Subject: Big day of measurements and stuff, long post
Posted by Adrian Mack on Sat, 13 Dec 2003 11:51:47 GMT
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Hi everyoneIn my never ending attempt to get design a horn around the Alpha 6 driver to operate from 300Hz to 1.6KHz I have had the most success today than I have before. Taking all advice etc into hand I built a conical horn with an 110mm diameter circle throat, which is a little smaller than the diameter of the Alpha 6's cone. I also used a phase plug. To start with here are the pics of the latest conical horn I've built. Below is the picture without phasing plug, but its got a compression ring installed to reduce it from 110mm diameter throat to 80diameter throat. Now here is a picture of the same horn, but with a phase plug installed. The picture after it shows close up of throat with phase plug. OK. Its the fourth midrange horn I've built so at this point I'm really hoping I would get what I want. The first test I did was using the full 110diameter of the throat, i.e: 110mm throat on the compression ring. All graphs in this post are taken with microphone 1meter from the dustcap, and all with the same volume control setting, RS meter setting, etc - everything kept equal basically so the graphs can be compared. All graphs have 1/10th octave smoothing. Here is what happened: Note that I've included only 100Hz to 5KHz range on the graph as that is the area of interest. This horn with 95cm^2 throat (which is 110mm diameter) is has a lot lot better HF extension than the 1st conical horn I had, which was exactly the same size and length, but the throat was only 30cm^2. That horn fell off very rapidly, like a rock after 1.1KHz, so you can see this 95cm^2 throat horn is already better. The stupid thing is that peak at 750Hz, I could not remove that on any of my graphs. So I am just talking bout the 1-2KHz region in this post really until I figure out how to get rid of it. 1-2KHz is what I have been trying to improve all along so thats also why I'm talking about this specifically in this post. Next up I tried an 80cm diameter round throat, which is 50cm^2. It is more flatter in the 1-2KHz range which is what I would expect with the smaller throat.Here is what happened when I added a phase plug with the 50cm^2 throat. The phase plug as you can see improved response more too, the difference between 1.2KHz and 2KHz is now only 2-3db, without the phase plug the difference was about 5db from the highest to lowest amplitude. You can see its now flat to 2KHz, rather than 1.6KHz so the phase plug has reduced some of the cancellations in the front chamber/throat. I removed the phase plug now and used a 2L back chamber with the 50cm^2 throat. Here is the measurement A little bit of improvement using back chamber compared to no back chamber. Output at 2KHz is increased, so the back chamber is something which increases HF efficiency, as I wrote a while ago in another post with tests I did on back chambers, gaps, etc. Now, I put them all in one. 50cm^2 throat with 2L back chamber and phase plug. Here is what I measured. Overall it is better than the rest. Output at 1.2KHz is the same as at 2KHz. There is a little peak at 1.55KHz, but the other graphs also had things similar to this and I found the back chamber with phase plug has the best, most flattest response to the highest frequency. Well, finally, I get the 1.6KHz response I wanted! I even got 2Khz. BUT... the problem is... look at the ugly peak at 750Hz with the dip right after it. I have no idea what to do about this. Ignore the 300Hz peak as I am crossing around 500-600Hz. But that 750Hz peak is a pain in the ass. Any suggestions as to what I should do to get rid of it? The phase plug has reduced some of the cancellations up high. With the graphs I posted it looks like the phase plug did not make hugely major differences but did improve it. Reason why is because my throat was large, when the throat is smaller theres more and more cancellations and the phase plug does a lot more to reduce them. I determined this myself using a phase plug on the other conical horn, the one with 30cm^2 throat, the phase plug did quite a considerable bit to improve the HF response. When the throat is very small the distance the sound travels from edge of the cone to throat is much further than what the sound travels from the dustcap to throat, and

so a lot more cancellation occurs. A bigger throat obviously reduces path length differences so less cancellation, the bigger the throat. The phase plug also helps to reduce the volume of the front chamber. On my horn anything less than 50cm^2 (or 80mm diameter throat) started to chop off the top end again too much, and rapidly, even with phase plug, I measured it. Would need very complex phase plug for very small throat. I think that this is the correct throat size for my application to get maximum efficiency in the 1-2KHz region and keep it flat. Anything too much bigger and you could get more response to a few higher kilohertz, but its also rolling off at the same time, but not like a rock, more slowly. However thats not what I wanted, I'd rather have it flat and I'm crossing at 1.6KHz to the compression driver/horn anyway. The 750Hz peak is still a problem. I do not know what to do at the moment with that... has anyone got any ideas or clues? My adivce therefore to anyone mucking around with midrange horns - do not make the throat small. If it is your got major phase cancellations above 1KHz. Make the throat big, and then experiment with compression rings to test out different throat sizes without rebuilding a new horn each time. Always use a phase plug if you want to use the horn up high, even if its a simple disc shape it does help. Small sized back chamber with acoustical lining I also reccomend to increase your HF efficiency. I have done the learning for you, built three different horns - tractrix, conical with small throat, and conical with big throat and ability to use/accept compresion rings. It was four horns in total because I built a pair of the tractrix type, (and its not fun building in 30 degree heat outdoors, that shows my commitment to this) and hours of experimenting with phase plugs, compression rings and back chambers, done measurements of them all so take my word for it. 750Hz peak... 750Hz peak... 750Hz peak... theres always a problem isn't there, can't win. Any tips from anyone would be very appreciated in reducing the peak/removing it. AdrianMy four midrange horns I have built

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Subject: Phase plugs
Posted by Wayne Parham on Sat, 13 Dec 2003 17:06:56 GMT
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Good job!That's a lot of work, and great information. Thanks for posting it here.I wonder if your 750Hz peak, and possibly the 300Hz peak, might be caused by sympathetic vibration of the material you've used to make your phase plug. Having support on the top and bottom only, I can easily visualize it entering into a rotating vibration mode, torquing the supports and resonating at a frequency determined by its weight and the stiffness of the supports.

Subject: Re: Phase plugs
Posted by Adrian Mack on Sat, 13 Dec 2003 23:26:18 GMT
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Hey WayneActually those peaks were there even without the phase plug as well. Do you think I should try and modify response with a phase plug? Or should I do something else to rid the

peaks?

Subject: Re: Phase plugs
Posted by Wayne Parham on Sat, 13 Dec 2003 23:40:13 GMT
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If it peaks down low with and without your phase plug installed, then I doubt a phase plug of different shape will correct the problem. If the disk had begun to vibrate with a resonant in the midrange, I could have understood it causing those peaks. But it must be something else. Maybe extend the mouth or put it on a large baffle and see what happens. That will help you isolate the flare, because its characteristics will change. Kinda looks like a mechanical buzz to me though. Or it might be a measurement anomaly; May want to check the raw driver dismounted from the horn.

Subject: Tamed the peak down
Posted by Adrian Mack on Sun, 14 Dec 2003 08:16:52 GMT
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Played around today with back chambers mostly, with a bit of luck I got this. The 750Hz peak is tamed down quite a fair bit. Using another sized back chamber, size of a bucket or so, this happened: That dip around 1KHz is filled in a little bit. The compartment which the horn will be installed in within my tower, I have a feeling that size is going to tame the peak a little bit further still. Overall I am very happy with the outcome now. Looks like I'll have to cross around ~600Hz, possibly a little bit higher. It will be actively crossed using Behringer CX-2300/4th order LR filter, its got adjustable xover freq in case I fiddle more and get more low end out of it. Since I used compression ring to get it down to 80mm diameter throat from 110mm, and I am gonna keep using 80mm as thats what I want; When I build a pair for it, do you think I should just make one more horn like this one with 110mm and use the comp ring to get it to 80mm. Or should I make two new horns with a real 80mm throat from the beginning? The dispersion could be a little wider using proper 80mm diameter throat (because I can get a little bigger wall angle), but I dont want to risk it not working right. Which should I build?

Subject: Forgot to say what I think.....
Posted by Adrian Mack on Sun, 14 Dec 2003 11:16:24 GMT

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I think it sounds awesome !!! I really like the sound of it, very nice midrange to my ears. I will still look for that JBL driver though, perhaps it might be better still. Wayne, do you think I should cross at 2KHz because I have output up there? Or 1.6KHz? I was thinking, perhaps I should use a pseudo butterworth filter instead of the "standard" butterworth if I cross at 2KHz. (possibly pseudo for 1.6KHz xover as well...)What sort of range do your midrange horns with the 2012/delta cover?

Subject: Re: Forgot to say what I think.....
Posted by Wayne Parham on Sun, 14 Dec 2003 14:34:14 GMT
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I have a couple of versions of the midhorn, one slightly larger than the other and with different throat sizes. Both cover the 200Hz to 2kHz decade. I'm pleased with both designs, but I'm tending towards the smaller one because indoor use (as intended), performance is just as good. The larger one would be better suited for outdoor use, but its size isn't justified indoors.About the peaks you're seeing, I've found it is sometimes difficult to get measurements that are decoupled from the environment at this range. Could be peaking from the flare or from the motor chamber, but it also could be caused by reflections off nearby surfaces. Then there's also the measurement system itself, which could generate anomalies on its own. Hard to say without seeing a response curve that doesn't have these peaks - It's tough down below 500Hz or so.But ignoring that for a moment, the performance in the top octave allows you some flexibility. That's good because it gives you more options. 1.6kHz is nice because it is a common frequency and there are many off-the-shelf components that use this frequency. Most compression horns work great in this range. And even the smallest horns are going to be free from reactive behavior by 1.6kHz, so you'll not have to worry about flare peaking from the tweeter horn. So you'll be able to look at each option on a case-by-case basis and choose whichever combination works best. Probably most will be fine with crossover anywhere in the 1.5kHz to 2.0kHz range, and maybe a little beyond.

Subject: Re: Tamed the peak down
Posted by Bill Martinelli on Mon, 15 Dec 2003 02:14:24 GMT
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I see the dip at 480hz to be the biggest problem. If you could raise that dip then your peaks would be nothing more than little 3db bumps that you could never hear or notice.other than that looks like your on to something there.Bill