

DIT-MCO Delivers First Production Fiber Optic Tester

Boeing-Mesa using integrated electrical/fiber test system on F-18 Hornet

On one hand, testing a fiber optic assembly is night and day compared to testing a cable assembly, electrical component, or an entire aircraft:

- At 100 microns in diameter, an optical fiber makes the average electrical wire look monstrous.
- The glass threads are highly susceptible to dirt, nicks, and precise centering of their microscopic cross-sections.
- Fiber optic cables are prone to breaking if they are bent – unlike their electrical counterparts, which often are draped across fixtures and pulled into tight spaces.
- Testing a fiber optic assembly measures is concerned with measuring the loss of light power across a fiber, while electrical testing measures resistance, capacitance, dielectric breakdown, and so on.

That's the one hand. On the other hand, testing fiber optic systems is right up DIT-MCO's alley because tests are concerned with precision of a pathway from one point to another, and finding errors for correction. And because DIT-MCO has a history of introducing new technology and establishing the testing standard in many companies, it suits DIT-MCO to be at the leading edge of optical fiber testing.

Under the direction of Jim Stone, DIT-MCO's engineering team has delivered an analyzer that integrates fiber optic testing in an electrical analyzer to Boeing's wiring shop in Mesa, AZ. The Fiber Optic Analyzer will be used during production of F-18 Hornets. Fiber is being used in F-22 prototype aircraft.

Fiber & electrical wires in the same equipment?

“The aerospace industry is even mixing fiber and electrical lines in the same cable,” says Stone, primarily for non-flight-critical systems, such as weaponry communication and

video. He points out that one fiber can carry many signals, weighs less than its electrical counterpart, and features highly desirable “stealth” characteristics. “Radar can’t detect fiber the way it can metal wires.”

A single fiber measures anything from 200 microns and smaller, and the trend is even smaller, down to 50 or 62 microns. The analyzer emits a very high frequency light signal, which is transmitted over the fiber to a receiver. The light signal is converted into an electrical signal, and the analyzer measures the loss of light power across the fiber. This power loss is known as attenuation.

DIT-MCO’s tester makes a power measurement in decibels, or dBs, Stone explains. “A fiber optic system has a ‘power budget’ – a threshold of power put out by the source, and you can’t drop below a certain point,” he says. “We’re generally looking for power losses less than 1 dB per fiber, or 1.5 dB across the system. With all the variables that impact the fiber, you can lose a lot of power quickly.” A 3-dB drop translates to a 50 percent loss of power, and losing 10 dBs converts to a 90 percent power loss.

DIT-MCO’s Fiber Optic tester features:

- A fiber optic chassis that contains 16 modules for a total to 32 bi-directional ports.
 - Bi-directional ports allow transmission of light in either direction. “You can measure attenuation, or dB loss, without having to physically change the cable connection,” says Stone.
 - Systems are expandable. A 144-point test would cover most final assemblies, though the system could accommodate up to 500 points.
- TestExecutive® to control and record loss measurements – the very same tools used in DIT-MCO electrical wire analyzers.
 - A single test file may contain both types of tests.
 - ACT files support fiber optic switching addresses exactly the same as electrical switching addresses. A single ACT file may contain both optical and electrical information.

- Programmers and technicians use the same interface and test instructions to set up test parameters for a fiber test as for an electrical test.
- Spring-loaded connectors to “butt” the fiber end within very tight tolerances for physical alignment. (Fiber connections are the not standard male/female connections used in electrical assemblies.)
- Launch conditions specified by the customer, either fully filled or AS-100 standard.

The system also meets Boeing’s requirements that the cabinetry match the appearance of the more than two dozen DIT-MCO wiring analyzers in the Mesa facility. The front panel includes caps to protect connectors and a locked glass door to protect the panel from dust and bumps.

Customers can install components to accomplish field retrofits to Model 2500 analyzers in a day. “There’s really a minimal cost and effort to upgrade to fiber,” says Stone.

DIT-MCO has participated in the emerging fiber optic system activity for more than 20 years. It launched its own R&D effort four years ago, when Ralph Taylor, Director of Engineering, began working with Dr. Chris Allen, Associate Professor, Electrical Engineering & Computer Science, University of Kansas. DIT-MCO exhibited a prototype at NEPCON and other industry shows early in 2001. In addition, the company has been actively involved in the industry standard-setting movement.