

**TRIP REPORT**

1. Location and Activities Visited: Prowler squadron forward deployed to Bagram, Afghanistan.
2. Dates of Visit: On/about October 2004.
3. Purpose of Visit: Emergency technical assistance by NATEC Weapons Systems Integrator (WSI) Greg Gross.
4. Summary of accomplishments:

The primary discrepancy requiring special attention was that one particular Prowler aircraft had suffered a seven-month history of intermittent problems/gripes on a critical cockpit display panel. These navigational system problems associated with the intermittent gripes occurred multiple times on nearly every flight but was only rarely observed on deck during troubleshooting. When flying in a war zone in mountainous terrain at night, this is a safety of flight condition.

Squadron maintainers had troubleshot the problem for weeks, changing all associated removeable components (Weapons Replaceable Assemblies - WRAs) and performing wire checks with no success. They performed their trouble-shooting procedures on all of the associated wiring using their multi-meter, HIPOT insulation resistance tester, and time domain reflectometer (TDR) and reviewed previous maintenance steps. The discrepancy was isolated to the navigational control panel. To add to the difficulty, documentation detailing the associated circuits were not available. Additionally there were errors and omissions in the Level II functional diagrams.

After approximately 60 hours of troubleshooting and phone consultation with NADEP engineering and the manufacturer of the electronic system being tested, we decided to remove the wing skin panels exposing the wire bundle containing the suspect circuits so that the bundle could be physically manipulated while under electrical test.

At first using a common digital multi-meter and then a HIPOT insulation resistance tester, we obtained negative results. Then using the *Eclipse ESP+ Standing Wave Reflectometer (SWR) tester\**, we observe a measured change of conductor length as we repeatedly ran the test while manipulating the wiring in the Liquid Oxygen Converter area.

\*NASA technology, manufactured by *Eclipse*, and provided to NATEC by Andrew Yang of NAVAIR-AAIPT under the Automated Wiring Analysis Program.

We didn't know exactly what it meant, but the *Eclipse ESP+ SWR* tester displayed definitive changes in the electrical properties of the intermittent faulty wire as the wire bundle was moved up and down. The problem went away when the faulty wire was replaced with a new wire from the cockpit disconnect to the malfunctioning system.

Several other long-standing discrepancies were corrected during this trip on a separate aircraft where pod stations 1 and 3 would not ID on deck. The historical pass down information from the previous squadron was that there was no phase C ground power and that the port engine would have to be dropped to affect the wire repair.

In fact, this wiring should not run anywhere near the port engine bay so we decided to have a look. We determined that both phases B and C were missing and that the problem was between two circuit breaker panels. Again using the Eclipse ESP+ SWR tester, we were able to determine that the broken wires were somewhere within one of the circuit breaker panels. This wasn't easy because this isn't a single direct wire run. There is a "T" splice, the power is shared with a fuel transfer pump via a fuel booster relay box.

The ESP+ SWR tester can't determine that the wire it is attached to goes to two directions, it just measures the total SWR. However, measuring from the three ends and using the undamaged phase A wire as a reference we were able to "guesstimate" the location of the open wires. The phase B and C wires had chaffed, shorted to ground, and burned open by rubbing on the case of the transformer rectifier, just below the power transfer panel.

On another aircraft the universal time code (UTC) would not display in the aft seat for the aircrew. Using the ECLYPSE ESP+ SWR tester, an open shield was found in a wire harness of the tactical computer.

5. Specific Problems and Recommendations: None

6. Items Requiring Further Actions:

- a. Requests (TPDRs) to update the Level II functional wiring diagrams will be submitted.
- b. The Prowler wire repair manuals need to be revised with a data column providing "Wire Length," like the old/obsolete 01-85ADC-2-2.2 series pubs. This would relieve a lot of the guesswork involved in wire repair. It will be essential as the SWR test technology is incorporated into the fleet.
- c. The Eclipse ESP+ SWR tester should be modified with a "continuous test" option. This would allow observation of changes as the wiring under test is manipulated.
- d. Data tables of Impedance and Velocity of Propagation for all cable/wiring types in the Prowler should be compiled and provided to fleet users of SWR technology.

7. Conclusions: This deployment facilitated the repair of jets that had suffered long-standing gripes and trained the troops on advanced troubleshooting techniques in the process. Aircrew confidence in the navigation system was restored. We also got a first "real world" look at a promising new approach to wire/cable testing. This was a personally satisfying experience despite the

adverse environmental conditions, Spartan living, and hostile enemy activity.