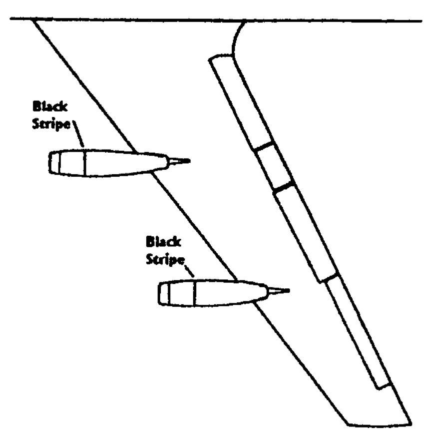
AEROSPACE COATING SERVICE TEST
TECHNICAL EVALUATION TEAM INSPECTION SHEET

General Information	
Today's Date	Aircraft Type
Inspector	Serial No.
Title of Inspector	No. of Flight Hours
Date of Last Inspection	

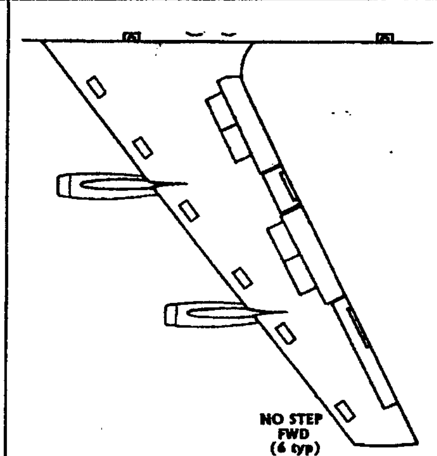
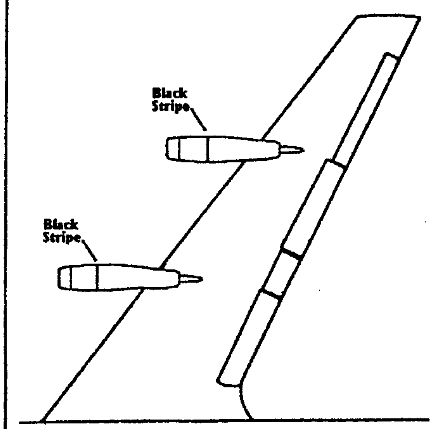
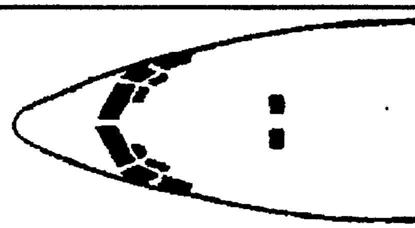
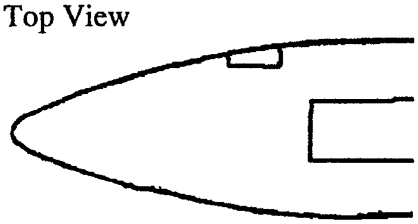
Coating Information		
Painted by	Location	Date
Surface Preparation		
Primer	Manufacturer	Batch No.
Topcoat	Manufacturer	Batch No.

Exposure Conditions			
Avg. Ground Temp.	>80° F. ☐	50° -80°F. ☐	<50° F. ☐
Avg. Ground Humidity	> 80% RH ☐	50 % - 80% RH ☐	<50% RH ☐
Avg. Ground Light	Outside ☐	Hanger ☐	Mixed ☐

Visual Inspection

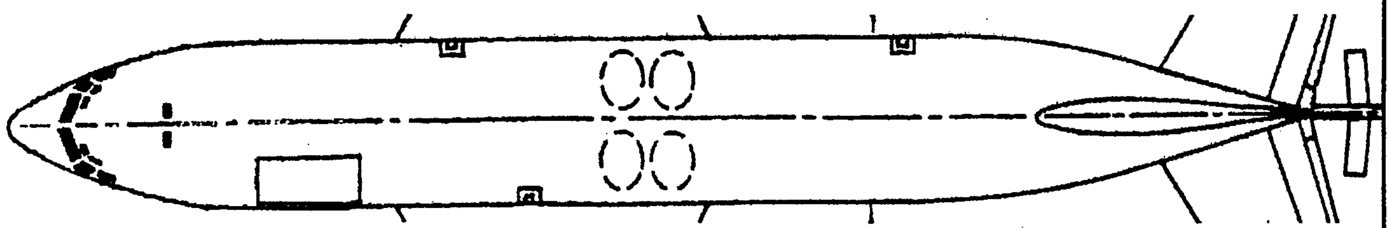
Area/Tests	Location / Substrate	Defect	Size (sq. in.)
Wing, Right - Upper Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Wing, Right - Lower Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

AEROSPACE COATING SERVICE TEST
TECHNICAL EVALUATION TEAM INSPECTION SHEET

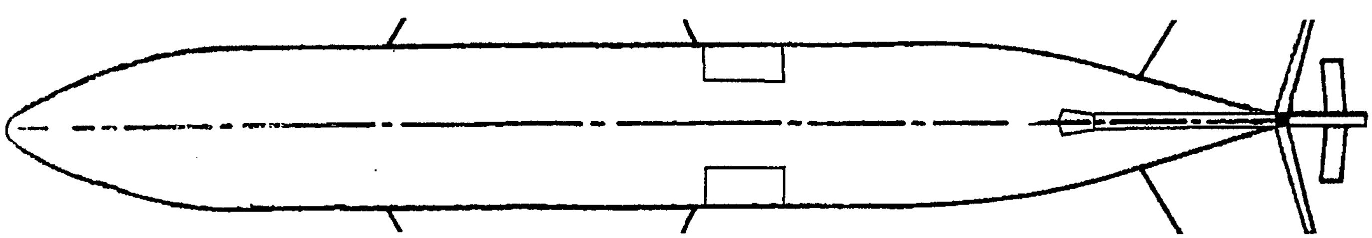
Area	Location / Substrate	Defect	Size (sq. in.)
Wing, Left - Upper Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Wing, Left - Lower Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Fuselage, Forward Section	 Top View  Bottom View	Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

AEROSPACE COATING SERVICE TEST
TECHNICAL EVALUATION TEAM INSPECTION SHEET

Area	Location / Substrate	Defect	Size (sq. in.)
Fuselage - Top Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

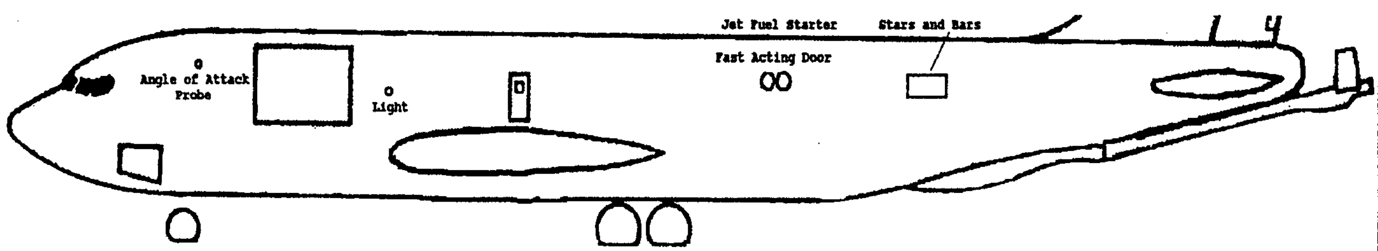


Fuselage - Bottom Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

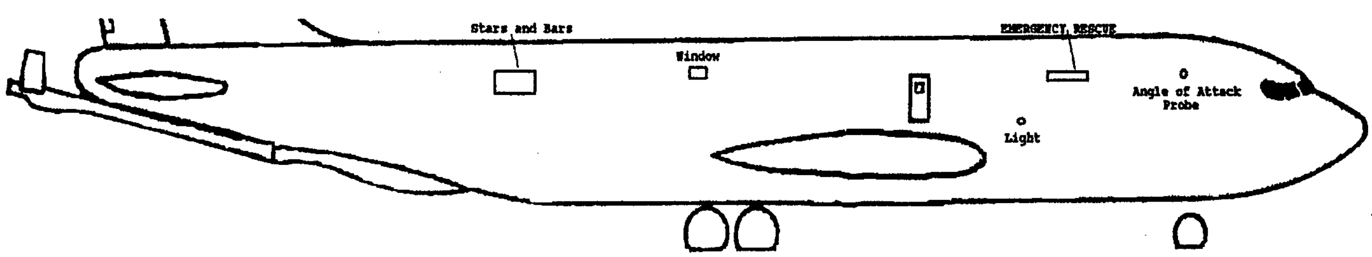


AEROSPACE COATING SERVICE TEST
TECHNICAL EVALUATION TEAM INSPECTION SHEET

Area	Location / Substrate	Defect	Size (sq. in.)
Fuselage, Left Side		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

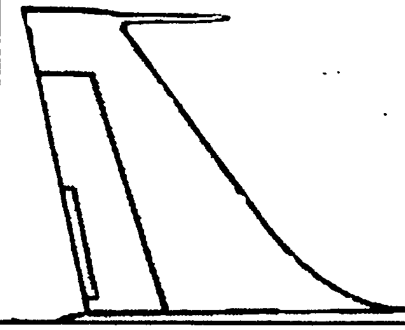
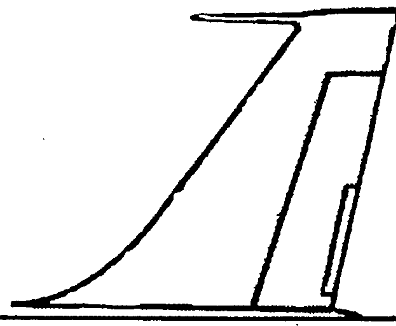
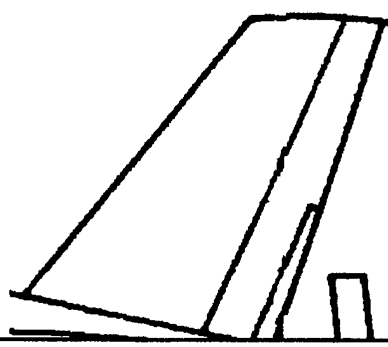
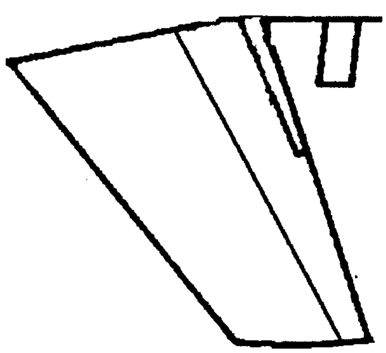


Area	Location / Substrate	Defect	Size (sq. in.)
Fuselage, Right Side		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

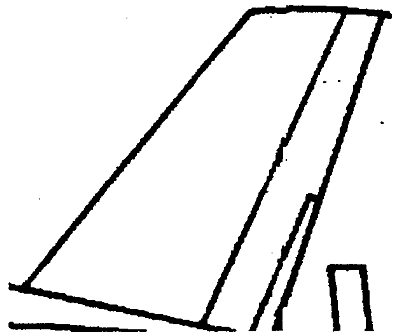
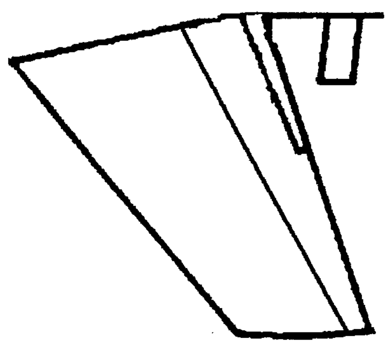


AEROSPACE COATING SERVICE TEST

TECHNICAL EVALUATION TEAM INSPECTION SHEET

Area	Location / Substrate	Defect	Size (sq. in.)
Stabilizer, Vertical Right Side		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Stabilizer, Vertical, Left Side		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Stabilizer, Horizontal, Right Top Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Stabilizer, Horizontal, Right Bottom Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

AEROSPACE COATING SERVICE TEST
TECHNICAL EVALUATION TEAM INSPECTION SHEET

Area	Location / Substrate	Defect	Size (sq. in.)
Stabilizer, Horizontal, Left Top Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	
Stabilizer, Horizontal, Left Bottom Surface		Erosion	
		Chipping	
		Blistering	
		Peeling	
		Chalking	
		Stains	
		Corrosion	
		Other(Specify)	

AEROSPACE COATING SERVICE TEST

POST WASH INSPECTION SHEET

General Information	
Today's Date	Aircraft Type
Inspector	Tail No.
Parked in: Hanger ☐ or on Flight Line ☐	Total Flight Hours

Coating Information		
Painted by	Location	Date
Surface Preparation		
Primer	Manufacturer	Batch No.
Topcoat	Manufacturer	Batch No.

Exposure Conditions this Reporting Period			
Avg. Ground Temp.	$>80^0$ F. ☐	50^0 - 80^0 F. ☐	$<50^0$ F. ☐
Avg. Ground Humidity	> 80% RH ☐	50 % - 80% RH ☐	<50% RH ☐
Avg. Ground Light	Outside ☐	Hanger ☐	Mixed ☐

Chemical Exposure					
Chemical Type			Coating Degradation Observed		Comments
	Yes	No	Yes	No	
Hydraulic					
Fuel					
De-Icing Fluid					
Engine Oil					

Aircraft - Wash		
Area Washed	Date	Wash Chem. - Mil Spec, Type, Mfg., Product No., Name, Mix Ratio
Exterior Hot Water Used: Yes ☐ No ☐		
Other (Exhaust Tracks, APU Track, Gun Port, etc)		

AEROSPACE COATING SERVICE TEST
POST WASH INSPECTION SHEET

Maintenance - Touch-Up Painting				
Area Touched-Up	Date	Primer: Mil Spec /Mfg. Topcoat: Mil Spec /Mfg.	Application Method	Reason for Repair
Wing, Upper Surface				
Wing, Lower Surface				
Wing, Leading Edge				
Fuselage, Top				
Fuselage, Sides				
Fuselage, Bottom				
Empennage				
Stabs, Vertical				
Stabs, Horizontal				

Visual Inspection			
Area	Defect	Cause	Size (sq. in.)
Wing, Right, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Wing, Right, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Wing, Right, Leading Edge	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Wing, Left, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Wing, Left, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Wing, Left, Leading Edge	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	
Fuselage, Right, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ________ ☐Air Flow ☐Impact ☐Unknown	

AEROSPACE COATING SERVICE TEST

POST WASH INSPECTION SHEET

Fuselage, Right, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Fuselage, Left, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Fuselage, Left, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Empennage	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Vertical, Right Side	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Vertical, Left Side	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Right Horizontal, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Right Horizontal, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Left Horizontal, Upper Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
Stabilizer, Left Horizontal, Lower Surface	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
#1 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
#2 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
#3 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	
#4 Engine Cowling/Intake	☐None ☐Chip ☐Stain ☐Peel ☐Blister ☐Chalk ☐Soften ☐Other________	☐Fluid ______ ☐Air Flow ☐Impact ☐Unknown	

AEROSPACE COATING SERVICE TEST
POST WASH INSPECTION SHEET

Overall Comments