

Interview with Atlantic Technology on Loudspeaker Design Philosophy

by Gene DellaSala

In preparation for our up and coming article that discusses what's in a truly high end speaker and the common cost cutting approaches some companies often make to deliver a high value product, we sat down with the well established and revered brand Atlantic Technology to get their views.

In this interview, we ask Atlantic Technology what their take is on the importance of:

- Cast vs Stamped baskets on woofers
- Benefits of vented Pole piece on woofers
- Benefits of rear chamber on tweeters
- Air core vs iron core inductors on critical crossover circuits
- Poly vs electrolytic capacitors in critical crossover circuits
- the importance of an anechoic chamber for loudspeaker design and measurements

Steve Feinstein (Director of Marketing and Product Development) was kind enough to provide his answers into a short and informative editorial below.

Get the Basics Right

This is a far more complex subject than it might appear to be on the surface. All the items you list are certainly considered to be among the "pre-requisites" for a so-called high-end speaker, and any top-quality speaker will contain many, if not all, of these features.

But before a speaker design is completed, it must, more than anything else, get the basics right. The axial frequency response must be smooth and accurate. Yes, granted, there is still the ongoing controversy over near-field axial response vs. far-field power response, but even far-field power proponents will concede that a good near-field response doesn't necessarily detract from their far-field goals.

- Distortion must be low. There can't be any mechanical artifacts like port chuffing, surround snap, or voice coil rub.
- Drivers should be well-behaved. "Well-behaved" is not the exclusive purview of esoteric drive units. Many modestly-priced units perform quite well, while an embarrassingly large percentage of supposedly "SOTA" drivers are rather pedestrian performers, at best.
- Avoidable diffraction should be, well, avoided. Flush-mounted screws, a minimum of cabinet protrusions, etc. Don't throw diffraction pebbles into the calm waters of the acoustic pond for no reason.

Perhaps the most important aspect of speaker design is to have clear goals. Like that great philosopher Yogi Berra once said, *"If you don't know where you're going, you'll probably end up someplace else."*

What are your goals? Flattest possible near-field axial response? Wide dispersion in the forward hemisphere? High SPL capability? Sharp 'imaging'? Complete non-directionality? Deep bass extension? High sensitivity?



Atlantic Technology H-PAS

Once the goals of the design are firmly established, the components and building blocks needed to get there can be evaluated and selected. Speaker design is a continuum, from budget on one end to super high-end, no-compromise on the other. Exactly when a speaker (or any product, for that matter) transitions from moderately- or value-priced to high-end is a judgment call to a large degree. For some customers (and some companies), a \$1000/ea. speaker is “high-end.” For others, it can be much more or much less.

We feel that one of the most important design aspects for a “high-end” speaker is component tolerance. (I’d opine that Atlantic’s definition of what price constitutes high end is likely a lot lower than some other companies’.) Drivers need to have very, very close frequency response consistency from unit to unit. Crossover components have to have similarly close tolerances. Typical drivers can vary +/- 2 or 3 dB from unit to unit and average crossover components are toleranced to within 10% of nominal values. If these tolerances stack up in the wrong direction, your oh-so-carefully designed speaker can easily drift several dB off its performance target. Crossover frequencies can shift from 500Hz to 450 or 550Hz—that is obviously audible, regardless of the so-called ‘type’ of component being used.



So, clearly-defined goals, a solid, verifiable engineering approach to attain those goals, and components (drivers and crossover elements) that adhere to tight tolerances. That’s for starters, and that’s 99.99% of what’s required for a truly excellent speaker, high-end or otherwise. Call it what you like. If it doesn’t pass this test, nothing else matters.

All the items you bring up can be discussed in terms of one thing: Is it audible or not? I recall an incident at another speaker company I was at before Atlantic Technology. It was a very well-known company whose products were highly-respected and prized for their performance-to-price ratio. We were doing a new family of clearly higher-end speakers, and we employed poly by-pass caps on a later prototype. The President—well-known for his solid engineering approach but famously skeptical of ethereal high-end features— came in to listen to this newest version and immediately proclaimed that it was superior in an A-B comparison to the version he’d heard earlier that only had electrolytic caps.

“What’s different? Let me see the curves.”

“The curves are identical. The difference is by-pass caps.”

“D*mn!! I *hate* when those high-end things make a difference!”

Most of the individual items you’ve listed probably relate more to their suitability for a specific design goal than being generically high-end *per se*. Rear chambers on tweeters to lower their Fs is important if it’s a 2-way design and your goal is a lower woofer-midrange crossover point to achieve wider midrange dispersion. Don’t want an 1800 Hz crossover because you’re not looking for the widest-possible midrange dispersion? Then you don’t need a low-Fs rear-chambered tweeter. It is design goals, not arbitrary components, that matter.

Vented woofer pole pieces are fairly standard on good designs, to give woofers higher power-handling and greater reliability. All Atlantic Technology woofers use vented pole pieces, even though not all of our speakers would be considered “high end.”

Air core coils can get pretty large, physically, and they introduce more resistance in the circuit than iron-core coils. Of course, conventional iron-core coils are prone to saturation and subsequent audible distortion at high drive levels. Laminated-core can work very nicely, can be physically-smaller than air-cores of the same value and usually have lower resistance. A good designer will choose what’s appropriate to achieve the performance target, rather than what looks more impressive on the marketing spec sheet.

The Importance of a Well Engineered Enclosure

There is probably no disagreement about reducing cabinet resonance/vibration. This is one aspect of higher-end speakers that they all share in common. Bracing, constrained-layer damping, sound-deadening lining on the interior of the cabinet, solidly-mounted drivers by way of thick baffles or interior support, these are all important features. Lower-cost speakers just don't have the room in the budget for this, and therefore many budget speakers have enclosures akin to empty milk cartons.

Our cabinet designs have been more intended to redirect and reduce resonances, instead of the usual brute force method of more bracing is better. MDF panels have a tendency to resonate in the frequency band of dialogue if braced improperly. We use asymmetrical bracing to help reduce the resonance. Asymmetry is very important in all aspects of audio, from bracing placement in a cabinet to sub placement in a room. Whenever you can avoid stacking up multiples of resonant frequencies on each other, you're going in the right direction. Mathematically-unrelated (and therefore frequency-unrelated) distances/dimensions are always a good thing.

The "Swiss Cheese" aspect of the CDFB brace in the AT-1 helps to dampen the brace itself. We use a rubbery paint to coat the inside of a heavily-ribbed plastic midrange enclosure on one of our in-wall speakers that does the same thing. The enclosure is really 'dead.' Common-sense stuff that has real acoustic payoffs.

Can you see the effects of a really solid cabinet in measurements? Sometimes yes, sometimes no. Often a cabinet resonance will show up as a 'blip' when you run an impedance sweep on the system. And a 'lively' cabinet becomes audible at higher SPLs (most often as a loss of clarity), as the bass vibrations begin to set the cabinet in motion, so to speak. One of the limitations of most speaker measurements is their static, steady-state nature, whereas many audible artifacts are dynamic (level-sensitive) in nature. That's why after the basics are confirmed by measurements, the ear remains the best arbiter of the final system result.

Are Anechoic Chambers really necessary?

There are those that argue an anechoic chamber is an absolute necessity for designing and measuring loudspeakers. The reality is gating measurements have really rendered the anechoic chamber far less necessary than before. For bass frequencies, no reasonably-sized anechoic chamber is valid much below the upper bass/lower mid region. If you're measuring a sealed system, then you can bury the speaker in the ground outside, with its front baffle flush with the ground, for a perfect 2-pi measurement environment. Edgar Villchur of AR used to call this "God's anechoic chamber."

For ported/vented systems, the situation is a bit trickier, and anyone who claims that it's not is either not being totally honest or they just 'don't know everything they don't know,' as the saying goes. There is the vent contribution and the contribution from direct driver radiation. But....there's a rather complex formula for determining exactly how those two contributions should be weighted, based on the area of the vent and the area of the driver, the distance of the vent from the driver, their phase relationship, all kinds of things. D.B. Keele had a great article in *Audio* magazine about this about 20 years ago, and it illustrates very clearly the somewhat ambiguous nature of getting ironclad, dead-accurate LF measurements from vented systems.

Conclusion

Speaker design remains a humbling exercise and if we had everything perfectly sorted out, there wouldn't be 100's of speaker companies with 100's of different approaches. I know enough to know that I don't know everything, that's for sure. But the pursuit and discovery of knowledge is still exhilarating, even after all these years.

Many thanks to Steve Feinstein from Atlantic Technology for taking time to discuss the topic of loudspeaker design.

