Subject: Need suggestions for a lower range horn to mate with new Mid/High horns
Posted by noviygera on Thu, 25 Jun 2009 19:56:14 GMT
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First off, hello to everyone and to Wayne. Wayne, I had the pleasure of talking to you once on the phone, probably a year ago. We talked about you constant dir. midrange horn. I made one, by the way.

This is my first post here.
I have a DJ/listening system in my basement. Mostly, self made.
(I had JBL 2470 for mids and 2405 tweeter)
Some pictures:
http://picasaweb.google.com/noviygera/BasementSystem#

Just recently i installed NEW Funktion-One RES 1.5HS horns.
(I believe I'm the first one in the US to have these!)
Pictures:
http://picasaweb.google.com/noviygera/FunktionOne#

My current system:
18" subs on H open baffles (Eminence drivers)
10" Rola on open baffles (really old drivers)
5" RES 1.5 HS (Funktion-One): 25v x 90h degree coverage.

Digital crossover by DBX Driverack PA, 200 HZ, 630Hz.
Eq is "flat" above 600Hz. RES 1.5 HS sound very good this way.
Some eq used for midbass(minor, +/-2db) and subs(some heavy eq below 100Hz).

At this point I would like to move to a mostly horn system, adding a midbass horn to cover up to 600Hz, where it will cross over to the Mid/High horn. I'd like to start by replacing the 10" Rola on open baffle.

So, I'm looking for a Mid bass horn to go up to 600Hz.
Should I make one or get a used one somewhere?
My priority is sound quality over output.

You may notice (in the second link above) I made one constant directivity horn, per Wayne's plans. But I made just one and I think it will not go down to 150Hz like I need.

TWO options I came up with:
The crossover point will be 530 to 600Hz. the RES 1.5 midhigh is 18" x 10" x 9" deep.

Keeping in mind, I'm trying to cover 600Hz and below... Given space constraints of a medium size basement room...

1st option is to get the 10N Pro midbass horn. It 17" x 21" x 10" deep. Freq resp: 250Hz-1.6kHz
http://www.ddshorns.com/catalog.php?page=DMB10NPro
I will then need to get an appropriate 10" mid, make a box and mount the midbass horn

UNDERNEATH the Res1.5 midhigh. Seems reasonable.

2nd option is to get one of these: DVB 15H or DVB 15N Pro:
http://www.ddshorns.com/catalog.php?page=DVB15H
http://www.ddshorns.com/catalog.php?page=DVB15NPro
DVB 15H is 22" x22" x 5.75" deep, Freq resp: 60Hz - 1.25kHz
DVB 15N Pro is 22" x 22" x 15" deep, Freq resp: 60Hz - 800Hz
both will require a 15" driver instead of the 10" but size wise they are not that much bigger (5" taller)

...and to mount the the Res1.5 midhigh COAXIALLY, in the center of the big horns. Remember, the mid high mouth is 16" x 8", the mibass mouth is 22" x 22". Is this a GOOD IDEA? The question is will the midhigh create a shadow, or block the sound of themidbass driver and horn. It it worth emulating a single point source or will the drawbacks be to great?

Attaching a sketch of my concept. Will the directivity difference at 500 Hz cause a problem?

-Herman

File Attachments

1) concept_horn.jpg, downloaded 464 times

Subject: Re: Need suggestions for a lower range horn to mate with new Mid/High horns
Posted by Wayne Parham on Thu, 25 Jun 2009 21:11:42 GMT
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Looks like you're having fun. Nice stuff!

corners, but it won't go that low out in the open. It's designed for home hifi use, where it blends with a woofer in the 100Hz to 200Hz range. The corners help, acting sort of like mouth extensions, because the midhorn is tucked into the corner so close to the side walls. Without corners, the mouth area is insufficient for output below about 250Hz. You'd need a larger horn for that.

I'd grab a copy of Hornresp and start playing with it. You can probably knock out a few models that look good in a short period of time. Myself, I'd prefer a straight horn rather than folded for use in the midrange. Folded horns are great below 100Hz, but once you're in midrange territory, I don't like them. Wavelengths are too short and you inevitably run into problems with standing waves.

Here are Hornresp models of a couple larger midbass / midrange horns I tinkered with a few years back:

Subject: Re: Need suggestions for a lower range horn to mate with new Mid/High horns
Posted by noviygera on Thu, 25 Jun 2009 21:26:19 GMT
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Wayne,

It's NOT possible to install horns near corners of the room. So no corner gain, but I wander if I can couple the midbass to the ceiling?

what do you think about my coaxial "horn within the horn" sketch? It's attached to the post.
The small horn would be mounted in the big horn. If crossed at 500 to 600 Hz would it work? dispersion problems happening here?

Theoretically, the midbass horn would be 18" wide, like the high horn, but tall, about 35" high, coupled to the low ceiling of my basement.

-Herman

Subject: Re: Need suggestions for a lower range horn to mate with new Mid/High horns
Posted by Wayne Parham on Thu, 25 Jun 2009 21:44:52 GMT
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I understood you cannot use corners. I find most cases, corner loading isn't an option. I merely

small to be used in freespace.

The main thing I wanted to show was the link to the earlier thread with a couple of Hornresp models and brief instruction how to model a horn. You could perhaps use that as a starting point.

Coaxials have never held my fascination because they solve one problem by causing another that I think is worse. Whatever you do in a coaxial arrangement, something is compromised. Usually the inner horn is too small, and suffers poor loading and pattern control. This gives ripples on and off-axis. If the inner horn is made large enough, it tends to obstruct the outer horn, leaving a hole in the pattern on-axis. Some configurations have been used that pack a driver or array of drivers along the side walls, but this creates multiple reflections and even in its best trim, it's really hard to get the summing right. Any shifts cause whatever alignment is provided cold to be misaligned hot. So none of these kinds of coaxial or coentrant arrangements are very attractive to me.

There is one thing that a coaxial or coentrant horn does well, one problem it solves. There is no vertical offset between the sound sources. So if you need a tall vertical pattern, you have the possibility to get one using a speaker arrangement like this. The thing is, I can't see much use for

a tall vertical pattern and the price you pay to get it takes that option off the table for me. But if you need tall vertical coverage, it might be useful. It also makes for nice convenient packaging.

Subject: Re: Need suggestions for a lower range horn to mate with new Mid/High horns
Posted by noviygera on Thu, 25 Jun 2009 22:58:36 GMT
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I see your point, Wayne, thanks for replying. I will do some measuring and post sketches of two more options I thought of.
In brief, one idea is to mount the midbass above the mid/high right under the ceiling (touching the ceiling), horn loading the ceiling from 150 to 600 Hz.
The other (coaxial) is to make the midbass horn large enough to accomodate the midhigh horn inside being offset from the midbass center vertically. So the midhigh will be inside the midbass, but above the throat level of the midbass, leaving the midbass driver unblocked from view. But this would, make it unnecessarily wide dispersion vertically.

Subject: Two midbass horn layouts...
Posted by noviygera on Wed, 01 Jul 2009 02:25:53 GMT
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While trying to figure out HornResp, I came up with two midbass horn layouts. The question is weather they will work in my setup, so I included both sketches.

1. Midbass ABOVE the midhigh, coupled to the ceiling: available area: 12"x34" mouth, 30" depth.
(option1.jpg)

2. Midbass VERTICAL, below the midhigh. I was inspired by this JBL horn:
http://www.jbl.com/home/products/product_detail.aspx?prod=1400%20ARRAY%20BG&Language=ENG&Country=US&Region=USA&cat=BFS&ser=PTS

Can this be made to cover 90 deg horiz x 25 deg vert? By stretching out the throat to be tall and narrow?
(option2.jpg)

Thank you.
Herman

File Attachments
1) option1.jpg, downloaded 8407 times
2) option2.jpg, downloaded 7589 times

Subject: Re: Two midbass horn layouts...
Posted by Wayne Parham on Wed, 01 Jul 2009 03:02:31 GMT
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There are a lot of ways to skin a cat. But as for me, I try to keep the sound sources above the Schroeder frequency spaced so they sum constructively through a fairly large vertical arc which means relatively tight vertical spacing. The crossover should be designed with the same goal, to provide a large forward lobe with widely spaced vertical nulls. Naturally, you want to have the same horizontal coverage from each sound source so directivity and spectral balance is uniform along the horizontal plane. I say naturally, but I guess that isn't a given. That's just one of my priorities.

Below the Schroeder frequency, the sound sources can be (read that should be) spread out a little more to smooth out the room modes. So I guess my vote would be to use a midrange that blended with your woofer in the upper modal region. Keep the woofer low-pass under the Schroeder frequency, but let the midrange run down as low as possible for good blending. You can't do that if power levels are high like for prosound, but in that case you probably wouldn't have room modes to contend with so the tradeoffs would be different. For home hifi and home theater, I think it's a good way to go.

Subject: Re: Two midbass horn layouts...
Posted by noviygera on Wed, 01 Jul 2009 03:08:24 GMT
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So, Wayne, do you believe any of the two options would work? I couldn't figure out if you are against both options, in which case I assume I would have to mount the midbass, between the highs and subs. Please clarify.

Thanks,
Herman

Subject: Re: Two midbass horn layouts...
Posted by Wayne Parham on Wed, 01 Jul 2009 03:18:28 GMT
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I would not choose the option with the mids and tweeters near the ceiling and the woofer on the floor. I'd prefer the mids and tweeter down closer to the woofer, with a fairly wide overlap and smooth blend between woofer and midrange. The second option with the tall mid source - something like a line array - might be a good option. You could do this with a line of drivers perhaps. But in that case, I might be also tempted to use a line of tweeters instead of a point source.

those, the woofer and midhorn have a wide overlap to smooth the upper modal region. The midhorn and tweeter are tightly coupled to provide good summing over a 90°x40° pattern. You could always scale up the midhorn if you wanted. Larger horns tend to provide acoustic loading and pattern control down to a lower frequency. The only thing to watch out for is that you don't also reduce the upper frequencies or make it too large to give good verticals. There are lots of competing priorities to balance.

Subject: Re: Two midbass horn layouts...
Posted by Bill Wassilak on Fri, 10 Jul 2009 03:06:24 GMT
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I would go with your 2nd option. Like Wayne said " The second option with the tall mid source - something like a line array - might be a good option."

I use 8 - 6.5" drivers, operating at 100-2.3kHz in a 55" line array for p.a. for mids, the drivrs are Dayton's from Parts Express, and they run pretty much flat, what ever room I put them in.

I recommend Jim Griffen's white paper on line array's. Which can also be found on this board.

File Attachments
1) nflawp.pdf, downloaded 465 times

Subject: An array of 8" mids
Posted by noviygera on Fri, 10 Jul 2009 05:18:23 GMT
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I was just exploring that option after talking to McCauley tech support. By the way, their support is the best I've ever come across. I talked to (I think) David and he gave me tons of useful information regarding the basics of sound reproduction and speaker designs and capabilities. Gave me advice on my system. No sales BS, just useful information that is hard to get online in a systematic way. Like Wayne from Pi Audio, also very helpful.
So it's my duty to pay them my thanks.

The McCauley has no midbass horn in their product line. However I was advised to explore and midbass array as follows: three 8" mids as in here:
http://www.mccauleysound.com/product_overview.cfm?ID=2122

I can probably build something like this myself. The idea is to have limited vertical dispersion to match that of the horn at 600 Hz.

Question: will there be any problems caused by three 8" drivers covering 150 to 600 Hz as compared to a midbass horn with a single 8" or 10"?

Subject: Can we get away with a tall, narrow horn?
Posted by noviygera on Tue, 18 Aug 2009 06:24:40 GMT
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Wayne,

I finally got to try the Hornresp with 9pi midbass parameters as a starting point. Indeed, a very useful tool, that brought me a wealth of information about horns, and clarity to what would have been trial and error, maybe lost time and money.

For example, I modeled the DDS 10n pro horn and contrary to what DDS told me the horn only works truly down no lower than 250Hz (and NOT 150Hz!) which is not good for my application.
I found out that for 200Hz in Half space the smallest horn mouth would be about 560 in sq.
Thanks for your advice!

I do have a question and it's more like a theory for a 600Hz crossover:

Lets say the HF horn is mounted above the MF horn.The vertical distance between driver centers of HF horn and MF horn is about 20" (for example, if the MF horn mouth is tall). Crossover point is 600Hz. Listening distance is 7 to 14 feet. Will the sound be coherent? Is the spacing too great to sound "right"?
So, let say I use a 36" high x 20" wide mid freq horn, rather than 20" high x 36" wide. I know coverage pattern is flipped. BUT! it's not a big deal if the horizontal and vertical pattern at 600Hz are pretty similar. Here some proof i found:
http://www.eaw.com/info/EAW/Loudspeaker_Product_Info/Legacy_Loudspeakers/MH_Series/MH690iE.pdf
this is a 90x40 mid horn.
on PAGE 27, look at the pattern numbers below 800Hz. The speaker is becoming less directional.

Why bother with this? So that we can flip the flat and wide midbass horn on its side and have a "friendlier" narrow but tall midbass that can be used as a floor coupled stand for the high horn. If the high horn is 18" wide, we can make the midbass 18" wide, and 36" high and get away with good coverage pattern (given crossover is below 600Hz) Or can we? That why I'm asking if the resulting longer spacing between driver centers is a problem.
What do you think?

-Herman

Subject: Midhorns and boundary loading
Posted by Wayne Parham on Tue, 18 Aug 2009 15:08:25 GMT

outdoors. When used indoors, you can usually use a smaller horn.

I've found that horns designed for use below 300Hz are able to get boundary loading in small rooms, even if not directly placed in a boundary. The simple fact of using them indoors provides something similar to boundary loading. I think it is partly due to the fact that the room influences directivity by being a constrained space, and perhaps also partly because of room modes. In a sense, that's saying the same thing, they're flip sides of the same coin.

I've found that boundary loading in small rooms is different than what a simple model can describe. Again, the reason is probably the combined condition of room modes and the fact that all the boundaries are affecting the horn, not just the closest ones. This is in effect saying the same thing, but to visualize the situation, I think it helps to picture what's happening.

The reason boundary loading works is really one of directivity, it's due to the fact that the room boundaries act as extensions of the horn. If in an infinitely large trihedral corner, then the radiation pattern could never exceed 90° so it is in effect a very large conical horn, with the loudspeaker sitting in its throat. A horn in the loudspeaker acts as part of the throat, setting the radiation angle at high and maybe mid frequencies and the walls of the room setting the angle at low frequencies. The same thing happens in quarter-space or half-space, but just with a larger radiating angle.

When you put a speaker in a room of finite size, the adjacent and opposing boundaries have an effect on the radiation pattern too. The larger the room, the lower in frequency there is an effect and if large enough, it's out of the audio passband, in effect, the same thing as outdoors. But that takes a really large room to act the same as freespace. The smaller the room gets, the more effect adjacent and opposing boundaries have on the radiation pattern, the energy distribution in the room.

The frequency that marks the upper end of the range where the room boundaries have this kind of influence is called the Schroeder frequency. Above that point, the walls still reflect sound but the standing wave modes formed by these reflections are grouped so tightly together you can't tell them apart. Above the Schroeder frequency, the acoustic field is said to be reverberent and below it, it's modal. The only real difference is the distance (in frequency) between modes, whether you can clearly define them or not, or if instead they blend into a continuum.

When a speaker is placed in a room, the walls contain most of the acoustic energy in the room. Some goes through the walls or out passages and some is absorbed but most stays in the room. This is, in effect, modifying the directivity of the loudspeaker, in fact, by quite a large amount. It is no longer radiating omnidirectionally or whatever pattern it would do outdoors. The shape and size of the sound field is controlled largely by the room boundaries, which hold it in. So a horn placed in a room is radiating into an environment that is (much) smaller than free-space or even half-space, and at frequencies below 300Hz, this translates into what works like boundary loading, even if the horn is not sitting in a corner or against a wall.

Pattern flip is an issue that happens at low frequency, below the point where the horn gains

directivity control. At low frequencies, the mouth exit works like a diffraction slot. At higher frequencies, the wall angle sets the pattern. So if you make an asymmetrical horn, you may want to consider mouth dimensions to see if it is large enough to set the pattern in the desired passband.

There are competing priorities with regard to vertical spacing and mouth side. A taller horn will control the vertical pattern lower in frequency, but it will also cause the vertical nulls to come closer together. You'll want to make sure that the forward lobe is positioned where you want it to be and that the nulls do not fall where listeners might be. The position of the forward lobe, the upper and lower nulls and the secondary lobes are all set by the size, shape and position of the horns/drivers and by the crossover frequency and phase.

Subject: Re: Midhorns and boundary loading
Posted by noviygera on Fri, 21 Aug 2009 01:27:26 GMT
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Wayne,

What I got out of the last post is that I will get a midbass horn and see what works in my room. But thank you for going in depth over the competing priorities. Though, it would be too difficult for me to predict how the room would interact with the speaker. Maybe there is software that does it all...
I narrowed my selection to two options: one is the DDS 10 pro, another a private copy of the EAW MR102L.
I have all the dimensions and driver specs and I modeled both horns in hornresp to see which one would perform better. Here is the result (half space):

The black curve is the EAW copy, the grey is DDS 10pro.

The DDS goes lower but it has some ripples in the responce, its a big horn, though being 34" deep!
The EAW copy "looks" better to me, even though it does not go a s deep it has a smoother response. It's smaller as well.

Any thoughts on which would work better in a basement space?
Thanks,
Herman

File Attachments
1) hornresp1.JPG, downloaded 4222 times

Subject: Re: Midhorns and boundary loading
Posted by Wayne Parham on Fri, 21 Aug 2009 04:16:13 GMT
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Both horns will have nearly the same response in small to medium sized rooms (provided driver breakup doesn't do weird stuff above 1kHz). The differences will be a little easier to notice outdoors. Even there, the biggest difference will be fullness of male voices and cello from the DDS pipe mode around 120Hz. Other than that, it wouldn't be night and day because while the sim results look pretty different, those DDS peaks are only about 3dB. Its lower frequency extension is about an octave lower because of that lowest pipe mode. Indoors, this is all irrelevant because room modes swamp the horn's pipe modes. The room modes will be getting closer together in the 100Hz to 200Hz range, blending in with the pipe modes of the DDS horn and sort of filling in the bottom end of the EAW horn.

Subject: Re: Midhorns and boundary loading
Posted by noviygera on Fri, 21 Aug 2009 14:00:37 GMT
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Once again, thanks for your input, Wayne. I will post my results with the new horn.