ESTECH CONFERENCE 2011

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On May 2nd - 5th 2011, ESTECH held their 57th conference in Chicago. Among the various working groups, tutorials and sessions was a program titled "Multi Axis, Multi Shaker Testing" chaired by Curt Nelson of *Team* Corporation. This session was designed to provide an exploration of the equipment available, techniques used and results obtained from state-of-the-art multiple degree of freedom testing. Participants included Curt, Neil Loychik of General Dynamics, David Smallwood as a consultant and 50 year employee of Sandia National Laboratories and Dr. Michael Hale of Redstone Test Center.

Curt Nelson opened the session with his paper titled "Vibration Test Evolution: The Transition from Single to Multiple Axis, Considerations and Expectations." This presentation discussed the design features of 3 and 6 degree of freedom systems, their advantages, weaknesses and expectation of performance. The presentation made use of several animations and movies to demonstrate the kinematic and mechanical solutions used to achieve controllable motion in several directions simultaneously.

Neil Loychik followed with his presentation "Comparison of SESA, MEMA and HALT Shaker Results to Field Performance of a Line Replaceable Unit". This research was generously funded by General Dynamics and released into the public domain to encourage further investigation into comparative studies. While the sample size of Neil's research was limited due to funding and consequently qualitative in nature, the results were quite clear; multi-axis simultaneous excitation of a the test object generated the most failures found in fielded assemblies more rapidly than any other test methodology.

David Smallwood's presentation, titled "Generating a Spectral Density Matrix for a Multiple Input, Multiple Output (MIMO) Vibration Test" established a mathematically valid method for developing a full 6 degree of freedom test profile from incomplete data sets. This is extremely important work as the majority of historical data gathered from field-tested components did not properly capture the entire array of information needed to preserve phase, coherence and cross spectral density required for the synthesis of valid test profiles for laboratory use. David's methodology provides a "road map" for test engineers to utilize historical data with the latest test equipment and have a high degree of confidence the test levels are appropriate.

Contributing to David Smallwood's paper and moving from a theoretical investigation to an actual test case was Mike Hale and his presentation "A 6 DoF Specification Development Methodology". This presentation documents the process, success achieved and further work needed when applying the theory from David's efforts to a real field condition. Application of the theory will result in appropriate test profiles, but requires considerable manual intervention by the test engineer. Both David and Mike are working with 2 prominent test controller manufacturers to incorporate features in future software releases that will ease the burden of inputting and developing the 3 dimensional matrices needed for accurate test profile generation.

The session was extremely well attended, with estimates of up to 30% of symposium registrants vying for seats or standing room. While the evaluation forms are confidential, based upon the spirited Q&A session following the presentations and the gratifying compliments offered by the crowd, the session could only be considered a hit. By their own admission, the “early adopters” of multi-axis testing have test systems and software that are “fantastic” and means are under development to allow the use of existing data sets to more accurately reflect field testing conditions. Next year’s ESTECH could very well be the venue where a new family of 6 DoF test systems and software are introduced, systems that are based upon all the lessons learned over many years of effort. It is truly an exciting time in the vibration test world.