www.iotech.com

# Optical Fiber Testing
## *using the WaveBook*

*Aerospace*

**Application Note #77**

## Application Summary

Most large test laboratories around the world that conduct conformance and life tests for new products are usually well outfitted with the finest equipment. Besides off-the-shelf instrumentation such as oscilloscopes, analyzers, computers, and signal generators, much of it includes custom simulators and test setups for meeting domestic and foreign performance and safety standards as required by various customers. The most critical instrumentation intended for any test lab, however, is the data acquisition system, which records and displays all component variables during a test and stores the information for later analysis and reporting.

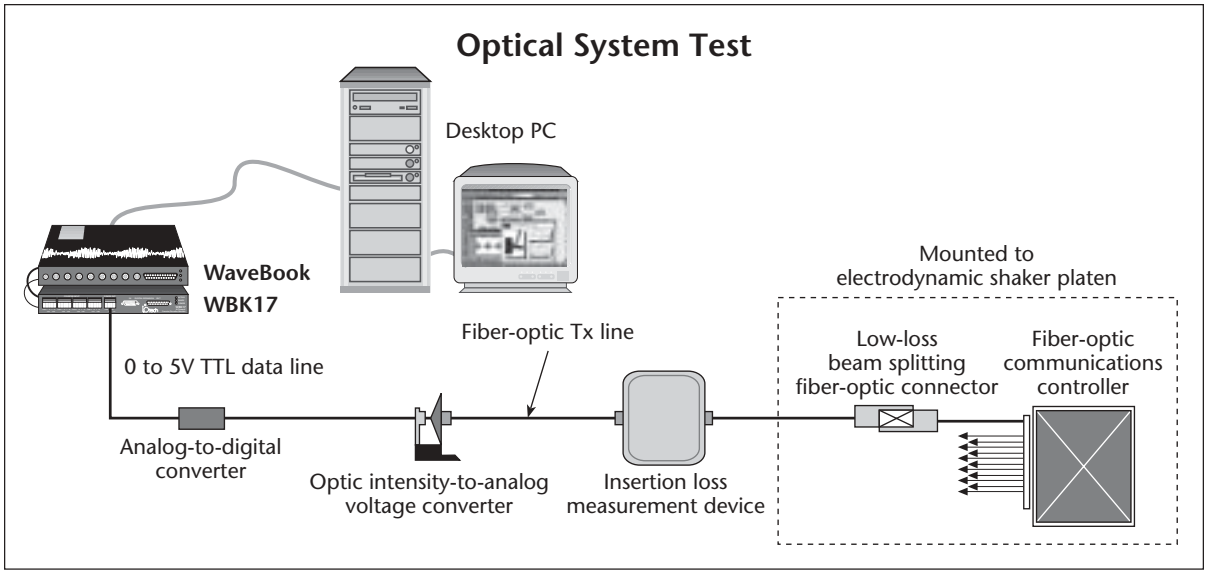
One such test facility, Wyle Laboratories, is located in Cedar Falls, Iowa. It's an independent environmental, dynamics, and EMC product qualification laboratory that tests a wide array of components including both ground and aeronautical vehicles. For the past five years, the test facility has had both general-purpose and special high-speed data acquisition systems intended to run the environmental and dynamics test lab. The high-speed data acquisition system principally acquires dynamic and high-speed accelerometer data for vehicle testing based on many international standards such as SAE, ISO, and MIL specifications. It works sufficiently well for testing most mechanical components under sine and random vibration, and shock tests. The general-purpose acquisition system monitors and controls test setups in combined temperature and humidity environmental tests, HALT (highly accelerated life testing), accelerated corrosion, and life cycle tests to name a few. However, when a customer contracted the lab to conduct fiber-optic component testing for jet aircraft, their existing data acquisition system proved to be too slow.

## Potential Solution

Shock and vibration tests on fiber-optic components for a jet-powered aircraft require a data collection system that can detect rapidly changing signal amplitudes and intermittent signal loss in a fiber-optic communications network. Tests include acquiring burst signals, and detecting interruptions and pulse breaks over a specific range of wavelengths. Although special test gear is manufactured specifically for this purpose, it comes at a relatively high cost.

## IOtech Solution

Ryan Urness, Senior Test Specialist is responsible for designing all electrical test setups at the Cedar Rapids facility. He evaluated the IOtech WaveBook™ while searching for an alternative solution for monitoring fiber-optic components. "My major concern was being able to capture accurate data at high speeds," says Urness. "I found that the IOtech WaveBook's acquisition rate and resolution coupled with the WBK17™ interface was more than sufficient to collect the data needed by our client's engineers, and the cost of the system was about one-fifth that




*An IOtech WaveBook and WBK17 signal conditioner collect data during an optical-system test for repeatability, continuity, and insertion loss. The WaveBook measures data during dynamic vibration of a communications controller outfitted with a low-loss, beam-reflecting fiber-optic connector.*

of the dedicated optical test system." Moreover, Urness says that because DASYLab® and LabVIEW® software had been widely used throughout the lab with previous equipment, the test personnel didn't need additional training to commission the WaveBook. They were able to implement it immediately.

The test verifies repeatability, continuity, and insertion loss (measured in dB) of fiber-optic communication data during dynamic vibration of a communications controller and a low-loss, beam-reflecting fiber-optic connector. The fiber-optics communications controller and connector are fastened to the plate of an electrodynamics shaker for random vibration testing. The signal measured from the connector and controller during vibration reaches the WaveBook through a series of signal conditioners. First, the connector connects to a special device for measuring insertion loss through a fiber-optic transmission line. The output of the measuring device then drives the input of an optical intensity-to-analog voltage converter, which in turn drives an ADC. Finally, the digital signal feeds the WBK17 interface on the WaveBook. This test typically runs with only four channels, while the WaveBook collects samples at the full 1-MHz rate, and the WBK17 interface captures 5-MHz signal bursts.

Although both LabVIEW and DASYLab software are familiar to lab personnel, the DASYLab is preferred to handle all the data in the acquisition system. The data are observed in real time and streamed to a computer's hard disk. Files may be saved in several different file formats and custom templates prepare the data for customer reports.

Urness also particularly appreciates its versatility and resiliency. For example, "In addition to testing fiber-optic components," says Urness, "our IOtech systems are used in a wide variety of environments where they can be exposed to the same elements as the device under test. Some have received doses of high heat, chemical splash during chemical compatibility pressure and spray tests, and high temperatures and humidity in accelerated life tests without experiencing data loss or system failure."

## Conclusion

One of more than 13 Wyle Laboratories located around the United States – the Cedar Falls facility – chose IOtech's WaveBook over a dedicated test system to conduct durability tests of optical communication devices for jet aircraft. The WaveBook monitors 5-MHz signal bursts during random vibration of an optical communications controller and beam-reflecting connector while mounted on a shaker plate. Specialists use DASYLab software to observe and collect data for reporting the optical system's performance.

## WaveBook Series

The WaveBook™ series of portable and desktop digitizers offer multi-channel waveform acquisition and analysis for portable or laboratory applications. All WaveBook models include 8 built-in channels expandable up to 72 channels of voltage, accelerometer, microphone, strain gage, thermocouple, position encoder, frequency, high voltage, and other signal types. For applications beyond 72 channels, up to four WaveBooks can be combined within one measurement system, for a total capacity of 288 channels. WaveBooks are available with an Ethernet connection to a PC.

### Features

- PC connection via Ethernet
- 1 µs/channel scanning of any combination of channels
- Expandable up to 288 high-speed channels
- SYNC connection allows multiple units to measure synchronously
- Add up to 224 lower-speed thermocouple channels
- DSP-based design provides real-time digital calibration on all channels
- Single and multichannel analog triggering with programmable level and slope
- Digital TTL-level and pattern triggering
- Pulse trigger and external clock
- Programmable pre- and post-trigger sampling rates
- Sixteen 1-MHz digital inputs
- Operable from AC line, a 10 to 30 VDC source, such as a car battery, or optional compact rechargeable battery module

*Using WaveView software's spreadsheet-style interface, you can easily set up your application and begin taking data within minutes*

### Included Software

- WaveView™ for *Out-of-the-Box*™ setup, acquisition, and real-time display:
  - Scope mode for real-time waveform display
  - Logger mode for continuous streaming to disk
- eZ-Analyst™ for real-time spectrum analysis
- Export data in third-party formats
- Includes drivers for Visual Basic®, Delphi™, C++ for Windows®; DASYLab®, and LabVIEW®
- ActiveX/COM development tools