

Non-Destructive Fault Location on Aging Aircraft Wiring Networks Part 2 – Live Wires in Flight

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Aging aircraft wiring has been identified as an area of critical national concern. As the system ages, the wires become brittle and crack, break, or develop short circuits. Short circuits, in particular, have been implicated in a variety of smoke incidents, in-flight fires, and crashes. Some of these faults are intermittent, occurring only sporadically as the physical vibration, stresses, temperatures, electrical loads, moisture condensation, etc. change throughout the flight. When the plane is on the ground, no fault can be found. These types of problems are among the most frustrating for aircraft maintainers, resulting in a typical “no fault found” incident taking tens or even hundreds of hours to locate. Some planes even remain grounded for extended periods of time until basic electrical systems can be fully replaced at great cost and labor. One of the greatest hazards of these systems is that they may foreshadow a more serious in flight hazard as a small fault grows, yet for all intents and purposes, the system checks out OK.

This paper describes two systems based on spread spectrum technology that are the first known sensors that can actively locate faults on live wires in flight without disrupting or interfering with existing 400 Hz power or 1553 data bus signals. These systems are found to be highly robust to in-line noise, connection mismatches, etc. They provide measurements accurate to within inches or feet over several hundred inches of both shielded and unshielded cables. They can function accurately within a realistic network environment, and can locate intermittent short circuits (wet or dry arc events) in flight. The sensor development and testing for realistic situations, algorithms for enhanced data processing, and real-time analysis methods are described.