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AGILENT 3070 TEST PROGRAM SET (TPS) DEVELOPMENT

CACI

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AFRL-IF-RS-TR-2004-298 has been reviewed and is approved for publication

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13. ABSTRACT ***(Maximum 200 Words)***

This report documents the Test Program Set (TPS) development to perform In-Circuit Testing of Ten (10) Circuit Card Assemblies (CCAs) using the HP3070 test development system. The goal of this effort was to verify that current Air Logistic Center test system workload could be moved to the HP3070 system. The ten (10) CCAs were test candidates to verify that the HP3070 test system could repair these CCAs and return the cards to inventory and the return of the cards would prevent the F-15 from being grounded due to lack of available Line Replaceable Units (LRUs) and Shop Replaceable Units (SRUs). The successful results of this effort will assist in returning organic capability to the Air Force to repair LRUs and SRUs in a timely, cost efficient manner.

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1 BACKGROUND

The Avionics Production Division WR-ALC/MAIPE at Robins Air Force Base, Georgia has the responsibility for maintaining the Line Replacement Units (LRU) for the F-15 aircraft which involves repairing and testing the Circuit Card Assemblies (CCA) for 10 different LRU's. The repair and testing of the CCA's were still being performed on the outdated Original Equipment Manufacturer's (OEM) test system. The OEM test system had been experiencing malfunctions for some time and due to diminishing supplies, the test systems were becoming unrepairable. In reviewing the test procedures and accuracy of the repairs, it was determined that the technology to improve the repair and testing of the CCA's was affordable and necessary.

During the course of this project improvements were made in the diagnostics process and in the rate at which units could be tested. The run time for testing of each board was decreased significantly as is shown in figures 5 and 6 and described in section 3 of this final technical report.

2 SUMMARY

Rehosting of the CCA's from the OEM test system to advanced technology utilizing In-Circuit Test (ICT) systems would improve the repair and testing of the CCA's. The Agilent 3070 ICT system would provide superior test coverage, accuracy and repeatability for the CCA's. The time to test the CCA's would also decrease allowing more test time thus improving throughput. Additional discussion of the test program enhancements is included in Section 3 of this final technical report.

The superior coverage provided by the Agilent 3070 ICT is based on the system internal program called In-circuit Program Generation (IPG). This program is used to create the Test Program Sets (TPS) by modeling and analyzing the circuits and components in those circuits. In this way, the IPG generates a special algorithm to test and diagnose faults for each component.

3 METHODS AND PROCEDURES

3.1 In-Circuit Test Development

The Avionics Production Division WR-ALC/MAIPE at Robins Air Force Base, Georgia provided Masterpiece Engineering, Inc. (MEI) CCA's (gold boards) and schematics to developed ten different ICT programs utilizing five different fixtures. During test development each individual CCA was digitized to obtain X & Y coordinates. These coordinates were used to provide component graphics and test point locations for every network connection on the CCA. After the digitization process is complete In-circuit Program Generations (IPG) begins. During IPG the electrical and physical properties of the Unit Under Test (UUT) are described to the Test Consultant Software (TCS). When the properties are entered into TCS and the software is allowed to run and finish without errors, fixture software files are generated at this time. The test fixture when completed contains nests for two individual CCA's with the software capable of testing two CCA's at one time or the operator can individually select the desired CCA to be tested. One vacuum test fixture is capable of testing two different Circuit Card Assemblies.

3.2 Hardware Design

The fixture software files are transferred to the Mechanical Design (MD) group for hardware design. The MD group models hardware around these fixture files so that shop personnel can construct a vacuum actuated ICT fixture (Figures 1 and 2 below showing open and closed configurations). When an ICT fixture construction is complete, the debugging process begins. During debug all tests generated during IPG are verified for correct testing of the device under test (DUT). Any mechanical defects will surface at this point and will be corrected. When all test software and hardware passes MEI's Quality Specifications, the ICT fixture is shipped to the customer with accompanying software. Circuit Card placement within the test unit is demonstrated in Figures 3 and 4 below. This is the configuration that will be used by customers after the units are delivered.

Figure 1: Dual Nest Fixture with Vacuum Box closed

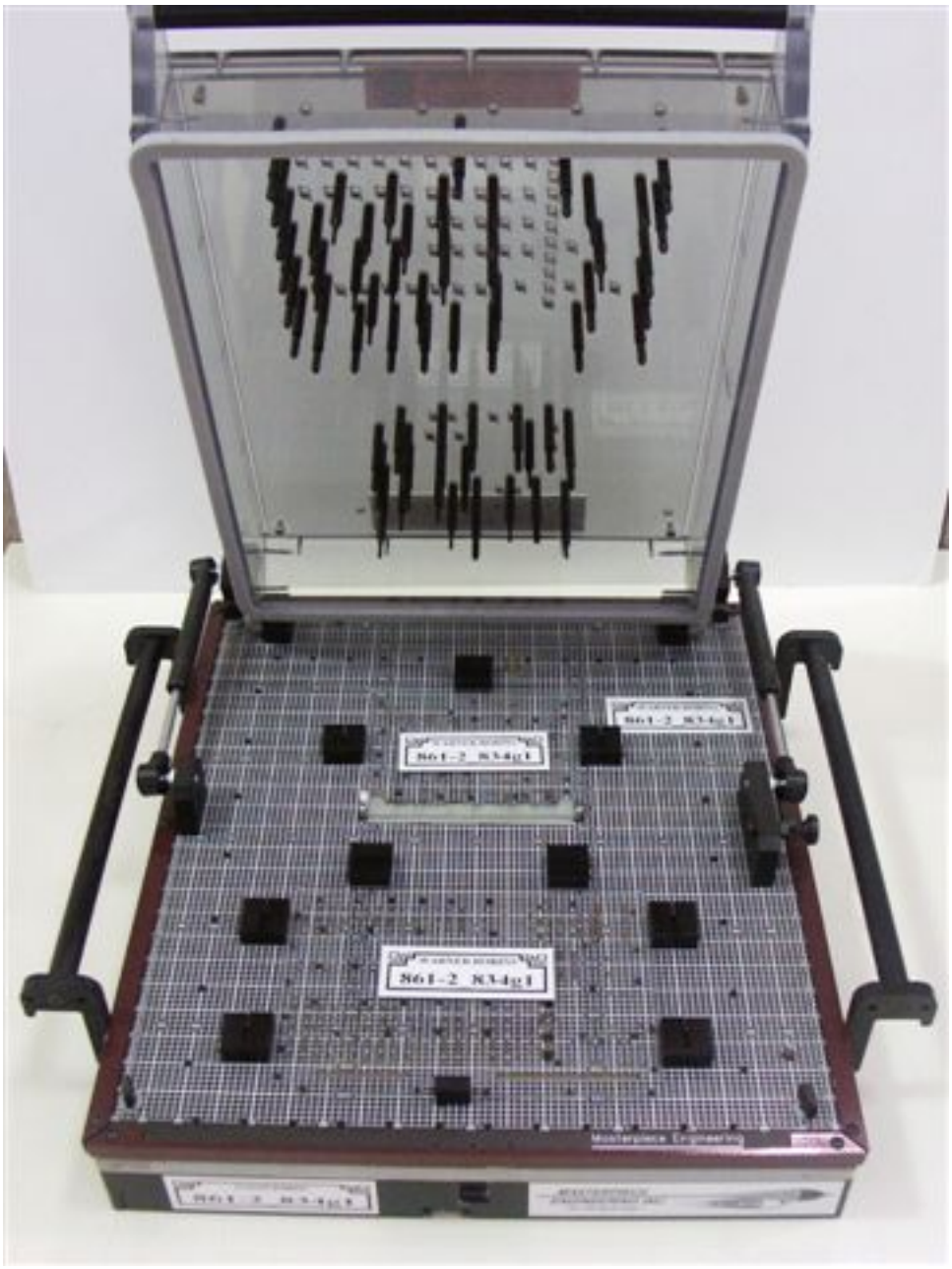

Figure 2: Dual Nest Fixture with Vacuum Box opened

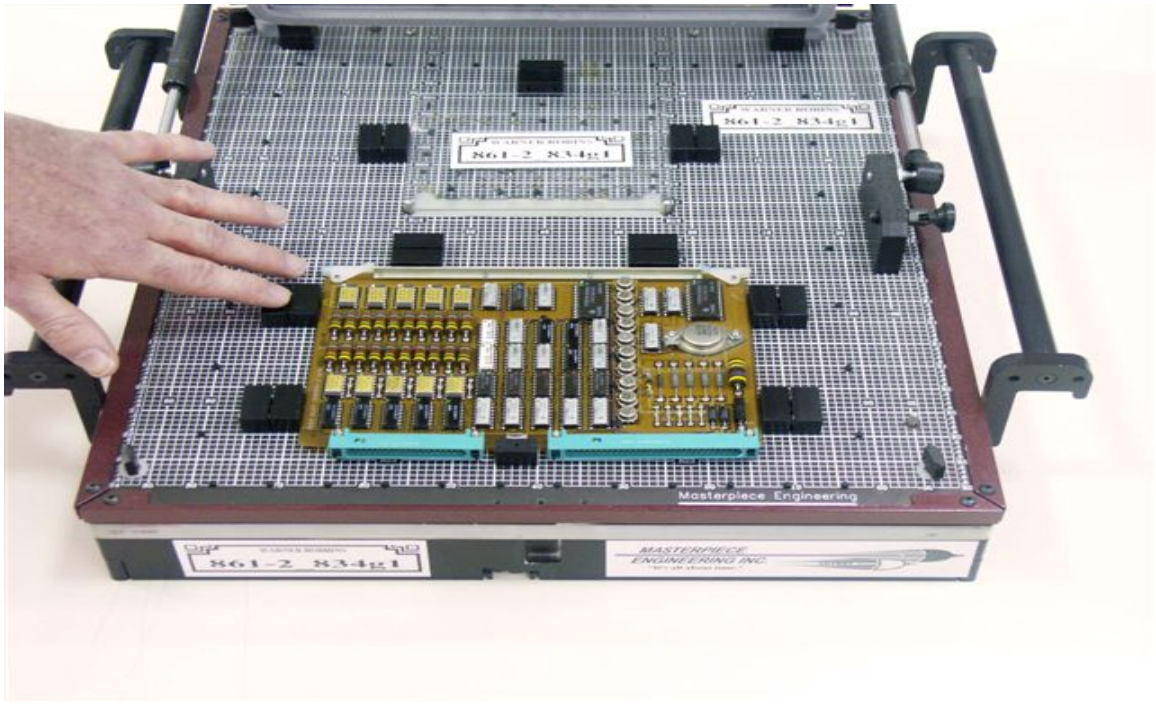

Figure 3: CCA placement in forward nest of ICT Fixture

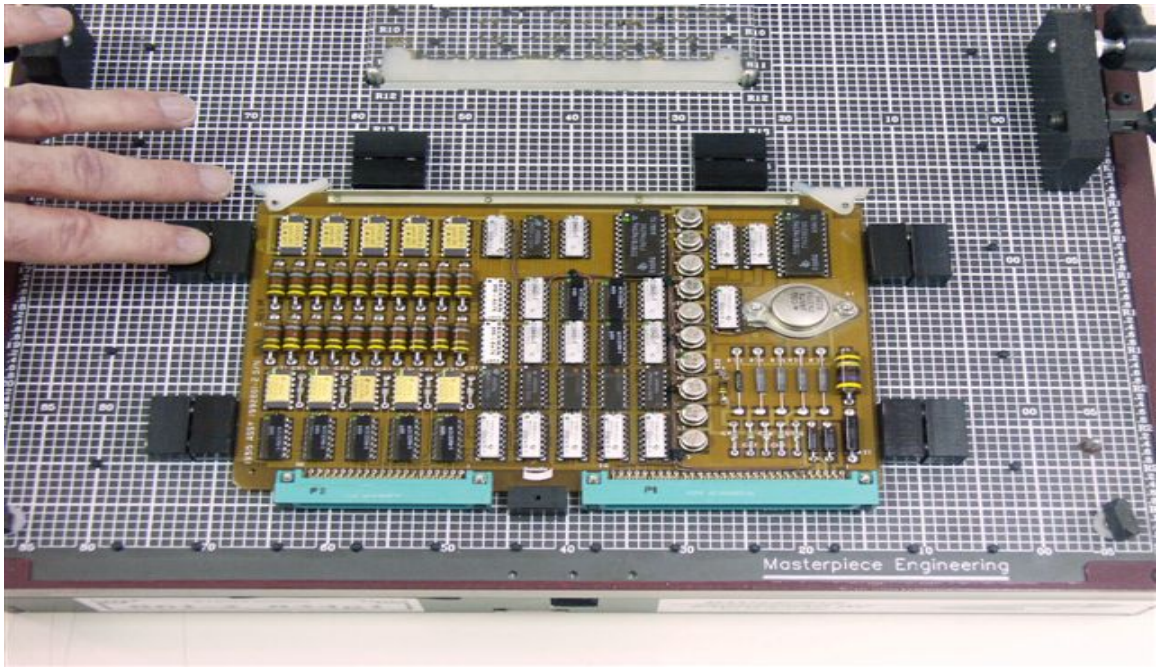

Figure 4: Close up of CCA with vacuum box opened on ICT Fixture

3.3 Test Program Sets (TPS)

Each TPS developed by Masterpiece Engineering went through a standard TPS certification process. Customer representatives including an Equipment Specialist (ES) Electronic Technician (ET) from the shop, Electronics Engineer (Project Manager), as well as the software engineer from Masterpiece Engineering were present at each sell-off. The steps for this process are as follows:

1. A test cycle is run using the new TPS to ensure that the circuit card being used for the certification process is "A" condition. A form is signed by the ES, ET, and Electronics Engineer certifying that the step was completed successfully.
2. A non-destructive fault is inserted in the circuit card and the TPS is cycled to ensure that the fault is detected. Success of this process is validated and signed off by the customer ES, ET, and Electronics Engineer.
3. This step is then repeated for nine additional faults.
4. A final test cycle is run to ensure that the circuit card is still in "A" condition. The successful completion of this final process is also acknowledged through sign-off by the customer representatives.

3.4 Test Program Sets Delivery and Installation

The Test Program Sets (TPS) were then delivered and installed. The ICT fixtures and programs were then approved and certified for production use based on the process described in para 3.3 above and illustrated in Figures 3 & 4 above.

Figure 5 below shows that the testing time for circuit card was reduced from approximately 30 minutes per card to less than one minute per card. The improved process throughput results are illustrated in Figure 6. With the improved process, approximately sixty tests can be run in one hour compared to the previous process where less than three tests per hour could be accomplished.

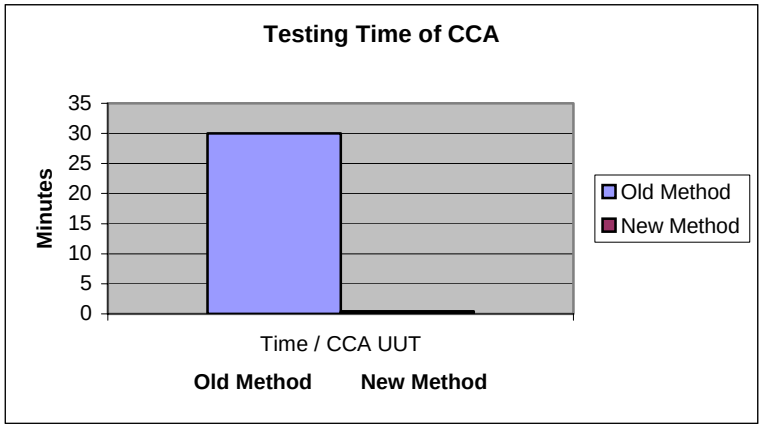

Figure 5: Testing Time of CCA

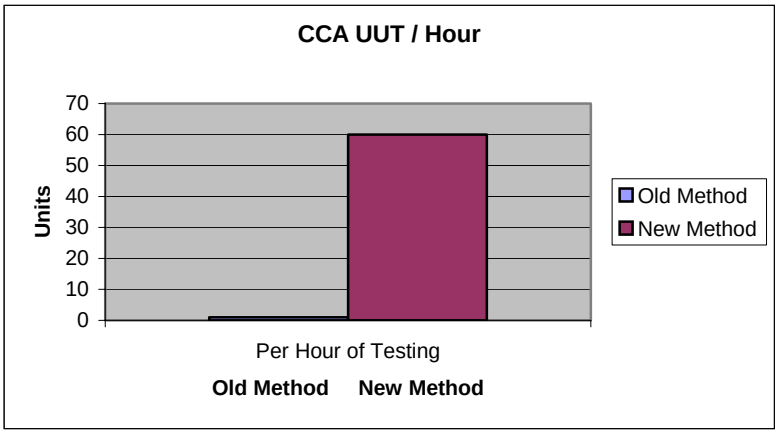

Figure 6: CCA UUT per hour

4 CONCLUSION

The purpose of this effort was to develop a modern technology solution for repairing and testing LRU's that support the F-15.

The repair and testing of the CCA's were still being performed on the outdated Original Equipment Manufacturer's (OEM) test system. The OEM test system had been experiencing malfunctions for some time and due to diminishing supplies, the test systems were becoming unrepairable. In reviewing the test procedures and accuracy of the repairs, it was determined that the technology to improve the repair and testing of the CCA's was affordable and necessary.

Masterpiece Engineering developed a process using the Agilent 3070 ICT system that dramatically reduced the time for testing each unit and resulted in significant savings to the government on future test procedures for these 10 CCA's. The procedure is transferable to In Circuit Testing for other CCA's.

Rehosting of the CCA's from the OEM test system to advanced technology utilizing In-Circuit Test (ICT) systems improved the repair and testing of the CCA's. The Agilent 3070 ICT system provides superior test coverage, accuracy and repeatability for the CCA's. The time to test the CCA's also decreased significantly allowing more test time and improving throughput.

The assessment of the re-hosting program has been successful. What previously took 30 minutes or more to test a CCA now takes approximately 45 seconds thus increasing throughput. The accuracy of the ICT test has also improved the repair of the CCA's.

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6 LIST OF ACRONYMS

CCA - Circuit Card Assembly
ICT – In-Circuit Test
IPG – In-circuit Program Generation
LRU – Line Replacement Unit
MD – Mechanical Design
MEI – Masterpiece Engineering, Inc.
OEM – Original Equipment Manufacturer
TCS – Test Consultant Software
TPS – Test Program Sets
UUT – Unit Under Test