Subject: Re: The Most Powerful Subwoofer in the World
Posted by Wayne Parham on Mon, 17 Oct 2005 19:38:16 GMT
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I agree with you, 100%. I thought LABhorn response could have been a little better. The models certainly indicated that it could. So that's one of the things I focused on.Another thing that I focused on was really a sort of price / performance issue. I realize that DIY builders often discount labor costs and don't include it in the overall cost of ownership. But I always have, because I always have a cabinet shop build my speakers. So I design speakers with an understanding that cabinet cost includes labor. That drives my designs in certain directions.For me, a basshorn cabinet like this costs at least a thousand bucks. So it should be a no-compromise design to justify its cost. I could possibly make one that's a little smaller, maybe

than just throw an inexpensive woofer in the system, because the real cost is in the cabinet.That's where the push-pull idea comes in. I had considered using woofers with shorting rings, to take advantage of their reduced distortion. But I eventually decided to go with the push-pull idea instead. My thoughts were exactly the same as yours - If you have two woofers anyway, why not? It almost seems a waste not to take advantage of the arrangement. And it works, especially at the lowest frequencies.Below the flare frequency, all basshorns unload and cone motion rises. Every basshorn I've heard makes a chuffing sound down low, some sounding more like a beating. I'm not talking about the sound of mechanical interference, although some horns do that too, if xmech is exceeded. That's wht the Fitzmaurice guys called "farting" because it does sound that

just doesn't make that sound. Below horn cutoff, the speaker is just plain quiet. No harmonics. And then I realized that's what the "helicopter" sound is - It's when the harmonics are considerably louder than the fundamental from a basshorn driven below cutoff. The fundamental is almost inaudible, but the harmonics enter the horn and are amplified by it. So they can be something like

lowest bass notes aren't distorted. At the lowest frequencies, where the drivers are essentially acting as direct radiators, they at least have the push-pull mechanism to cancel harmonics and hold the distortion down. It works very well.And then there's the heat exchanger. I could write a whole chapter on that, but it's better just to click the link and see what's already been written about it. The thing is, no matter how you look at it, the device cools the motor. Whether its sine waves or music material, the issue is heat and the cooling plug wicks it out of the pole piece and removes it from the motor. If the music isn't driving the speaker to its thermal limits, fine. Then it isn't needed. But if the music has continuous low bass, then those subs are going to get a workout. That's when the heat exchanger becomes very important.Lots of people have written to me with LABsubs saying they're blowing woofers after every gig longer than a couple hours. My usual response is "I know". The most common failure mode of a loudspeaker is the voice coil coming loose from the former. It makes the speaker buzz or rub, the symptom everyone is familiar with. This is the result of continuous heat making the glue fail. It isn't from an instantaneous peak, which would fuse the coil or perhaps cause physical interference of some sort, breaking the former, suspension or cone. It's from constant, steady heat in the pole piece and magnet, literally cooking the voice coil glue and causing it to fail.I was initially working on a fairly sophisticated air cooling device. My idea was to use a two-way valve, one side having laminar flow and the other with turbulent flow. This would allow me to have a hot air outlet and a cool air inlet. One of my best friends and partners is a brilliant mechanical engineer that specializes both in heat flow and fluid flow (gasses and liquids) and he helped me build the prototype. The prototype worked very well. But I realized something while working on it, and that is the air didn't carry much heat at all.It is important that the air surrounding the voice coil be cool, and that it be moving. Turbulence and airflow generally help remove heat. But the heat removed is actually pretty small compared with the volume of air. The interface is exceedingly poor, and not much heat is transferred. If there were fins on the voice coil or something, it would probably transfer more heat but that would hurt speaker performance in other ways. So there just isn't much surface area to work with and the best you can do is pass a lot of airflow by the coil and hope for the best. The air that passes by stays relatively cool, even if the metal inside is several hundred degrees.If the magnet gets hot in a small sealed cabinet, then the air gets hot too. That's bad. And more importantly, even if the air is cool like when the speaker is mounted on an open baffle in an air conditioned room, the voice coil radiates heat into the pole piece which is surrounded by ceramic. It's the perfect oven. And that's exactly what it acts like. The voice coil sits in a hellish environment which literally cooks the voice coil glue and causes it to fail. Just a few hundred watts is enough to melt the best glues, turn them black and brittle and allow the voice coil to come undone. That's why the heat exchanger is so important.If the speaker keeps moving and the air surrounding it is cool, then the venting action will help a great deal. But if the magnet temperature rises to 200º, cooling air won't help much. The voice coil will fail, because the glue can't take this kind of heat. So that's why I am so excited about the heat exchanger. It really raises the power limits on the driver. It does so removing the heat from the magnet and pole piece. These are what surround the voice coil, so we want to keep them as cool as possible.