Subject: A few questions
Posted by Allan on Sun, 18 Jul 2004 20:27:25 GMT
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I've been wanting to build a line array for a couple of years and when I saw the PE 4 inch buyout ($.69 each) I went ahead and bought 40 of them. I'm also planning on buying 12 Dayton PT2 planar tweeters from PE this week. Mostly an experiment with no magical expectations, but I still want to follow the guidelines in Jim's white paper (thanks for that effort Jim). I've got some general questions that maybe you guys can help with.1) I can go with either 16 or 20 drivers per side. IF I go with 20, my ear height will be lower than the center of the array. Is there any disadavantage to having the center of the array above your listening height?2) If I go with 16 drivers, I'll plan on using 4 tweeters per side. Wiring both the 4 inchers and the tweeters for 8 ohms each, I'll have a ~4ohm load if I run the tweeters parallel to the 'woofers'. Theoretically, I'll have approximately the same efficiency (~98db/1/w/m) from both arrays so they should match up pretty well. XO point will be wherever they sound right, but I thought I'd start with ~10Khz and work down. I know, comb effects should start screwing everything up after ~3.4Khz, but the 4 inch drivers should have reasonable response out to 10khz and I want to use the wide-range aspects as much as possible. I've got the components to play with the XO point, so at worst, it's no more than a waste of my time (which I have plenty of:-) So, the second question I have is about the placement of the tweeters relative to the woofers. My instinct is to locate them centered on the woofer array, and placed as close to both themselves and the 4 inchers as possible. The other option is to place them centered on groups of 4 woofers, with an obvious gap between the tweeters themselves. It would look balanced, but would it cause more problems than if they were placed immediately adjacent to each other? The center to center distance of the tweeters would of course at least be doubled if not tripled.3)Dipole vs sealed: I can go OB or sealed with them. Any experience and opinions of one vs the other? The PE drivers have the qts (.77) to make them doable in an OB.4) BSC circuits: In general, a line array is going to be pretty tall and skinny - it's sorta the nature of the beast. I'll have mine pretty close to a back wall so it may be a moot question, but, do you guys normally try and apply a BSC circuit, or is there something about the array that makes it unnecessary? I'd rather not mess with the efficiency of the array, so I'd like to avoid any series resistance if possible. Just wondering what your thoughts/experiences have been with baffle step issues.5) If I go with a sealed box arrangement, I was thinking of building the array in compartments - groups of four drivers each in separate boxes that can be stacked. Any adavantage/disadavantage to a single, large sealed box? Thanks for any input and subjective opinions are fine. Personally, I always let my own subjective opinions override any theory anyway:-)Allan

Subject: A Few Answers
Posted by Jim Griffin on Mon, 19 Jul 2004 01:54:38 GMT
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Allan,A few answers to your qquestions:1) I can go with either 16 or 20 drivers per side. IF I go with 20, my ear height will be lower than the center of the array. Is there any disadavantage to having the center of the array above your listening height?Answer: I suggest that you try to center

the woofer array about the ear height at the listening position. I would use 8 Pt2 tweeters per side so that you can cover both sitting and standing listening positions plus nearly equalize the power responses from the two lines. 2) If I go with 16 drivers, I'll plan on using 4 tweeters per side. Wiring both the 4 inchers and the tweeters for 8 ohms each, I'll have a ~4ohm load if I run the tweeters parallel to the 'woofers'. Theoretically, I'll have approximately the same efficiency (~98db/1/w/m) from both arrays so they should match up pretty well. XO point will be wherever they sound right, but I thought I'd start with ~10Khz and work down. I know, comb effects should start screwing everything up after ~3.4Khz, but the 4 inch drivers should have reasonable response out to 10khz and I want to use the wide-range aspects as much as possible. I've got the components to play with the XO point, so at worst, it's no more than a waste of my time (which I have plenty of:-) So, the second question I have is about the placement of the tweeters relative to the woofers. My instinct is to locate them centered on the woofer array, and placed as close to both themselves and the 4 inchers as possible. The other option is to place them centered on groups of 4 woofers, with an obvious gap between the tweeters themselves. It would look balanced, but would it cause more problems than if they were placed immediately adjacent to each other? The center to center distance of the tweeters would of course at least be doubled if not tripled.Answer: You will need a crossover so your amplifier will see a nominal load of 8 ohms in each band--not a 4 ohms load.On efficiency you will lose a little of that 98 dB SPL--say 3-4 dB to baffle step reduction if you go with a sealed box. More bad news on the tweeters in that you will likely have no array gain with them--their sound fields don't overlap enough to add efficiency. You can only gain sensitivity by reducing the nominal impedance--a reduction of array nominal impedance from 8 to 4 ohms would yield 3 dB sensitivity. Hence, that 92 dB SPL 8 ohms planar tweeter would still be 92 dB if the nominal array impedance is 8 ohms in the array. Read my white paper on this subject.Bottom line on the woofer and tweeter sensitivity issues is that it is usually better to have a little higher sensitivity tweeter line so that you can attenuate the tweeters to match the woofer line sensitivity. You need to look up the frequency response graphs on the Parts Express site to help you make a decision on the woofer line crossover frequency. Also above a wavelength spacing center to center you'll start losing sensitivity (the comb line effects shows up as a reduction in the array's gain as you frequency goes up--above 3.4 kHz in your case). I'd shoot for a lower crossover than what you are thinking. 3)Dipole vs sealed: I can go OB or sealed with them. Any experience and opinions of one vs the other? The PE drivers have the qts (.77) to make them doable in an OB.Answer: These are very small drivers to work successfully on an OB baffle plus the baffle size will have to be large to attempt to push the dipole rolloff frequency down low enough to hand off to subwoofers. OB may still need equalization compensation to counteract the low end roll off. I like sealed boxes as they are easier to design/implement/smaller size and yield acceptable performance. 4) BSC circuits: In general, a line array is going to be pretty tall and skinny - it's sorta the nature of the beast. I'll have mine pretty close to a back wall so it may be a moot question, but, do you guys normally try and apply a BSC circuit, or is there something about the array that makes it unnecessary? I'd rather not mess with the efficiency of the array, so I'd like to avoid any series resistance if possible. Just wondering what your thoughts/experiences have been with baffle step issues.Answer: Addressed above.Answer: Space the tweeters as close together as possible so that you will achieve a constant wavefront from them. Any separation or gaps are bad in this respect. Again see the white paper to understand why sseparations are bad for the tweeter line. 5) If I go with a sealed box arrangement, I was thinking of building the array in compartments - groups of four drivers each in separate boxes that can be stacked. Any adavantage/disadavantage to a single, large sealed box? Answer: I might suggest internal partitions (braces that separate the larger box into compartments) to break up any enclosure's pipe modes. Four woofer drivers to a partition would

be just fine. Compartments like this will strengthen the box without resorting to double walls or other methods to prevent flexing the box walls. This would result in a stack of effectively small boxes inside the large enclosure but the external walls would carry all of the loads to the floor.Good luck. Let us hear how it turns out.Jim
Near Field Line Array White Paper

Subject: Re: A Few Answers
Posted by Allan on Mon, 19 Jul 2004 15:22:45 GMT
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Thanks Jim. That IS bad news about the tweeter array:-) I re-read your paper and realized I missed that point. Are you saying then, that to get array gain from the tweeter line, I should go with a cone/dome tweeter?As for the XO, I think I'm gonna buy another amp and a 3-way active XO and tri-amp the whole thing. I'm already bi-amping with a 2-way active XO and I've been wanting to go 3-way anyway. Dialing in the correct XO pint will be alot easier all the way around. The PE drivers are #265-568 (extended range) and look to have useful output between 150hz and 10khz in a sealed box, with a nasty peak between 7khz and 10khz. My original thought was to start at 7khz to avoid the peakiness and I wanted to hear the 6.8khz comb effect - I'm more interested in learning something by this project than anything else. If I go active on the XO, I can just dial it anywhere I need it and get a quick feel for how the array behaves. I'd try to cross at ~150hz to my stereo subs, but they're big 18 inch drivers and I don't know how high I can go with those yet. An OB version would force me to cross at ~200hz and I don't have alot of faith in the subs at that point. The 4th order slopes will help and I'll have some gain control between the 4 inch driver array and the tweeter array.Anyway, thanks again Jim for your input. We'll see how it all turns out.Allan

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Subject: Re: A Few Answers
Posted by Jim Griffin on Mon, 19 Jul 2004 19:14:12 GMT
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Allan,On the tweeters let me say that I really like the Pt2 planars versus the small domes eventhough you don't have that much array gain. If you have to increase the sensitivity, then wire them for a lower impedance (a 4 ohms array would yield 3 dB more sensitivity or slightly more than 95 dB SPL). Unless you have very small domes you are not going to realize much array gain with them when you go beyond a wavelength center to center spacing as it is.The only way to get into the upper 90's dB SPL is to use more expensive ribbon tweeters (Founteks from Madisound or Aurum Cantus models from E-speakers). In contrast the Pt2 planars are one fourth or more less cost per device.On the woofer crossover I think you need to be thinking about a lower than 6000 Hz cross point. The directivity of the woofers will start to fall above 3.4 kHz for your case so you will be getting less array efficiency as you go above that frequency point. With the active bi-amp'ed crossover you can address both the crossover point and any gain offset between the

two lines at the same time. Just takes more amplifiers. Jim

Subject: 4 ohm wiring
Posted by lcholke on Tue, 20 Jul 2004 13:05:51 GMT
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Hi Jim,I was reading this post (very helpfull) and had a question. Will changing the Qes or Qt by wiring for 4ohms change the sound. My pe-87 16 array sounded lifeless, wired for 8 ohms. 4ohms was to lively and 6ohms (12 drivers) seems just right =;). I have them open baffle and the amp is .1 ohm published. You wrote,If you have to increase the sensitivity, then wire them for a lower impedance (a 4 ohms array would yield 3 dB more sensitivity or slightly more than 95 dB SPL). -----Linc

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Subject: My results don't agree here.
Posted by Bill Fitzmaurice on Wed, 21 Jul 2004 15:26:58 GMT
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I've used Pt2s stacked 3 high and the measured output averaged 101dB/2.83v at 5.3 ohms impedance (this results from using a cross-firing array of 3 tweeters apiece, each vertical bank wired in parrallel, the two banks in series). It is also very easy to horn load them for even higher sensitivity if desired.There is literature that suggests that the spacing on center between drivers is not critical to integration of point sources but rather it is the distance between the edges of their respective radiating planes, ie, the mounting flanges and surrounds, that must be held to no more than a wavelength. My measured results with not only Pt2s but also 3/8" domes suggest that theory is in fact correct.

Subject: Re: My results don't agree here.
Posted by Jim Griffin on Fri, 23 Jul 2004 02:29:54 GMT
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Bill,Across the lower part of their frequency band with the Pt2's (and several other similar size planar and ribbon tweeters) you will have array gain. Near 2000 Hz (the lower end of the Pt2 freqeuncy band) you will have significant vertical dispersion or sound radiation (out to 30-40 degrees or even more) so you will have sound field overlap if you array a line of these drivers at 2000 hz. But as you can see from the vertical dispersion frequency response of a single Pt2, you will see that their vertical dispersion decreases as you go to higher freqeuncies. In some cases the dispersion from the drivers overlaps less than 5 degrees close to 20000 Hz. This means that in such an array their sound fields will have little (if any) array gain in the upper octave (10k to 20k

Hz area). Bottom line is that you should not count on achieving all of that array gain across their entire operating band. With these drivers in an array and because of the reduced vertical sound field overlap vs. frequency, you will have minimal issues with comb lining (little sound field overlap so comb lines don't form as frequency increases). What is important in such an array is the percentage of active length of these elements in the array. This is the amount of active radiating length to flange and separation distance. Various researchers have recommended that the active ratio percent be near 80% for best results. This is all explained in my near field line array white paper by the way. Jim

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