



LOW/NO VOC AND NONCHROMATED COATING SYSTEMS FOR SUPPORT EQUIPMENT

FIELD EVALUATION REPORT #1

3 JULY 2002

**Prepared For
HQ AFMC/LGP-EV
Wright Patterson AFB, OH**

**Prepared By
Science Applications International Corporation
1000 Park Drive
Warner Robins, GA**

Field Evaluation Report #1

Dates of Trip: 3-7 June 02
25-27 June 02

Location: Cape Canaveral AFS, FL
Patrick AFB, FL
NAS Brunswick, ME
Naval Station Everett, WA

Key Personnel Contacted:

Location	Name	Organization	Phone Number
Cape Canaveral AFS, FL	Kurt Kessel	NASA AP2 (ITB, Inc.)	(321) 867-8480
	Bob Carr	Space Gateway Support (SGS)	(407) 853-7077
	David Degram	Space Gateway Support (SGS),	(407) 853-7077
Patrick AFB, FL	MSgt Micheal Coles	920 MXS/LGMG	(321) 494-4705
	TSgt Donovan Irons	920 MXS/LGMG	(321) 494-4705
NAS Brunswick, ME	CWO4 Kent Klein	AIMD/SE	(207) 921-2138
	ASC Russell Jobe	AIMD/SE	(207) 921-2138
NS Everett, WA	ASCS James Huskey	USS Abraham Lincoln	(425) 304-5077 X 571/575
	AS2 Jason Eslinger	USS Abraham Lincoln	(425) 304-5077 X 571/575

Team Members:

Name	Organization	Phone Number
Susan Misra, Project Program Manager	HQ AFMC/LGP-EV, Wright-Patterson AFB, OH	(937) 257-3498
Pat Doyle	Naval Air Warfare Center, Lakehurst, NJ (NAS Brunswick only)	(732) 323-1281
James Dean	SAIC, Warner Robins, GA	(478) 918-2917

Purpose of Trip:

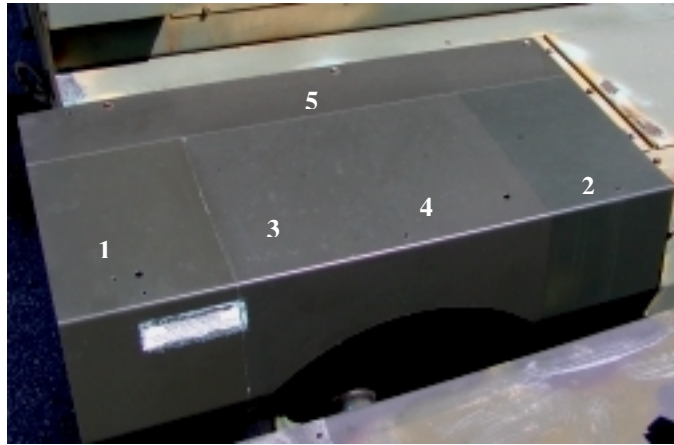
This is the first of three field evaluations to collect coating and corrosion data from previously painted support equipment (SE) test panels mounted on operational SE. The operational SE is positioned at corrosion prone military operating locations in the northeast, southeast, and northwest. The test data being collected includes coating gloss, color measurement readings, and a visual inspection of the test articles for any types of coating failure and corrosion.

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Findings:

Note: The U.S. Air Force and U.S. Navy provided the test panels from operational SE in varying structural condition. The test panels were reconditioned at Johnstown PA and recoated with the test coating systems in a manner to simulate field applications. Several small recessed areas on the panels did not receive complete coating coverage. These areas were noted in the initial coating inspection in November 2001. The survey team noted minor surface corrosion in these locations during this visit. This pre-existing corrosion is noted on the coating tracking forms, but will not be considered in the overall coating/corrosion condition ratings for the test coating systems. These corroded areas will be monitored and documented for the duration of this project.

The test coating systems were applied to sectionalized panels on operational SE. Each panel was divided into 5 sections. Sections 1-4 received one of the test coating systems with the baseline coating intersecting all of the test coating systems in section 5. The typical coating pattern is shown here.



Coating Systems	Description
1	DuPont Powder Coating, Gray Morning Epoxy ELH503S5055 base coat and DuPont Sky White triglycidyl isocyanuarate (TGIC) PFW510S9 topcoat
2	Morton Powder Coating Zinc Rich Gray Epoxy 13-7004 base coat with Morton Corvel White TGIC 30-1007 U1578-1 topcoat.
3	Deft zinc rich primer (44-GY-16), Deft Intermediate Primer (44W007), Defthane 0-VOC Topcoat (55GY005).
4	Aqua Poxy 912 epoxy primer with Defthane 0-VOC topcoat.
5	Coating Standard MIL-PRF-53022 primer and high solids polyurethane MIL-PRF-85285 topcoat (Colors – US Navy - gloss white color17925; US Air Force - semi-gloss forest green color 24052).

As a general note, the majority of gloss measurements taken on this survey were lower than the initial readings. However, there were several gloss measurements reading higher than the initial readings on the green-coated panels. Almost all of the readings on the white-coated panel at Brunswick NAS were higher than the initial readings. All “CIE L*a*B*TM” color measurements were higher than the initial readings. Conversations

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with Mr. Steve Finley (HQ AFMC/LGMP-EV) suggested that the difference in the color measurements was expected.

Although the test coating systems supplied by the vendors were required to match Federal Standard 595b, during coating application/curing we noted that several of the colors did not exactly match the federal standard. As a result, the field evaluation will not compare the color shifts of one vendor against another, but will track any color or gloss shifts of a particular vendors coating against a protected baseline coating sample of the same coating.

Overall the test coatings are performing as well as the baseline high solids polyurethane coating system. The white coating systems 3 and 4, applied to shipboard operating equipment appear to be yellowing and staining more on the USS Abraham Lincoln than the same coating applied to land-based equipment at NAS Brunswick ME. While it is too early to determine the exact cause(s), possible links to the operating environment and more frequent cleaning of the shipboard equipment as compared to the land-based equipment will be thoroughly evaluated.

Cape Canaveral AFS, FL

Aircraft Generator, Registration # 80X1005, #140

The survey team rated the overall appearance and surface condition of the test coating systems as good to excellent. However, the survey team did note coating systems 3 (Photo [mvc-003x](#)) and 4 (Photo [mvc-006x](#)) had singular spots of corrosion resulting from a break in the coating system. The breaks in the coating systems appeared a result of impact damage; however, this could not be confirmed. The spot in both coating systems indicated red rust in the point of origin, but there were no indications of rust creepage under the coating. Water spots and dust appeared over the entire fender, likely cause would be morning dew or rain and dust from the surrounding area. We were unable to effectively clean off the spots and dust, which may attribute to the lower gloss measurement readings. As previously noted, all three –86 generator fender wells had similar areas on the underside of the panels where primer and topcoat missed a closed seam. We are monitoring each of the condition of the fenderwells. As of this survey, the condition of the specific welds area on the fenderwells, (typical condition shown here [mvc-001x](#)), have not progressed beyond the surface rust previously reported. Wash schedules and materials are the same as reported on our initial visit.

Aircraft Generator, Registration # 87X1372, #150

The survey team rated the overall appearance and surface condition of the test coating systems as good to excellent. Water spots and dust appeared over the entire fender, likely cause would be morning dew or rain and dust from the surrounding area. We were unable to effectively clean off the spots and dusty dirt with soap and water. The spotting and dust may attribute to the lower gloss measurement readings. As noted in the initial baseline measurements, visual comparison of each of the different topcoats

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matched against the Federal Standard 595b color standard, made at the time of the initial coating application, showed minor color differences as shown here. Wash schedules and materials are the same as reported on our initial visit. No major corrosion found during this visit.

Aircraft Generator, Registration # 83X1003, #137

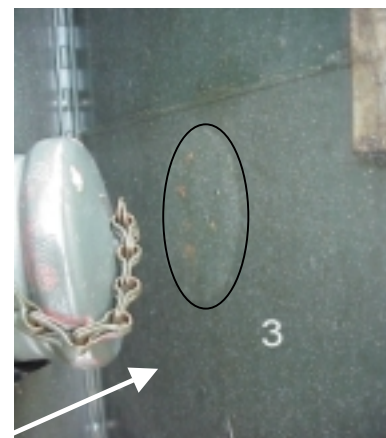
The survey team rated the overall appearance and surface condition of the test coating systems as good to excellent. The team visually compared each of the coating systems using the color standard (two pieces of metal painted with all five coating systems made at the time of the initial coating application) showed minor color differences. Water spots and dust appeared over the entire fender, likely cause would be morning dew or rain and dust from the surrounding area. The team members were unable to effectively clean off the spots and dusty dirt, which may attribute to the lower gloss measurement readings. As with the other -86 generator panels, the pre-existing corrosion located in a seam weld area has not progressed beyond the surface rust previously reported. Wash schedules and materials are the same as reported on our initial visit. No major corrosion was identified; however, a small area exhibited coating lifting and minor corrosion noted along the edge of the wheel well opening with coating system #3. The team determined the probable cause was a lack of coating wraparound along the edge. SAIC will request the on-site project manager track this area more often to determine if the corrosion is propagating.



Patrick AFB, FL

NF-2 Light Cart, Registration # R-96

The local equipment registration number has changed from R-21 to R-96. The registration number correction has been entered in the coating tracking workbooks. The overall test coating appearance on the door panel appears good to excellent with some minor surface corrosion in coating system # 3. The corrosion occurred where the test coating has chipped to bare metal. The apparent cause of the chipping is related to the door's operation. Technicians opening the door are not properly latching the door. As a result, the door is repeatedly striking the gas cap and chain, shown in this high- lighted area. The survey team will track the



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progression of these areas of corrosion. Pre-existing corrosion located in the hinge and latch area has not progressed beyond the surface rust previously reported. No major coating failures were noted. As part of the normal equipment corrosion preventive maintenance, all assigned equipment, including this unit is coated with "Corrosion X" Corrosion Preventative Compound (CPC). Prior to color and gloss measurements, the survey team removed all "Corrosion X" using a General Purpose Detergent, 7930-00-926-5280, Fed Spec P-D-1747C, Class 1. The 920 MXS maintenance personnel provided this product.

NF-2 Light Cart, Registration # R-97

The local equipment registration number has changed from R-22 to R-97. The registration number correction has been entered in the coating tracking workbooks. As with the unit R-96, the overall appearance of the door panel appears in excellent condition with no major corrosion or coating failures noted. As noted on the other NF-2 panels the pre-existing corrosion located in the hinge and latch area has not progressed beyond the surface rust previously reported. This unit was coated with "Corrosion X" (CPC), which is used by maintenance personnel to help reduce corrosion on assigned equipment. Prior to color and gloss measurements, the survey team removed all "Corrosion X" using a General Purpose Detergent, 7930-00-926-5280, Fed Spec P-D-1747C, Class 1. The 920 MXS maintenance personnel provided this product.

NF-2 Light Cart, Registration # R-98

The local equipment registration number has changed from R-73 to R-98. The registration number correction has been entered in the coating tracking workbooks. The overall appearance of the door panel looks good with minor rust found inside the door bottom lip caused by a 1-inch piece of masking tape that was not removed when the initial coating application took place. This will be considered as pre-existing corrosion as reported at the beginning of this report. Pre-existing corrosion located in the



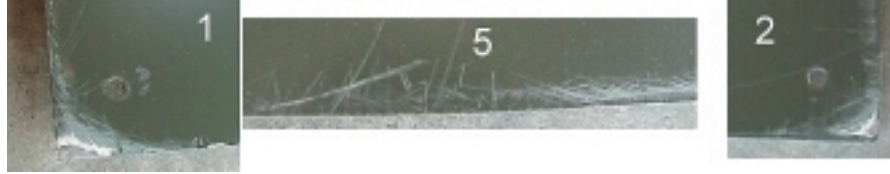
hinge and latch area has not progressed beyond the surface rust previously reported. This unit was coated with "Corrosion X", (CPC), which is used by maintenance personnel to help reduce corrosion on assigned equipment. Prior to color and gloss measurements, the survey team removed all "Corrosion X" using a General Purpose Detergent, 7930-00-926-5280, Fed Spec P-D-1747C, Class 1. The 920 MXS maintenance personnel provided this product.

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NAS Brunswick, ME

De-Icing Truck Boom Cover Plate, Truck Registration # T-46

The overall appearance of the panel appears in good to excellent condition. The test coating systems were applied on the interior side of the panel. This will expose the test



coating systems to high heat, humidity, carbon deposits, deicing fluids, and exhaust gases. The panel had numerous scuffmarks and scratches in coating systems 1, 2, and 5. These discrepancies are not a result of coating degradation, but could have occurred during installation and normal maintenance. The boltholes around the outer edge of the panel each had, what the team initially thought to be corrosion, originating on the test



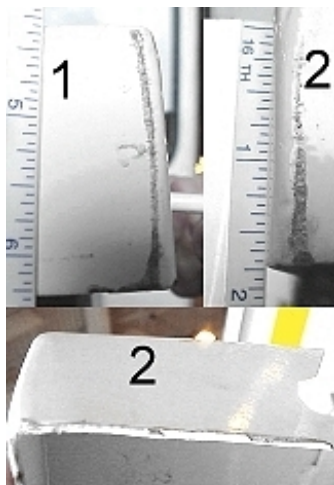
panel. Further investigation revealed the panel was installed over a corroded spot on the mating surface of the truck. The supposed corrosion on the panel was actually staining transferred from the corroded spot. The coating was marred but no actual corrosion



was evident in the coating depressions. Pre-existing corrosion located in a seam weld area has not progressed beyond the surface rust previously reported.

Towing Tractor Hood, Registration # LTC-084

The overall appearance of the tractor hood appears good to excellent. No major corrosion was noted during this visit. Prior to taking gloss and color measurement, the survey team removed the "road film". The hood was cleaned using a Navy approved cleaner, (Oasis 136, NSN 7930-01-398-0955, manufactured by ECOLAB), and rinsed with water. Gloss measurements were taken twice and both reading series were higher than our initial measurements. Coating system 5 had a small chip that



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went to the substrate; probable cause maybe a dropped tool. No corrosion was seen on the substrate. Coating systems 1 and 2 were worn and scratched on the leading edge corners; probable cause was standing on end prior to installation.

Naval Station Everett WA

A/S47A-1 Enclosure Panel

Test Panel Control # J-99-OC-014-01, is assigned to the USS Abraham Lincoln stationed at Naval Station Everett, Washington. The tow tractor, which the panel is installed, is used exclusively on deck during deployments. The panel was hand cleaned with a Navy approved cleaner (Oasis 136, Solvent-Detergent Cleaning Compound, Manufactured by ECOLAB Inc.) with no fresh water rinsing. During deployments all assigned Support Equipment is also hand-cleaned daily with this product with no rinsing. During the visual inspection we noticed coating system 1 had a soiled appearance; most of the soiled areas were in pits from previously removed corrosion. Coating system 2 had minor corrosion under a latch that had been removed. We questioned the maintenance personnel about the latch and they indicated none had been installed. Coating systems 3 and 4 had yellowed significantly and each had a minor chip with minor corrosion. Additionally, each of these coating systems had noticeable stains, which we were unable to remove. Coating system 5 had mostly scuffmarks and scratches none of which appear to have any corrosion. The outer edge corner had corrosion, which has some minor undercutting taking place.

Maintenance personnel assigned to the USS Lincoln were very interested in this project and asked numerous questions about each of the coating systems which were applied to the test panel. Mr. Dean briefed AS2 Eslinger specific areas are required for the digital photos and what coating failures to look for in case they were deployed for our next scheduled visit in November.

The remaining two test panels J-99-OC-014-02 and J-99-OC-014-03 are currently located on the USS John F. Kennedy and not available to the survey team.

Metal Wire Arc Sprayed Equipment

The Joint Group for Pollution Prevention project stakeholders requested that the survey team, while at Patrick AFB FL, document the condition of support equipment, previously sprayed with an 85/15% Zinc/Aluminum Metal Wire Arc Spray (MWAS). In 1999, the 920th MXS/LGMG, Aerospace Ground Equipment personnel conducted a test of the MWAS technology. Technicians sandblasted four pieces of operational support equipment that was exhibiting very severe corrosion. Each SE unit had to be abrasive blasted to a white metal finish with a two-mil surface anchor profile for the MWAS to properly adhere to the substrate. Once properly applied, the zinc/aluminum material would cathodically protect the steel substrate from corroding. Photos are available upon request but are not included in this field evaluation report. The following is a brief summary of what the survey team observed:

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Aircraft Generator –86

The un-topcoated generator had a dark gray appearance. This is a normal effect of the zinc/aluminum coating actively protecting the metal substrate. To evaluate the effectiveness of the metallization process, no primer, sealers, or topcoat was applied to the unit to reduce the hazardous materials used in painting operations. Several areas on the generator had blisters approximately 1-inch in diameter indicating improper surface preparation prior to metallization. All areas, which had been severely corroded, were abrasive blasted, and treated with the zinc/aluminum coating showed no evidence of active corrosion. Although there were several small areas of minor corrosion present on the unit, the zinc/aluminum was effective in reducing/eliminating further migration of the corrosion.

F-2 Trailer

As part of the test, a structurally condemned, severely corroded, F-2 General Purpose Trailer was sandblasted on the top platform only. The field technicians applied the MWAS zinc/aluminum coating over the platform. At the time of the survey, the trailer was performing well with no evidence of corrosion on the top platform. The un-metallized underside was still severely corroded.

B-1 Maintenance Stand




The survey team noted several areas on the B-1 maintenance stand where the surface was not properly prepared and the MWAS coating chipped off. In those areas minor surface corrosion was evident but had not progressed past the minor surface corrosion. In the very corrosion prone area of Patrick AFB FL, the metallized coating is providing excellent corrosion protection. Grease and oil residue were noted over a good portion of the stand; a pressure washer is used to easily remove these contaminants. No topcoat is applied to the stand.

MC-2A Air Compressor

This unit was sandblasted, coated with MWAS zinc/aluminum coating, and over-coated without primer with MIL-PRF-85285, high solids polyurethane. There were several small areas where the MWAS began to fail, but no major corrosion was detected. The MWAS coating failures were again attributed to not achieving the required 2-mil surface profile prior to metallizing. The polyurethane topcoat was beginning to show visible signs of fading.

Note: All of our points of contacts were very helpful during our visit. Special thanks to Ms Susan Misra for the help she provided during the inspections at each location.

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Photo Ref	Embedded Photos Jun 2002
mvc-003x Return	 A close-up photograph of a small, circular, orange-brown stain on a dark, textured surface. A white ruler is positioned below the stain, showing markings for 16 TH and 1.
mvc-006x Return	 A close-up photograph of a small, irregular orange-brown stain on a dark, textured surface. A white ruler is positioned below the stain, showing markings for 16 TH and 1.
mvc-001x Return	 A close-up photograph of a long, thin, horizontal orange-brown stain on a dark, textured surface. The stain appears to be a dried liquid or residue.