Posted by Wayne Parham on Fri, 08 Jul 2005 07:03:41 GMT
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they aren't directly related to the current implementation of the device. So I thought I would write about them separately.

like an upgrade, an improvement to the LABhorn, much like Brad Litz's version. Like Brad's

LABhorn, and that requires a little bit additional excursion. You can't get the bass for nothing. But there are a lot of similarities in each of these designs, and I think the size constraints along with the 30Hz requirement of the original LABhorn are what made it destined to have the tradeoffs that it has.

A few years back, just after the LABhorn prototype was built and tested, I commented about the response dip in 30-60Hz range and also about the choice to use woofers without shorting rings.

woofers with shorting rings. The horn reduces distortion but the shorting rings reduce it even more. So I felt pretty strongly that the system would have been better if it had some mechanism to improve motor symmetry and if it didn't have that 30-60Hz dip.

In all fairness, the size dictates the response. Basshorns are sometimes made too small and if that's the case I'd rather have a direct radiator or a bandpass box. I don't like the peaky response of a basshorn that's too small. But if you group them together, that helps.

About distortion, I asked Eminence to make a woofer that contained a shorting ring. I could use it in my own horn, and it could also be used to retrofit LABhorns and used in other designs as well. It would also make a pretty fine small home subwoofer as a direct radiator in a vented box about 2-4ft3. So I had hoped to have a suitable woofer made with a shorting ring. What Eminence found was that they couldn't easily reduce distortion below 100Hz. That makes reduced effectiveness of the shorting rings for a basshorn that is intended to be used below 100Hz. It isn't that it can't be done - it can - but there are limits, and to push those limits lower in frequency requires the use of more metal in the motor, both in the conductive ring and in the magnet and return circuit metal required to make up the difference.

So I decided to make a basshorn with push-pull woofers instead. This helps motor symmetry by using two of the same woofers and connecting them in opposite directions. The things that cause asymmetry are countered pneumatically that way. When one motor is pushing in its weak mode, the other is pulling in its strong mode. Then they flip sides for the other half-cycle, both having a strong side and a weak side. This does the same thing as a shorting ring, but in a different way. It is more effective down at low frequencies because it is done pneumatically instead of electro-magnetically.

The problem now is that a push-pull basshorn throat has the magnet and vent of one driver and the cone face of the other. There were concerns about vent noise and cooling. I immediately started looking at ducting the cooling vent, which would muffle vent noise and also I could make improvements to the cooling system as well.

About a year ago, there had been time enough to start seeing LAB12 failures in the field and some were thinking maybe they were heat related. So the cooling system improvements looked like an excellent side benefit to pursue of this push-pull basshorn and its cooling system.

I must admit that I hadn't really inspected the LABhorn until the last couple of weeks. All of my previous comments were based on models and measured datasets. I had heard that some were using aluminum access panels, hoping for some heat conduction but it was only recently that I saw the plans for the LABhorn to know specific dimensions, and to see that the aluminum plate was there in the plans, not as an add on.

But I also had already done some measurements of the woofer, its vent and the heat generated and knew immediately that the access panel on the LABhorn wasn't doing any good as a heat exchanger. There's no thermal conduction path between the motor and the plate.

Air in the cabinet doesn't transfer much heat to the panel. Even the cooling vent air doesn't carry much heat - Most of it is radiated into the center pole and magnet. The air inside the cabinet is heated slowly by the magnet. And the air in the cabinet heats the access panel even more slowly. So the inside of the cabinet can get really hot, and then the one thing that marginally helps cool the voice coil - the air surrounding it - is too hot to do any good.

Since my thermal measurements showed that most heat is radiated into the pole piece, I decided to explore the use of a simple heat sink and heat exchanger instead of a ducted intercooler

made me decide to use the simpler cooling system is that its easier to implement and should be just as effective. The tube connecting the speaker center pole to the access panel will conduct heat very effectively. The second reason I shifted is that it is a solution that others can implement easily as well.

LABhorns in the field can be easily retrofitted to include this part. Just drill a hole in the existing access panels, and countersink so that the mounting screw is flush. Put the aluminum rod on the access panel and insert it into the magnet vent hole. The rod is hollow so air passes through it and out the cross-drilled port holes up near the access panel.

So the cooling system is just too simple to pass up. It can be used on lots of other basshorns in

and an aluminum plate. Simple stuff that any machine shop can make at low cost. It's a lot cheaper than woofers. I'm anxious to get more data on how effective they are, because my initial tests are extremely promising.

That brings me up to the current day. I have the cooling system, the horn models and a lot of paperwork. Now it's time to build a prototype. Should have one within a month and I'm extremely optimistic.