

The Great Divide

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As technologists in the world of sound and vibration, we are often reluctant to admit that our highly technical world can be so profoundly impacted by the subjectivity of human nature. But human nature, being what it is, can be found anywhere people work together towards common goals. The business of noise and vibration control is no exception. In particular, human nature seems to be most prevalent in the technological and cultural divide that separates the community of Computer Aided Engineering (CAE) and the Experimental (or Test) community. This "Great Divide" between Test and CAE is seen by most of us as an immutable truth, one which has always existed, and one which we are powerless to change. Many might even argue that this situation is benign and poses no threat to the advancement of NVH product development.

But we are not powerless to change it, and change it we must. The threat this Great Divide presents is real and it is time we (particularly those in leadership positions) address its destructive force, its impact on product quality, and how we can build bridges across it.

Why is there a Great Divide between NVH CAE and Test? Probably for the same reason there are Democrats and Republicans, Labor Unions and Management, Red Sox fans and Yankees fans. Our inherent human desire is to gravitate towards groups that share our values and goals, and to protect those values and the group representing them from any force that might pose a threat.

For many reasons, the type of people who gravitate towards experimental-based techniques in solving noise and vibration problems are different from those who are attracted to the more theoretical side of CAE. In my experience, members of the Test community tend to view themselves as "hands-on" problem solvers, pragmatic and less theoretical. Members of the CAE community tend to view themselves as analysts, with a strong foundation in theory and mathematics, and who are quite comfortable with the somewhat arcane and abstract world of computer simulation. Of course these are generalizations, and in no way indicate a value judgment for or against the unique traits in each group. But as one can see, there are common values that attract various people to each of these groups, and these common values form the glue that binds them together. Unfortunately, this bonding also creates tension and division within a larger organization as the camps compete for ac-

ceptance, authority, and recognition.

It is easy to see why, then, there can be such lack of coordination, communication and cooperation between Test and CAE. The bad news is that due to this lack of cooperation, the end product (whatever it may be) ultimately suffers. At the end of the day, it is the product that matters, not each group's existence.

Sound and vibration control is so complex, and the optimization process is so difficult, that it needs the precise combination of computer based and experimentally based solutions to be truly successful. I would argue that today's products for which sound and vibration control are important have not reached their optimal levels, especially in light of tradeoffs with cost and weight and with other engineering functions (e.g., durability, safety, etc.). We need Test and CAE to work together towards the common goal of a better product. The fallacy which separately exists within each of these groups is that since each group believes the other to be unreliable, the best way to make the product better for noise and vibration would be for the design community to listen only to their group and ignore the other. This is an understandable position given human nature and the group self-preservation mindset, but it is unfortunate and it is wrong.

I would argue that it is possible and desirable to bring these two groups together, not so they become 'one,' but that they at least learn to "play nice" together in the same sandbox. Doing so first requires acknowledging that human nature is what it is and, for the most part, cannot be changed. That means that it is unrealistic to expect these two groups of people with different cultures, values, educations and perspectives to merge together into a utopian force for the betterment of noise control. Rather, we must acknowledge that while the Great Divide may always exist, at least we can build bridges across it which people from both sides can happily and safely cross when necessary.

Building bridges across the Great Divide of Test and CAE is no easy feat, one which requires paradigm changes in technology and organizational structure, as well as a healthy dose of psychology and, most importantly, strong leadership. Here are a few initial suggestions for how we might begin to build this bridge:

1. Make technical data easily accessible and sharable between the CAE and Test worlds. This may sound obvious, but most CAE techniques are carried out in the frequency domain and are not subject

to the problems of analog-to-digital conversions, which are the bane of test methods. All testing begins in the analog world of time domain measurements, and are subject to issues of digitization, time-to-frequency transformations, windowing, and so on. As a result, the compatibility of CAE and Test data is often questionable. However, with knowledge of, and careful attention to, the many variables and boundary conditions used in both Test and CAE software, it is possible to achieve data compatibility. This takes experience and communication to work.

Further, CAE and Test software programs use many different file types and database structures, which are generally not compatible. Certainly, files can be converted to ASCII and then further converted from one form to another (Excel macros, MATLAB scripts, etc.), but processing large amounts of data in this way is so impractical as to be impossible. Therefore, a significant IT (Information Technology) effort is needed to integrate network communication hardware, file database structures, and special software in such a way as to make the user virtually unaware of the source of the data (Test or CAE).

It is only when an "NVH Engineer" can seamlessly work with large amounts of compatible Test and CAE data that we can even begin to build this bridge. One only need look at the internet to see how technology-based information sharing can bring people from disparate groups together.

2. Integrate Test and CAE functions.

It is my belief that corporate structures separating Test people from CAE people physically and organizationally are fundamentally flawed. In the early days of CAE (20-30 years ago), as the technology was changing and improving rapidly, it was necessary to keep CAE people together to maintain core CAE technology. This cohesive CAE team could work together to develop new methodologies and procedures, which they could quickly and efficiently communicate amongst themselves. But while technical challenges in improving CAE models will always remain with us, CAE is now much more mature and stable than it once was, and so there is less need to centralize or isolate the CAE organization. Simply put, the need for technology and process uniformity *does not* justify a self-contained CAE department.

A much better solution is to create a functional-based organization (i.e., 'acoustics,' 'NVH,' etc.) containing both

Test and CAE personnel. A department of this kind would employ what I call true “NVH Engineers,” not “CAE Engineers” and “Test Engineers.” Certainly, some “NVH Engineers” would be highly skilled in CAE, and some highly skilled in Test. Many would have skills in both. All department personnel would have common department goals, work from the same resource and budget pool, and most importantly, collaborate on noise and vibration solutions using their combined technical tools. In fact, this collaboration must be a part of their accountability to the organization; it must be expected from them. Ideally, they would be co-located, or at least able to have regular face-to-face contact. Of course, all scientific data would be centralized, searchable, and shared seamlessly across all platforms via the latest hardware and software technology.

Yes, competition and diversity of approach have their benefits. But just as the medical field has its cautionary phrase, “a surgeon cuts,” we too, in either camp, need to be alert to the sometimes destructive tendencies that lead us to practice, protect, and defend only what we know and to disparage what we do not. Regardless of which camp we reside in, we too often apply only the most familiar tools and methods rather than defer to those that might be most appropriate and effective for the task at hand. Both approaches have validity and value in particular circumstances. It is time for us to acknowledge that fact and integrate our respective knowledge and resources rather than dig deeper trenches along our battle lines.

To make this happen, the leadership of an integrated NVH department would clearly recognize the psychological dangers of the “Us vs. Them” syndrome. They would see the need to bridge the gap across Test and CAE. They would know how to leverage the strengths and weaknesses of each discipline, and from the two synthesize a combined strategy to achieve the department’s ultimate goal of optimized product NVH performance. Ultimately, if this vision of an integrated Test-CAE organization is to happen at all, it will be because of strong leadership, clear vision, and a willingness to break with past paradigms. It will not be easy, and it may not be popular at first, but in time, I am convinced that it will prove the right thing to do.

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