Subject: Horn Depth & Mouth Diffraction
Posted by Cuppa Joe on Sun, 11 Mar 2007 18:03:38 GMT
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When we discussed mouth diffraction in the past, it was under the assumption that the horn in question had an axial depth of at least 1/4 WL of the cutoff frequency.On another forum, a designer/manufacturer informed a poster that a conical horn's axial depth needs to be at least a FULL WL at cutoff in order to prevent any mouth diffraction. For a 160Hz midbass horn (for instance), that would mean an axial depth of approx. 7ft! Is he correct, or just over-cautious? How significant is this "spillage" at 1/4 WL, if such is the case? One of my 3 designs could be in the toilet....

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Cuppa Joe on Sun, 11 Mar 2007 18:15:16 GMT
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Of course, the above was contingent upon the stipulation that the horn mouth perimeter was square and equalled the WL.

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Wayne Parham on Mon, 12 Mar 2007 13:18:14 GMT
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I don't think the reference to horn length had anything to do with mouth diffraction. I think it was the reactance due to reflection from the mouth transition that he was referring to, which is a different matter. Diffraction is strictly a matter of aperature size verses wavelength, and can occur in a slit having no path length.

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Bill Wassilak on Mon, 12 Mar 2007 16:49:50 GMT
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He's just over cautious, that would apply if you were using a horn in total free space, like up on a utility pole or something.

Subject: Re: Horn Depth & Mouth Diffraction
Posted by DMoore on Mon, 12 Mar 2007 23:47:55 GMT
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I agree - horn length is a mouth reflection/reactance issue.

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Cuppa Joe on Tue, 13 Mar 2007 01:23:32 GMT
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So that you guys don't have to go by my interpretation, here are excerpts from the original quote (with spelling corrections):"Once the wavelength is longer than the horn, diffraction comes into play. The larger frequencies will reach the mouth and then go sideways.""Even with a large mid flare you only end up controlling the top half of the range.""...if your low cutoff in the mid is 150Hz, then the length of your horn for total control would have to be 2.29 metres long minimum."My concern, of course, is significant comb filtering in an arrayable multi-box system, whether vertical or (especially) horizontal. In an arced horizontal system, the diffractive spillage would also spell noticeable multiple arrival times. Yes, I know, the arced cluster arrays of the past are acoustically taboo, however my aim is toward a single-tier array of only 3 to 5 traps. The fact that several people in the past have told me that it can't ever sound good just makes me all the more stubborn!!

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Wayne Parham on Tue, 13 Mar 2007 14:55:59 GMT
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Path length sets the position of standing wave nodes, but it is not a determiner of diffraction. Diffraction is set by aperture size and wavelength. The size of the opening and the wavelengths that pass through determine the amount of pattern spreading from diffraction.Pattern control and mouth sizeIf your main concern is comb filtering, you might consider that at 150Hz, wavelength is 7.5 feet. Sounds sources can be nearly 2 feet apart and still sum as a single sound source.

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Cuppa Joe on Wed, 14 Mar 2007 02:14:05 GMT
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So Bill is right, this manufacturer is just being overly cautious. (And I thought MY shorts were a little tight....) He might also have some confusion about how large the mouth needs to be to avoid

diffraction. Thanks guys, back to feeling better!

Subject: Re: Horn Depth & Mouth Diffraction
Posted by DMoore on Wed, 14 Mar 2007 18:09:28 GMT
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The issues of comb-filtering which I have experienced with folded bass horns occurs when the frequencies (bass and midrange) involved overlap too much, that is, the bass horn is putting out too much SPL at upper bass frequencies which overlap the midrange output. This is dependent on the design of the bass horn, the chosen crossover point, and the particular upper frequency corner of the driver in it.This can be avoided by using a steeper slope on the crossover network or employing a woofer with a lower mass roll-off, etc.Usually, a folded horn will tend to knock-off the upper frequency range because of the folds cancelling out the smaller wavelengths first, but not always, especially if the folds are designed to maintain phase integrity. A reasonably straight (or one employing few folds or less-drastic folds, for instance) long bass horn will usually be more likely to create comb-filtering problems generally due to its inherent ability to pass frequencies with wavelengths that physically fit inside or across its channels and mouth. The longer the pathway, the more phase-delay will occur between the midrange horn and the bass horn, same relative frequency. The difference in phase and/or time associated with the disparate sound paths from the two (or more) horn mouths will result in comb-filtering along the way to the listening position.Those smaller wavelengths also will tend to "beam" as they fit inside of the mouth size/flare and no longer follow the flare rate seen at the mouth as they get smaller (per Olson).But let me tell you from experiencing it firsthand, you will definitely hear comb-filtering as recognisable distortion if it is there at all! It's pretty horrible sounding - right up there with a bad diaphragm!DM

Subject: Path length delay
Posted by Wayne Parham on Wed, 14 Mar 2007 19:27:14 GMT
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You're right about the delay caused by path length. If the subwoofers are basshorns, it's best to set the top boxes on a delay to compensate.

Subject: Re: Horn Depth & Mouth Diffraction
Posted by Cuppa Joe on Thu, 15 Mar 2007 01:56:46 GMT
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Path length difference is one of the main reasons why I prefer an active crossover for a live SR system. The other two reasons are rolloff slope and ability to apply electronic delay, if necessary.

For me, there's no comparison.Given the fact that a horn has to terminate into open air at some point, I tend to surmise that there must be a LITTLE expansion beyond the boundary edge as the pressure is released, even within the horn's pass band. Is my hunch correct, or am I way off? If there's some meat on that bone, then my concern is that two tightly arrayed traps (covering the same frequency range) splayed at different angles might also create the phase-delay problem Dana mentioned. Someone standing on axis to one trap might get a delayed spillover from the other, resulting in time smear due to the differing path lengths to the listener. Any significance to this?Yes, I've heard HF comb filtering in a large outdoor venue, where wide-coverage 2" horns were stacked next to each other horizontally. As I walked across the coverage area, it sounded like a wind storm as I heard the phase shift with every step. However, I did notice two things: One is, the farther I walked away from the stack, the less combing was noticeable (line array theory?). And two, when I stood in one place for long enough, my ear "adjusted" to the sound. The system was actively crossed and delayed, so I wasn't experiencing any multiple arrivals that I could detect. My conclusion: You can "get away" with a certain amount of comb filtering in certain frequency ranges if there aren't any other outstanding acoustic problems. I know, call me nuts!

Subject: Re: Horn Depth & Mouth Diffraction
Posted by DMoore on Fri, 16 Mar 2007 16:21:30 GMT
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Yes, in most cases there is some expansion outside the horn terminus. In the case of the Klipschorn, the terminus is 875 sq. in.However, the terminal flare rate is 38Hz, and in 1/8 (corner) space that means an overall mouth size of (approx.) 1160 sq. in. is required to prevent reflections and provide a smooth response.It can be surmized that due to the nature of the confinement provided by the corner walls and floor, that the true horn mouth ocurs well outside of the enclosure (about one more expansion length) into the room. Since the Khorn is indeed capable of 38 Hz reasonably flat, there is something to be said about expansion outside the horn terminus.Different mouth splay angles and horn terminus external boundary utilization techniques will have their effects and can be exploited somewhat to keep the size of the enclosure relatively smaller. Less of an effect can be achieved in 1/2 (stage) space placement, of course, being that only one boundary element is present, so it is not quite as "exploitable" as an environment with more boundary surfaces available.DM
