CONVECTION COOLED VME 6U FORMAT CIRCUIT CARD ASSEMBLY SALT FOG TEST REPORT

EXECUTIVE SUMMARY

October 20 1997

The Program Executive Office for Under Sea Warfare (PEO-USW, PMS428) has tasked Crane Division, Naval Surface Warfare Center to perform various salt fog tests on two convection cooled VME 6U format Circuit Card Assemblies (CCA) and enclosures in accordance with MIL-STD-810E, Method 509.3 and Radio Technical Commission for Aeronautics (RTCA) DO-160C. The detailed results of this test are presented herein.

Jon Homme
By direction

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Introduction

Between 20 July and 15 October 1997, Crane Division, Naval Surface Warfare Center performed various Salt Fog tests. The purpose of these tests was to address concerns that direct air impingement (convection cooled technology) Circuit Card Assemblies (CCAs) would not survive in a highly saturated salt environment. In addition, as the transition from MIL-STDs to commercial requirements in Military applications is ongoing, it was recommended that two series of tests be performed (MIL-STD-810 and DO-160C). After analysis, it was determined the two specifications were virtually identical, with the exception of time allowed after test completion to power up and test the unit under test. MIL-STD-810E allows for 48 hours while RTCA DO-160C requires power up within one hour of test completion followed by re-inspection and power up at 48 hours. NSWC Crane personnel tasked with conducting the above tests were Joe Jachim and Dan Geuder.

TEST	REQUIREMENTS DOCUMENT	TEST METHOD DOCUMENT
1. Salt Fog	None	MIL-STD-810E, Method 509.3
1A. Salt Spray	ACV Draft requirements	RTCA DO-160C, Section 14
2. Salt Spray	ACV Draft requirements	RTCA DO-160C, Section 14

CCA/Enclosure Type	Part Number	Notes
Matrix 68360	**MDCPU3602NNNC**	**Acrylic Based Conformal Coating**
Matrix 68360	**MDCPU3602NNN**	**No Conformal Coating**
SAIC VME bus exp. chassis	**91608-001**	**Functional**

Table One
Equipment Tested During Salt Fog Test One and Salt Spray One A

CCA/Enclosure Type	Part Number	Notes
Matrix 68360	**MDCPU3602NNNC**	**Uralane Based Conformal Coating**
Matrix 68360	**MDCPU3602NNN**	**No Conformal Coating**
SAIC VME bus exp. chassis	**91608-001**	**Non Functional**

Table Two
Equipment Tested During Salt Spray Test Two

Chronological Order of Salt Fog Test Number One and Salt Spray Test One A

DATE	EVENT
5/20/97	CCAs arrive at NSWC
5/22/97	CCAs programmed to verify operation
5/25/97	CCAs installed in TAC4 enclosure and Salt Fog chamber
5/25/97	Salt Fog test per MIL-STD-810E
5/27/97	Salt Fog test complete
5/29/97	CCAs and TAC4 enclosure passed operational tests
5/29/97	CCA physical inspection using optics
6/01/97	CCAs programmed to verify operation
6/01/97	CCAs installed in TAC4 enclosure and Salt Fog chamber
6/01/97	Salt Spray test per RTCA DO-160C
6/03/97	Salt Spray test complete
6/03/97	CCAs and TAC4 enclosure failed operational tests

Chronological Order of Salt Spray Test Number Two

DATE	EVENT
10/09/97	CCAs programmed to verify operation
10/12/97	CCAs installed in TAC4 enclosure and Salt Fog chamber
10/12/97	Salt Spray test per RTCA DO-160C
10/14/97	Salt Spray test complete
10/14/97	CCAs programmed, inspected, and passed operational tests
10/16/97	CCAs programmed, re-inspected and passed operational tests

Figure 1-TAC4 Enclosure

Figure 2-TAC4 Enclosure and Salt Fog Chamber

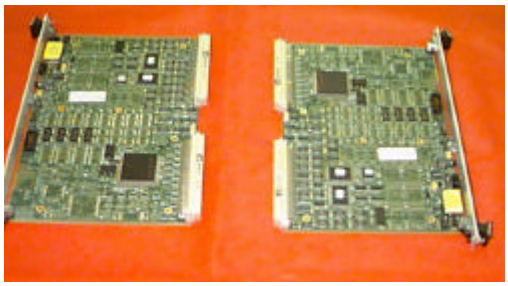

Figure 3-CCAs After Test

A. Salt Fog Test Number One

This test verifies the CCAs meet functional and physical requirements in a high Salt Fog environment.

1. Test Set-up.

The CCAs were installed into a TAC4 enclosure in slot locations 1 and 17 and communication between the cards was established across the backplane. The TAC4 enclosure was utilized as the test fixture. Refer to Figure 1. The enclosure was inserted into the Salt Fog chamber and the test was performed per MIL-STD-810E, Method 509.3.

2. Salt Fog Test Number One Findings

Upon completion of the test, the fixture was removed from the test chamber. The fixture was allowed to sit for 48 hours. At that time the TAC4 enclosure was successfully powered up. The CCA command program was downloaded and each CCA was verified to be operational.

The CCAs were removed from the TAC4 enclosure and inspected for signs of corrosion or other rejection criteria. The CCAs were moderately covered with salt particulate, some of which had the potential to bridge device I/O pins. Minor corrosion was observed on ~~hardware~~ captive screws and mounting hardware.

3. Salt Fog Test Number One Recommendations

The CCAs successfully completed the requirements of MIL-STD-810E, Method 509.3.

B. Salt Fog test Number One A

This test verifies the CCAs meet functional and physical requirements in a high Salt Fog environment.

1. Test setup

The two CCAs and TAC4 enclosure used in Salt Fog Test Number One were reinstalled in the salt fog chamber and were exposed to Salt Spray for 48 hours IAW RTCA DO-160C.

2. Salt Fog Test Number One A Findings:

Upon completion of the test, the fixture was removed from the test chamber. The fixture was allowed to sit 0.5 hour. At that time the TAC4 enclosure powered up, it was observed the 5 volt bus LED was not illuminated. Cycling power did not clear the fault, and it was concluded the TAC4 power supply had partially failed. The CCAs were removed from the enclosure and inserted in an identical TAC4 unit. Power was applied and an attempt to download the command program initiated,. Neither CCAs would reset and LEDs on each front panel indicated a fault condition.

Power was removed and the CCAs removed from the enclosure. Visual inspection of the CCAs revealed the same processor chip I/O pins had shorted on each board. Further evaluation revealed the conformally coated CCA exhibited more severe corrosion than the non-coated board.

The CCAs were taken to the NSWC Failure Analysis lab to determine the conformal coating used on the CCA. Crane FA determined the coating used was acrylic based. Subsequent conversations with the company revealed the coating used was not the coating desired nor ordered by part number.

The CCA vendor agreed to build up two new boards at no cost, The parameters selected mirror the initial purchase, one board coated with the desired Uralane conformal coating and one board uncoated.

C. Salt Spray Test Number Two

This test verifies the CCAs meet functional and physical requirements in a high Salt Fog environment

1. Test Set-up.

The CCAs were installed into a new TAC4 enclosure in slot locations 1 and 17 and communication between the cards was established across the backplane. The CCAs were then removed and placed in the TAC4 enclosure which had failed in Salt Fog test One A, this was done to avoid the potential of destroying an additional functional enclosure. The enclosure was inserted into the Salt Fog chamber and the test was performed per RTCA DO-160C.

2. Salt Spray Test Number Two Findings

Initial inspection: Upon completion of the test the CCAs were removed from the chamber and inspected. The CCAs were observed to have a small amount of salt particulate coverage, slightly less than observed after Test Number One. Minor corrosion was observed on captive screws and mounting hardware. The CCAs were inserted in the functional TAC4 enclosure and were verified to operate functionally.

Note: Due to a schedule conflict, a delay of 10 minutes was experienced prior to attempting the command program download. Total elapsed time from end of test to download was one hour and ten minutes.

48 hour inspection: The CCAs were left in the functional enclosure for the required time, then removed and visually re-inspected. Observations showed no changes to the mounting hardware, and no corrosion was observed on devices or connectors. The CCAs were inserted in the functional TAC4 enclosure and were verified to operate functionally.

3. Salt Fog Test Number Two Conclusions

The CCAs successfully completed Salt Spray requirements of RTCA DO-160C.

General Conclusions: Convection cooled technology CCAs can survive in accelerated Salt Fog/Spray qualification environments.

Note: The CCAs will be subjected to an additional 48 Salt Fog test without an enclosure. They will then be inspected and tested at routine intervals for latent defects, additional corrosion, and functional operation.