



## Changing The Landscape Of Long-term Field Testing With Lab-Quality High-Frequency Data Acquisition

### New Methods for High-frequency Data Acquisition and Analysis Yield Invaluable Results From Long-term Field Testing

A novel approach to field testing and analyzing equipment — whether the machinery is deep inside a mine or clearing a remote mountain pass — now allows engineers to gather a far more complete picture of the actual environment and stresses that lead to structural failures.

A pair of engineering firms from Milford, Ohio — SixDOF Testing & Analysis, partnering with Integrated Test & Measurement (ITM) — have combined to deliver the ability to gather, process and interpret terabytes of data captured during months-long, high-frequency tests of equipment on the fly. As a result of these “deep-dive” testing and analysis methods, clients are gaining invaluable snapshots of in-the-field stresses that can then be used to troubleshoot equipment failures, tweak product designs or even adjust validation tests to more accurately reflect real-world environments.

In a sense, these firms have found a way to move high sample rate structural tests, which were previously limited to a laboratory, out of the simulation setting and directly onto equipment in the field, where more authentic measurements can be gathered. The solution required an innovative use of National Instruments cDaq hardware, supplemented with an embedded PC, multiple 2TB hard drives and connectivity for both Wi-Fi and cellular. The unit is controlled by ITM’s iTestSystem software and a customized interface that allows for real-time monitoring as well as the ability to remotely switch storage drives to expand data capacity.

Among the key advantages of the integrated testing service, which SixDOF calls Unattended Data Acquisition and Analysis Technology (uDAAT), is the ability to gather a month or longer snapshot of high-frequency data — measuring such things as vibration and acceleration — through dozens of channels, and all from a single site visit for the initial install.

“You could have a technician fly out to an offshore rig to install the uDAAT, and it could be running for months and collecting data without anyone having to stay there or swap out memory cards,” says Rob Vickers, senior project engineer with SixDOF. “One of the challenges our customers face is they have no means to record high-speed data without having to send somebody to the site every few days. We came up with a way to stream that data to a portable USB hard drive.”

SixDOF Senior Technical Consultant Garth Wiley adds that the benefits of gathering data using the uDAAT go well beyond the convenience and cost savings associated with fewer site visits.

“We are gathering a more complete picture by recording more sensor measurements over a longer period of time,” says Wiley. “And that helps better define the environment the equipment is operating in. If you don’t understand that environment, you end up having failures in the field, which can lead to big warranty costs. So to get that genuine picture of the environment is very valuable.”

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#### CUSTOMER DUTY CYCLE



#### RUGGEDIZED cDaq



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# Gathering Data Is Half The Battle

**While recording terabytes of data from an extended field test is impressive, that ability is more or less pointless unless the volumes of data can then be analyzed in a way to yield actionable results for the client.**

To that end, SixDOF consultant and PhD Dave O'Brien developed statistical processing techniques to funnel the vast amounts of data from these tests into a series of rather revealing, yet simple, summary graphs. A color contour map, for example, serves as one of his visual expressions of the information.

"Good data acquisition is an art form," says O'Brien. "But the cost savings for a company will not be realized until equally good analysis is completed. It is what you do with that data that makes the difference."

If SixDOF were testing a new line of trucks, for example, and the manufacturer wanted field data to enhance the design of its turbocharger or any other component, O'Brien can boil down hundreds of thousands of data points from weeks of testing over the road into a report that lets the manufacturer quickly see such things as rare events — say off-the-charts vibration levels — that could potentially cause a failure. He can then isolate that point in time to interrogate any of a hundred other channels recorded and do enough data mining to explore exactly what else was occurring in the vehicle to help pinpoint the problem.

"You have to be able to dive into the data to identify the areas that are interesting," O'Brien says, while also pointing the firm's efforts to customize reports. "If I have an idea of what a customer's interests are in terms of data results, I can adjust my software and respond to that individual need."

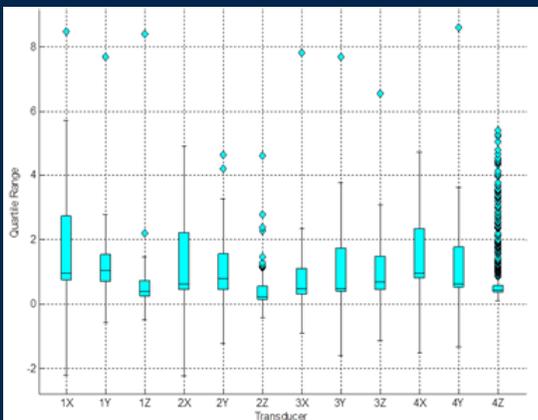
Staying with the truck-test example, SixDOF could also help a manufacturer more accurately build its laboratory validation testing by sharing average levels they render from test data to then allow a client to set their lab tests to reflect real-world conditions. The results of such findings and adjustments help assure products aren't over-designed, causing manufacturing overruns, or under-designed, causing expensive warranty claims.

Whether using the uDAAT system to troubleshoot equipment as it operates or to assist manufacturers in the design process, both SixDOF and ITM are pleased to add to their portfolio the means to acquire and analyze a hundred or more channels of data in the field, a method that was previously cost prohibitive.

More importantly, the results of being able to gather and process long-term high-frequency data are proving invaluable to their clients.

**See Front For Contact Info**

QUARTILE SUMMARY EXAMPLE PLOT



POWER SPECTRAL DENSITY SUMMARY EXAMPLE PLOT

