Subject: Dual-driver sub basshorn plans
Posted by Adrian Mack on Sun, 23 May 2004 06:12:04 GMT
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I've decided I still want a horn that is smaller than the 18" basshorn I designed last time. The only way is to get smaller drivers. My application requires its compact, especially more so because the subbass horn may have to be placed come 30-40cm out from the wall to make it function properly, hence I want it physically as small as I can get so it doesnt take up huge floor/people moving space in total. Here is a little horn just designed: I got in a true 3meter path length (right down the center - see dotted line in diagram) and the mouth is 2558cm^2. The mouth rapidly opens up in the last 15cm so my guess it will 'seem' more like a 2200cm^2 mouth or so, which is just fine. Expo flare.It uses TWO 10" drivers, using two can get a smaller size and deeper bass extension. I modelled up the Peerless CSX 10" 850146 and here is the response curve with 100W input power (drivers wired in parallel):So it reaches 27Hz at its low end. At 26Hz it is only 1db lower in gain so you could say it will do 26Hz actually - not bad for the size. The crossover at 70Hz~80Hz to the mains will smooth out the slightly rising response but it isnt' an issue anyway, only about a 3db 'shelf' and will definitly get rid of the peaks. I choose to model the dual CSX 10" because:*Peerless is a high quality manufacture from experience with their products*Has a shorting-ring in magnetic structure to reduce distortion and improve linearity*Extended 4-layer high power VC, 200W each or 400W total*Works for my applicationHorn size is 108cm high, 60cm wide, and only 80cm deep - all external dimensions and MDF is 25mm. Now all I have to do is build it :PIt will be sad to stop using my big 18" driver but the benefits are probably worth it. The basshorn can do 120db with 30watts compared to 500watts for my vented 18" sub - huge difference! And the horn can still do much more than 120db! Anyway ~~ any comments?BTW: probably a variety of other drivers that will work with it tooAdrian

Subject: Re: Dual-driver sub basshorn plans
Posted by GraemeG on Sun, 23 May 2004 08:13:20 GMT
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Should work fine, but may be interesting to get the drivers in and out..... maybe you could zig-zag the path up the box and put the divers on top.I would assume the ripples would be due to mouth size, but if there is enough excursion in the drivers, a little EQ should be fine.I have been thinking about a home use subhorn using 10" drivers myself, and am toying with the idea of going straight up the wall to ceiling height, using the horn as the rear of an entertainment unit (ie TV etc in front of horn as it goes up the wall - TV would sit on mouth opening section on floor).CheersGraeme

Subject: Re: Dual-driver sub basshorn plans
Posted by Adrian Mack on Sun, 23 May 2004 08:29:54 GMT
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Hi GraemeI'd make part of the side panel removable, just around where the driver is, on both sides of the box (to access both drivers) which should be easy enough. The CSX 10" drivers I modelled are only 10.8cm deep, and I have 19cm in the rear chamber - so about 8-9cm between magnet and back wall, should be a pretty easy job to get drivers out this way + have the complete 19cm clearance around the drivers to get to the screws on the other side of the driver. I thought about zig-zagging the folds too, it ended up making the box higher though which was not acceptable for my constraints (well the only height constraint is ugliness! but thats reason enough). That subhorn sounds interesting, I'm not sure I can visualize exactly what you mean though - so rear chamber and start of horn would be at the ceiling and it runs all the way down, kinda like a completely straight horn or maybe with one fold? Adrian

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Subject: Lose the second woofer.
Posted by Bill Fitzmaurice on Sun, 23 May 2004 19:28:25 GMT
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The second woofer is unnecessary; you don't need it for power in a home environment and it's only giving you an additional 3dB of output so I'd lose it. The space devoted to it coud be reassigned to the horn, allowing either a smaller box overall or a longer pathway for an even lower Fc. Don't underestimate what you can accomplish from a small box. This SPL chart is my Tuba 18, a 45cm cube driven by an eight. It doesn't go as low as your design but it sure goes a lot lower with more SPL than anything else in its size class. You can get what you want in a far smaller package or get even more from the same size box by bagging that second woofer.

Subject: Re: Lose the second woofer.
Posted by Adrian Mack on Mon, 24 May 2004 01:25:01 GMT
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Hi BillHow could I get a smaller volume by using just one woofer? In the horn I posted, I planned to have the woofers side by side (hence 60cm width or 55cm internal for two 25.7cm drivers + a few cm of wiggle room). If I dropped one of, the width could obviously go down to even 30cm, but to get the same mouth area and area along the whole horn the height and depth would have to be increased to make up for the area lost in the width... or do you use a more fancy method which could take up less space with 1 woofer?After Wayne had a little snicker at my use of the word 'small' to describe my horn plan I posted I went away and refolded it totally different. I came up with this: Its again for two woofers... but I managed to get height down from 109cm before to 95cm - had to decrease mouth area to 2000cm^2 but length is the same (well it was 3m now its 2.93m, practically nothing), no matter though its what I had originally wanted in the first place and doesnt change response curve barely: Im still going at it, Im trying to find a way to get the height even less now that I've got the depth pretty small. Adrian

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Subject: Re: Lose the second woofer.
Posted by GraemeG on Mon, 24 May 2004 03:36:47 GMT
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Thats starting to look like the folding in my new 12" design - sort of a lumpy spiral horn.Cheers

Subject: Re: Lose the second woofer.
Posted by Wayne Parham on Mon, 24 May 2004 05:22:55 GMT
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I love the equiangular spiral and exponentially increasing angle spiral shapes for basshorns. Looks great!(Sorry 'bout my snicker. You know I think your designs are excellent. It's just that I get a grin out of basshorns referred to as "little" basshorns, even those built by Mike for his car. I surely wasn't ridiculing the design, so I want to make sure you know that.)

Subject: My version!
Posted by Mike.e on Mon, 24 May 2004 07:27:41 GMT
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Compare to mine,~422L total ,1driver99x97x44 total\Note that adrians horn is ~1cube smaller,cos i have ~ 1cube too much vrc :-p I hate his angles though!200cm Throat2600cm mouthexpo 299cmthis little woofer has a shorting ring! awesome! + i trust peerless more than any other 150$ 10" woofer company!Im gona CAD up 2 drivers now ,superb performance!2drivers vs 1 driver. same horn apart from Throat and Vrc adjusted.(so bigger)

Subject: Re: My version!
Posted by Wayne Parham on Mon, 24 May 2004 08:25:50 GMT
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Your horn is pretty cool too. But why do you hate Adrian's angles? Maybe 'cause it's hard to measure and cut? You can pinpoint where things need to go pretty easily really. I personally like equiangular and nearly equiangular folding.The one thing I might change on Adrian's layout is the position of the throat in relation to the cone. Having it offset to the side will make cone movement resistance greater on the bottom than the top, which will make a tendency to rotate and torque the cone and voice coil at high levels. I think I'd modify it slightly so the throat cutout was centered over the cone.

Subject: Re: My version!
Posted by Mike.e on Mon, 24 May 2004 09:20:24 GMT
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yeah i hate complicated cutting.im going to try a wider horn in the morning,at the moment its 480L and 42cm wide so its rather big.Or i could just make it 40hz F3 :-) il try one of those woofers somehow :-DCya!

Subject: Re: My version!
Posted by Adrian Mack on Mon, 24 May 2004 10:06:01 GMT
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Yeah, I'll change the throat. I couldnt decide if I should have a round throat 20cm diameter (for 400cm^2 area) or if I should make it a sort of rectangular or oval shaped throat. Cuz both drivers need to share the throat, I was thinking that a round throat would be the least best of the three, and a rectangular or oval throat the best to get as much surface from both woofer cones as possible in the throat - what do you think? > I personally like equiangular and nearly equiangular folding. I think its one of the most efficient/smallest/waste-free folding methods too, at least out of the various ones I've tried.

Subject: Re: My version!
Posted by Wayne Parham on Mon, 24 May 2004 10:49:46 GMT
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One of the reasons I like equiangular spiral folding is that long standing waves are reduced. And each section is followed by a bend of 90o or less, whereas the W and Z folding patterns are much closer to 180o. So those are things I like about spiral folds.About the woofer cutout hole, I don't think its shape or proximity to the apex are terribly important because the frequencies you'll be using the horn for are so low. Cut it round or square, whichever is easiest for you to do. I would position the woofer(s) near the apex and cut a hole for each woofer, located centrally, just over the dust cap. That will make the hole less than a foot away from the apex, which will be just fine. The wavelengths you're dealing with are much longer than that.

Subject: How did Kirk defeat Khan?
Posted by Bill Fitzmaurice on Mon, 24 May 2004 19:43:51 GMT
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Because Khan used battle tactics that relied on two dimensional thinking, as in Chess. Kirk, a master at 3 level chess (though no match for Spock) thought in 3 dimensions. Khan never saw that last Photon Torpedo coming.The same applies to horns. All of your diagrams are two-dimensional, which infers that your thought process behind them is also two dimensional. When you lose that second driver you halve the required space for the rear chamber, space that can be added either to your pathway for a lower Fc or to the mouth area for a higher SPL or both, or just subtracted from the box for net size savings. Don't sweat standing waves in basshorns; they don't exist where surface to surface dimensions are 1/4 wavelength or less. A quarter wavelength at 100 Hz is about 2.8 feet; you do the rest of the math. Also forget both reflectors and damping; both the Tuba 18 and Tuba 24 don't use either, with no degradation in performance. Standing waves for the most part only exist in the minds of advertising executives.The poster who noted that SPL was the same from an indentical box with either one or two drivers was correct to a point. While wattage sensitivity renains the same, voltage sensitivity does go up by 3dB, as the halving of impedance doubles the wattage in for a given voltage. By the same token total output power is up 3dB, due to the doubling of PMax. However, what you don't get is the 6dB voltage sensitivity/power output gain that direct radiators acheive from doubling drivers. That because doubling cone area in a direct radiator acheives an effciency gain of 3dB from the doubling of radiating area, but in a horn the radiating area is the horn mouth, and since doubling or quadupling or googleplexing the mumber of drivers at the throat does not change the throat size the horn efficiency remains the same, only the input power capacity changes.

Subject: Re: How did Kirk defeat Khan?
Posted by Wayne Parham on Mon, 24 May 2004 21:22:35 GMT
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I don't really think that either Adrian's or Mike's thinking is two dimensional, it's just that their horns are probably of uniform width so a two-dimensional CAD drawing has everything needed to describe them.As for standing waves, you're right about doing the math. No matter how it's folded, if you have three sections of approximately three feet each, I'd expect the horn to work well up to about 100Hz. So as long as output is limited to 100Hz, it should be alright.Still, one thing that's attractive to me about the equiangular spiral is that the radius is constantly increasing. When a horn is folded to approximate this shape, each section's length is different and that tends to break up the standing wave modes along the long dimension.

Subject: Re: How did Kirk defeat Khan?
Posted by Bill Fitzmaurice on Tue, 25 May 2004 11:05:06 GMT
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My point was that if you do all your designing/thinking from a standpoint of two dimensions that you can overlook the benefits of going off on a tangent, literally. Keeping the horn uniform width is logical from both a design and a construction standpoint, and in basshorns is also sonically sound

practice. However, sometimes your design goal can better be achieved by sending the pathway at a right angle to its nominal direction, or for that matter by loading the driver from the side of the box rather than the front or rear. I can't say if I first used that method, but I've been using it since Snail III back in '96, and that one simple concept has made possible and been used in every horn I've built since then. The equiangular spiral I agree is the best folding method from a variety of standpoints for basshorns. It's the foundation for my Tuba sub series for just that reason.

Subject: Re: How did Kirk defeat Khan?
Posted by Wayne Parham on Tue, 25 May 2004 11:30:15 GMT
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Yep, yep. I agree. I'm still stoked by your new website.
BillFitzmaurice.com

Subject: Re: How did Kirk defeat Khan?
Posted by Adrian Mack on Tue, 25 May 2004 12:58:11 GMT
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> However, sometimes your design goal can better be achieved by > sending the pathway at a right angle to its nominal direction, or > for that matter by loading the driver from the side of the box > rather than the front or rear.I too considered something like this, but seems like a lot more work - mostly because I dont know how I would draw it up in CAD. Now thats a basshorn which really needs a lot of thinking! ~could it be more space-efficient than the spiral method?

Subject: Throat hole
Posted by Adrian Mack on Tue, 25 May 2004 13:03:23 GMT
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> I don't think its shape or proximity to the apex are terribly > important because the frequencies you'll be using the horn for are > so low. Cut it round or square, whichever is easiest for you to > do. I would position the woofer(s) near the apex and cut a hole > for each woofer, located centrally, just over the dust cap. Are you sure that doing a seperate hole for each woofer is OK? What you are saying makes sense, just want to make sure - I guess the horn wouldn't know where the drivers at this low freq's + close spacing.

Subject: Re: Throat hole
Posted by Wayne Parham on Tue, 25 May 2004 17:01:14 GMT
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You betcha. I'd prefer to have a separate hole for each driver because it keeps the pneumatic load symmetrical and uniform on the cone. I can't think of a disadvantage going this way. Like you said, the frequencies are low, so the wavelengths are long. That allows some physical distance without running into problems.

Subject: Re: How did Kirk defeat Khan?
Posted by Bill Fitzmaurice on Tue, 25 May 2004 18:23:55 GMT
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First, don't think that I mean going with a terribly convoluted design; not only would it be hard to design, it might be impossible to build. But at the immediate throat area there's potential to use right angle pathways where cross-sections are small. One problem I've encountered with radial designs is that you can end up with rear chambers too large for effective reactance annulling, and some right angle paths close to the chamber can help make it smaller and put some of that area into the horn. One thing about McBean- keep trying smaller and smaller rear chambers; curiously the longer the horn the smaller rear chamber you need, relatively speaking.Can't help you with the CAD thing- I don't have it. I'm just at the point of giving serious consideration to a graphics program so I can finally retire the pad and pencil.

Subject: Re:Pad and Pencil vs Cad
Posted by GraemeG on Wed, 26 May 2004 01:33:22 GMT
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Bill,Have recently retired pad and pencil myself - got tired of erasing, calculating, visualising etc. To work in 3 dimensions on paper requires good spacial imagination, and has worked ok for me so far (my dual 8" pushing the limit though). I am currently learning the ins and outs of Autocad (mainly cause I picked it up cheap), and it makes things so much easier to visualise a concept, especially in determining whether something CAN be practically constructed.CheersGraeme

Subject: ive found this too
Posted by Mike.e on Thu, 27 May 2004 03:54:19 GMT
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One problem I've encountered with radial designs is that you can end up with rear chambers too large for effective reactance annulling, and some right angle paths close to the chamber can help make it smaller and put some of that area into the hornI concur,this happens on my S horns in particular,because of the 2 corners 3 section horn,the last triangular volume for Vrc can end up needlessly large for a 10". For my jbl 15" however it tends to be just right :pThats why for small vrc woofers i prefer to try all the otherways too,such as my old first technique of going like the labhorn apart from the 90* change in horn flare expansion on the last folding.http://homepages.paradise.net.nz/quadroph/digitor_files/image009.jpgThat way i didnt waste any space..but driver accessability its abit worrysome.The S shape i prefer ,and try first :-) 2 CSX 10"s require ~50L or so which on my horn of 2600cm^2mouth 2.6m expo tends to not waste.Im just debating whether to use the jbl or not,because a csx10" horn of same cutoff as jbl is 100L smallerCheers