

Pain, Passion, and Persistence Payoff . . . Celebrating Gaberson's Victory

John Van Baren, *Vibration Research Corporation*

It is exciting to see common sense prevail. After reading the history of the pseudo velocity shock spectrum (PVSS), I have to admire Dr. Howard Gaberson's pursuit of a measurement method that has driven him to experiment and communicate for the past 40 years. I have read the papers, and they make sense – common sense. Not so common that you would immediately see the reason for using PVSS. But common enough that after brief thought, you would agree; yes, this makes sense. Sometimes good ideas and new concepts take a while for us to comprehend.

Recall that in the 1920s, Colonel William "Billy" Mitchell had very strong ideas and was very outspoken about the critical importance of air power in military campaigns. It was his position that air superiority was more important than naval superiority in a war. He was court-martialed for insubordination in 1925 because of his outspoken views on the future of air power. That was all before WWII. Colonel Mitchell was ultimately vindicated and posthumously promoted to major general in 1942.

At Vibration Research (VR), we always listen to our customers to figure out what they really need or want to do. That has really shaped our development efforts over the years. We listen to all our customer requests and act on the repeating common sense requests. That is why we were the first to introduce time-history waveform replication 15 years ago. We called it field data replication, or FDR. Immediately, the response was positive. However, the question always came up "what standard is this found in?"

Test standards aside, the folks who test to improve quality and reliability were the first to use this technique. This was largely the automotive industry, whose ultimate goal in testing is to improve the bottom line for investors. Industry will readily write internal procedures if they make sense and can be shown to improve the bottom line. This is usually an indicator of a good method. Today, many use the FDR technique for their quality control programs and have written internal test procedures. We are proud to point out it now shows up as a procedure in MIL-810G.

More recently, our efforts have been to adjust the kurtosis of a random vibration test. This was in response to customer requests of "we need shock on random." We explored this concept for several years. One day, VR's head of R&D said "I think we need kurtosis control." We developed the technique, discovered that the trick is to get the kurtosis into the resonances (this requires VR's patented Kurtosion[®] algorithm), and began promoting it. Our promotion started with a ½ day seminar USA road tour.

The introduction included the question

"who has heard of kurtosis?" For the first year, fewer than 5% of the attendees had heard of the term. It turns out that most of them came to the seminar for the free doughnuts. The unique combination of digesting sugars and stimulating the thought process in the brain prompted the engineers and scientists in the crowd to jump up and exclaim "eureka!" Now, just four years later, when asked the same question, we get a 95% affirmative response. It is thrilling to hear the complete spectrum of comments on this technique, from "this will not work, have you not heard of the central limit theorem" to "this makes a lot of sense." I say thrilling, because we are getting people to think again. Yes, we know all about the often misused central limit theorem.

I should also point out the importance of balancing listening to customers and implementing their requests. Ultimately, we need to provide for long-term sustainability. At Vibration Research, when we add a feature to our software, it becomes part of the standard code. We have only one version of current software, one that works for everyone. The importance of this was recently discussed in the December 2009 *Sound & Vibration* by Dave Hunt's editorial – "I'll Just Write a Software Program to Do That." If support questions come up five years after a sale, it is important to use the same current software version to answer questions. We are currently on Version 8 and soon will release Version 9 software. Even for those customers who do not keep their software contracts current, we have the latest release for all versions, which are continuously supported all the way back to Version 1.

Speaking of listening, a few years ago I was listening to a group of the good old boys at the annual SAVIAC and ESTECH conferences. They were reminiscing about the testing they did and how it made sense. I wished I had recorded the conversation. I see so much testing being performed to meet a specification that no one has any idea from where it originated or why a particular test requirement is made. In one sense, this is OK, because it is assumed that the test requirement was made for a very good reason. Even if you do not know why, the test still needs to be performed. It seems that with today's technology, the understanding of a test requirement and common sense are rapidly vanishing. The specification has to be met, and your controller better be up to the task of making the product pass this test so we can file the necessary paperwork to show that the test has been successfully completed.

A story from the trenches serves to embellish this point. We have a customer who pointed out that the random control was out of tolerance at the end of a test in

about one out of 10 tests. This was not good, because an out-of-tolerance test required the attention and sign-off from the quality assurance department. It turned out that this customer's test requirement was ± 1.5 dB with 154 degrees of freedom. Statistically, this will result in 1.5 dB out of tolerance in exactly one out of 10 test runs. This is what was occurring. So how do you correlate this fact to the "we never had this problem before" syndrome? More tough education needed to be done, because not every controller measures things "properly." You can read all about it in the October 2009 *Sound & Vibration* article "Does Your Controller Square with Chi?"

Recently, Vibration Research authored and presented a paper on research we had done applying SRS measurement techniques to random tests to quantify the severity of a test. It was quickly pointed out by the experts that an SRS is a transient shock event measurement tool and cannot be used to measure a continuous waveform. This is true. But what we had done was to set up some standard boundary conditions and criteria to try to come up with a uniform way to measure the rate of fatigue we were putting into a product. The same technique could be applied to the PVSS. I'm wondering if there is a standardized way we can agree upon using PVSS to measure sine, random, and time-history test severity.

At Vibration Research, we too are interested in what the future of shock and vibration is going to look like. I'm always amazed by how long it takes to change standardized techniques used for testing. So I'm also not surprised that it took 40 years to get a new standard for a common-sense measurement technique. We too are excited with Howard Gaberson that a standard has been developed to describe this unique measurement technique. With improved technology, capabilities can rapidly change. Usually, they do change far faster than any standards or specifications can be drawn up to define the technology.

We see that industry often uses its own internal standards to define how testing is performed, rather than only relying on standards, like ANSI and MIL-810. One needs to be on the cutting edge to stay ahead of everyone else. And that is also why some time ago, even before the ANSI/ASA S2.62-2009 standard was published, we added pseudo velocity to our analysis plots displayed in our shock software module. Our congratulations to Dr. Gaberson for witnessing his testing and technical common sense turn into an ANSI standard. And to Dick Chalmers, collaborator, a posthumous "attaboy" is certainly in order.

Author: jvb@vibrationresearch.com.