Subject: ?Horn Questions?
Posted by Cuppa Joe on Wed, 14 Feb 2007 05:38:04 GMT
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The following subject was partially explored on another forum.What kinds of results might be expected if a cone driver were simply flush-mounted from the front of a conical horn, so that the driver's overall diameter becomes the throat area? This would be in opposition to the usual practice of mounting the driver to the backside of a more restrictive throat, through a rear access panel. An example of such would be the Meyer Sound MSL-4, with the optional phase plug removed.Intuition implies that the cone's HF would sag, roll off and beam sooner than with a conventional throat, with more possible internal reflections, which means a lower crossover point. A considered application would be a horizontal trap of no more than 30-40 degrees, in an attempt to put the predicted beaming to some use.The advantages: No double-walled cabinet construction, no rear access panel, no protruding rear chamber to obstruct array angles. What are the disadvantages, and do they outweigh the upside?As always Wayne, I truly appreciate the time you take to answer my tedious barrage of questions, but I also invite other forum members to take a crack at me. I mean, if anyone feels that I'm monopolizing the forum, please let me know and I'll back off a bit!

Subject: Compresison ratio and front chamber size
Posted by Wayne Parham on Wed, 14 Feb 2007 18:38:47 GMT
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Hopefully others will chime in, as you've said. I'm always happy to throw in my 2¢ when I have time, but it's always good to get others input too.

The main thing that happens when the throat area is equal to diaphragm area is that efficiency is reduced, compared to a horn having greater compression. Risking over-simplification, as compression goes up, efficiency goes up. The response curve is also usually different between horns with and without compression, all other things being equal. There are also differences between horns having compression of different amounts, and with different front chamber volumes. You might grab a copy of Hornresp and model a few scenarios to see what you come up with.

Subject: Re: Compresison ratio and front chamber size
Posted by Cuppa Joe on Thu, 15 Feb 2007 03:07:57 GMT
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I haven't run any HornResp scenarios for the "throatless" horn yet. (Sounds a little like the

"Headless Horseman"!) I was hoping that maybe a narrow enough coverage angle might make up for some of the lost efficiency. In this case, as the wavelength becomes longer than the driver's diameter, does the efficiency increase for those frequencies? That is, would the lower frequencies see a higher compression ratio than those frequencies shorter than the diameter? Or, does a given throat geometry determine an overall compression ratio, regardless of frequency (within the passband, of course)? I have daydreamed about designing a simple throat section for this horn that could mount in FRONT of the driver...dreaming...where to start...!Has anyone else (besides Peavey and Meyer Sound) tried this idea?

Subject: Breakup modes and collapsing directivity
Posted by Wayne Parham on Thu, 15 Feb 2007 03:39:01 GMT
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Horns do a few things. They match moving impedance of the cone to that of the air. That helps efficiency. They act as acoustic filters. That modifies the response curve. And they act as directional control devices. That focuses the energy.The driver does some things that interact with the horn as a system. It also does some things independently. Two of those that are relatively independent of the horn are cone breakup modes and certain forms of collapsing directivity. These things aren't completely independent of the horn, as the acoustic load placed on the cone by the horn is different than the acoustic load of the cone in free air. This modifies cone flex, and breakup modes shift as a result. Collapsing directivity can be caused by a horn, particularly those that have curved walls and narrow throats. But even without a horn attached, a driver will enter breakup and it will begin to beam at some frequency.As the cone enters its breakup mode region, it becomes more efficient. It's behavior is less controlled, and response may become too peaky to be usable, but some drivers have reasonably well-behaved breakup modes that can be used to extend response past what the driver would do as a rigid piston. Parts of the cone move independently of the rest of the cone, and they move like ripples on a pond. These modes are resonant, so the speaker is pretty efficient though these bands.Another thing that happens at relatively high frequency, is that the driver starts to become directional. When wavelength is approximately equal to diameter, the pattern is roughly that of a 90° conical flare. As frequency rises, the pattern grows more and more narrow. As directivity collapses, the energy becomes more and more focused. So on-axis SPL increases as a result.These two things combine to make on-axis output significantly higher than the power response of a rigid piston. The diaphragm is no longer rigid, so mass-rolloff loses its meaning at some point. This is because the whole mass of the cone is not moving in unison. The concept of mass-rolloff is still right, but the mass that's moving isn't rigid anymore. It acts more like a lumped group of mass-spring systems. So the system just becomes more complex than what can be represented by a rigid piston. And since directivity is collapsing, on-axis response is greater even if power response stays the same. If power response is falling but directivity is rising at the same rate, then on-axis response will remain flat. If power response doesn't fall off quite as fast as directivity rises, then the on-axis curve will show rising response.

Subject: Re: Compresison ratio and front chamber size
Posted by Ian on Mon, 19 Feb 2007 06:11:33 GMT
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I've modeled a few throatless horns in hornresp before and I always wondered whether the modeling was accurate for that case? Some drivers looked very good on throatless horns in hornresp, so I'd consider making one if I thought hornresp was relatively accurate.I think this is a good question though. I've heard a lot of discussion about waveguides lately, but not much about cone, particularly midrange, waveguides.

Subject: Re: Compresison ratio and front chamber size
Posted by Wayne Parham on Mon, 19 Feb 2007 15:53:28 GMT
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I've modeled a few horns with throat area equal to diaphragm surface area and measurements from physical models corresponded quite well. The only places where the computer model didn't reflect the physical model were where I expected them not to match because of breakup modes or directivity from radiator diameter collapsing further than flare angle.Breakup modes and collapsing directivity

Subject: Re: Compresison ratio and front chamber size
Posted by Cuppa Joe on Thu, 22 Feb 2007 04:38:22 GMT
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Have either of you run across any drivers in particular that really seem to stand out for 1:1 duty (10" or smaller)? Yes, I'm trying to use your experiences to narrow my search parameters! When I'm not too busy being busy, then I'm too busy being lazy....

Subject: Re: Compresison ratio and front chamber size
Posted by Wayne Parham on Thu, 22 Feb 2007 16:28:26 GMT
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through the horn mouth. It also made the horn have a very wide bandwidth, giving it usable response up through the midrange. The biggest problem up high was that the sides were straight, so standing waves setup horizontally within the flare. But HF content was good and easily

or 2226.I know I'm sounding like a broken record, but I'd suggest modeling with Hornresp. I think you'll find general trends that way. Seems to me like one thing that was consistent between systems I liked with 1:1 throats was high BL drivers. I was looking for HF extension, so massive cones weren't good. Ligher cones with powerful motors were the ticket for that application.I think you'll also want to consider directivity and breakup modes. This is unrelated to the basic pistonic model, but on a straight horn with the entire diaphragm exposed, it will definitely play a big part in overall response. There is no front chamber to attenuate HF, so whatever the cone does will be presented to the horn. And when frequency is high enough that the diaphragm radiation pattern becomes more narrow than the horn wall angle, then the horn system will begin to have collapsing directivity even if the horn wall angles are straight. That will increase on axis SPL. The horn will no longer have constant directivity at that point, but it may provde some acoustic EQ, boosting the upper end of the on-axis response curve.

Subject: Re: I was considering a B&C 8PE21
Posted by swett on Fri, 23 Feb 2007 02:37:28 GMT
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I was considering a B&C 8PE21, but I haven't bought a pair yet. It has a copper shorting ring and 8" seems like a good size to slot between a 1" HF driver and a 15" woofer.   Its also a lot cheaper than the 10" JBL drivers.

Subject: Re: Compresison ratio and front chamber size
Posted by Cuppa Joe on Fri, 23 Feb 2007 03:50:52 GMT
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I know, I really should do my homework on HornResp. Your responses always point me back to the basics: crunch the numbers, build the prototype, measure, modify, and measure again. Beyond running McBean sims, I'm not yet ready for the remainder.The 10Pi must have been a storage shed! Might we please see some history on it? How does one go about avoiding standing waves, and do they occur more readily in a conical horn because of its symmetry?

Subject: Re: I was considering a B&C 8PE21
Posted by Cuppa Joe on Fri, 23 Feb 2007 04:03:32 GMT
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If you double the 15's and horn-load everything, you've got an X-tro. I've heard almost nothing apart from praise about the 8PE21's sound quality, but the Xmax is small and it won't play much below 250-300Hz. In the X-tro horn, the upper cutoff is claimed to be 2500Hz. Still a decent range!

Subject: Straight side walls
Posted by Wayne Parham on Fri, 23 Feb 2007 17:12:36 GMT
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any other horn. If the horn is flared in both axis, then standing wave nodes don't set up side to side, like they would in a basshorn having fixed width the whole length of the horn. That's where the problem lies. Basshorns with straight side walls and straight passages inside can develop standing waves along those dimensions if they're used up to high enough frequency. So it's not the expansion rate that causes notches in response, it's the constant width of the pathways, in a cabinet so constructed. If the horn isn't used to high frequency where the first standing wave node causes a notch, it's not a problem. Most basshorns are used only at low frequency, so straight side walls don't matter. But if used high enough, they'll cause notches in response.

Subject: Re: Straight side walls
Posted by Cuppa Joe on Sat, 24 Feb 2007 03:08:03 GMT
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OK, I feel better now!

Subject: Re: I was considering a B&C 8PE21
Posted by Wayne Parham on Thu, 01 Mar 2007 06:15:09 GMT
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Walt de Jong is a sharp guy. If that's what he used in the midhorn of his X-Tro loudspeaker, I expect it is a good choice. He is a very capable and thorough speaker designer.

Subject: Re: I was considering a B&C 8PE21
Posted by Cuppa Joe on Fri, 02 Mar 2007 02:14:58 GMT
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Yup, it's a 70 degree conical with a throat that's just a wee bit smaller than 4.75" square. The lower cutoff is a little higher than I like (350Hz), but that's easily fixed. The 1" driver is a B&C as well.