JOINT SERVICES WIRING ACTION GROUP

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JSWAG Conferences/ Announcements

The next JSWAG/JFOWG Meeting is scheduled for March 26-29, 2012 in Virginia Beach, VA. Please visit https://jswag.navair.navy.mil/ for more information.

Voting for the 2011 Lu Roberts award recipient has begun. Please visit https://jswag.navair.navy.mil/ to place your vote. Voting will end March 15 so the winner can be annouced at the 2012 Spring JSWAG/JFOWG meeting.

Other Conferences

- EA-6B MAG -- St. Augustine, FL
  February 7-8, 2012
- Dixie Crow -- Warner Robins, GA
  March 18-22, 2012
- Quad-A -- Nashville, TN
  April 1-4, 2012
- AA&S -- Baltimore, MD
  April 2-5, 2012
- AEA -- Washington, DC
  April 3-6, 2012
- AIMS Conference -- Panama City Beach, FL
  April 30-May 3, 2012
- AUVSI Unmanned Systems 2012 -- Las Vegas, NV
  August 6-9, 2012
- DoD Maintenance Symposium & Exhibition -- Grand Rapids, MI
  November 13-16, 2012

Newsletter Contact

JSWAG Coordinator
jswag@navy.mil

Avionics Chassis Wire Testing

In response to a Joint Services Wiring Action Group (JSWAG) action chit and discussions with COMNAVAIRFORCES Avionics and FA-18 class desk, PMA-265 and PMA-209, the NAVAIR Wiring Systems Branch undertook a Research, Development, Test and Evaluation (RDT&E) project. This project was funded and sponsored by the PMA-209 Avionics Component Improvement Program (AvCIP) to fill a critical gap in the maintenance capability of Intermediate Maintenance Activity (IMA). It focused on troubleshooting the electrical conductive paths inside avionics chassis.

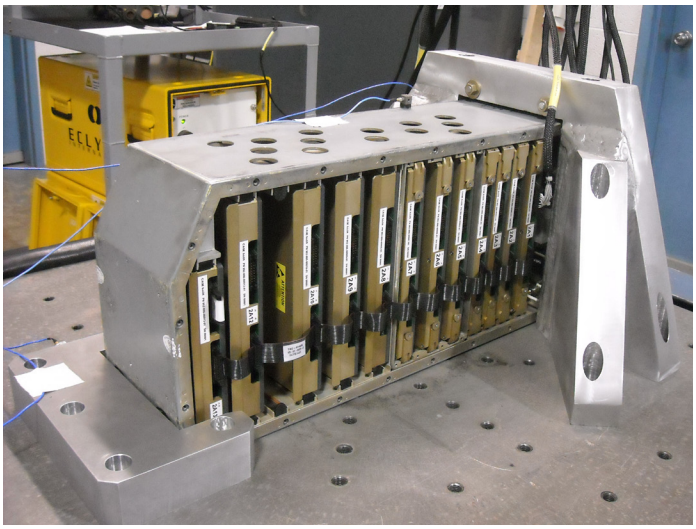
As avionics systems become more complex, the density of electrical inter-connect paths within Weapons Replaceable Assemblies (WRA) / Line Replaceable Units (LRU) has increased exponentially. The architecture of the inter-connect system has also become more complex, changing from discrete wires to ribbon cables, printed flex cables and printed circuit boards. Some WRAs have hundreds and even thousands of electrical paths. Basic programs of Automatic Test Equipment (ATE) such as Consolidated Automated Support System (CASS) assume that conductive paths within the chassis are good. This assumption has resulted in numerous false Shop Replaceable Assembly (SRA) replacements, and inabilities to fault isolate the true cause of the WRA failure. This has increased the repair cost and reduced availability of WRAs. Once a technician has replaced every SRA and the WRA still will not pass Automated ATE testing, the assumption can be made that there is a failure within the chassis wiring and inter-connect circuits. This leaves the technician faced with the daunting task of locating the failure with an ohmmeter and two probes. If the failure is intermittent, the task is insurmountable, leading to a high no-fault-found rate for the WRA. The WRA is ultimately declared Beyond Capable Maintenance (BCM) and sent to the next higher level of maintenance.

Wiring, or conductive path faults in avionics chassis manifest themselves as having poor system reliability, no fault found, could not duplicate, and bad actors. The Office of the Secretary of Defense (OSD) estimates that intermittent faults inside Weapons Replaceable Assemblies (WRA) are estimated to cost the DoD over $2B annually. There is no standardized, automated, DoD approved process, which capitalizes on a logistically supportable solution.

The FA-18 APG-73 Radar Receiver (RR) Chassis (WRA with all SRAs removed) was employed in the first test development due

see Chassis, page 2

Chassis from page 1



TPS under vibration (Dynamic Testing)

Test Kit

to its high repair cost and because it was the #1 avionics mission degrader for this Type/Model/Series aircraft.

NAVAIR 4.4.5.3 / 6.7.1.3 in collaboration with Eclypse International (Eclypse) developed the Test Program Set (TPS) which employs the recently fielded Automated Wire Test Set (AWTS) to test the more than 3400 conductive paths inside the RR chassis. The TPS was designed specifically so that it could be used in a typical aircraft vibration environment with the intent of increasing the probability of identifying intermittent faults.

The TPS consist of:

- Interface adapter cables - provides connection between the AWTS and the front panel of the RR
- Interface adaptor modules - closely resemble the original SRAs in size, mounting hardware, and electrical mating
- Test software – which enables the tailored test processes

Two tests programs, one static, and one dynamic (under vibration) were developed. They showed that about 74 percent of faults were identified during the one minute long static test while the remaining, about 26 percent were identified during dynamic testing, in under 30 minutes. The tests are performed very quickly (about 100 msec/wire) and tests are looped multiple times so as to capture the intermittent faults. The signals are multiplexed and use a RS485 interface. This TPS is the first of its kind to interface with the AWTS. The tests performed identify opens, shorts, high impedance faults and passive component tests (i.e. resistors, capacitors). Data acquisition is performed for quick fault isolation, engineering analysis, and trending capability. Tailored test capability focusing on specific test circuits is available. The TPS incorporates a graphical user interface, which guides the user to the faulty connector/path on the applicable technical manual wiring diagram enabling the Intermediate or Depot level technician to quickly identify the faulty wiring components requiring replacement.

Test program verification was preformed at MALS-11, MCAS Miramar and NAS North Island. Field-testing was done at FRC East, NAS Oceana and FRC West NAS Lemoore. Dynamic testing was completed at NAS Patuxent River. Fourteen RR chassis were tested during the field-testing. All except one chassis had hard failure in the chassis wiring detected during static testing. All failures detected by the AWTS were verified using an ohmmeter. This effort showed that latent wiring faults were found in 93 percent of the RRs tested. Prior to this testing, some of these WRAs were deemed serviceable, which would have resulted in various radar system failures upon installation in the aircraft.

This new capability to test WRA chassis wiring systems quickly, reliably and error-free, will greatly improve the repair capability, along with reducing the reliability and supportability of this WRA. A conservative BCM cost avoidance of over $1.6M per year is estimated for the RR alone. The improved Mean Flight-Hours Between Failures (MFHBF) and fewer replacement actions will directly impact the mission-critical radar system and readiness of the FA-18 aircraft. The solution is extremely cost efficient, as it employs the already fielded AWTS. The capability incorporates logistics supportability and addresses the critical elements as it is integrated in a new maintenance concept for this WRA. This capability is scale-able and adaptable to other critical WRAs resulting in a quicker fielding time and lower costs.