Subject: Re: 3pi Woofer / Horn Vertical Spacing
Posted by Wayne Parham on Wed, 11 Apr 2012 18:34:28 GMT
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Look at the response charts:

approximately 35° above and 25° below the centerline. That's a 60° spread. Even the spacing between the inside edges of the nulls is further than 50° apart. So the forward lobe is perfectly clean through a nice tall 50° vertical arc. I like putting the nulls in this position - just outside the vertical beamwidth at HF. It punctuates the edge of the pattern in the crossover region, where the horn/waveguide would otherwise have little vertical control.
Matching directivity in the vertical and the horizontal planesThe tweeter horn/waveguide I use provides constant 90° horizontal beamwidth through the passband, and a narrower vertical pattern at HF, which reduces ceiling slap. It also isn't hard to get close center-to-center spacing because the mouth isn't all that tall. You don't have to bring it edge-to-edge with the midwoofer in order to get a nice-sized forward lobe.
H290C Horn/WaveguideYou could bring the woofer and tweeter closer together by an inch or so, but then you would have very little room for the cross-brace, which is a pretty important thing. Cut it too close, and the brace becomes ineffective because the thin baffle section is too weak. And you don't want to omit the brace because it not only reduces panel vibration, but also serves as a place to put the sheet of insulation that spans the cross-section. This is required, because it reduces the intensity of internal standing waves that line up in the lower midrange in a cabinet this size. That combined with the fact that the nulls are already very widely spaced, I just don't see the need to shoe-horn a tight fit.

This isn't at all like a round horn that requires a foot or more spacing. It isn't uncommon for a design like that to have vertical nulls within 10° from the forward centerline. Take the Geddes Summa, for example. It had vertical nulls a mere 7° from the forward centerline. They're straight in front of the speaker until you are over ten feet back, where they gradually angle off above and below. I could hear the nulls very distinctly at the GPAF in 2005. When I walked into the room and then sat down to listen, I passed through a null and heard that telltale swooshing sound. I questioned Earl about this problem, and he basically discounted it, saying he felt horizontals were more important.

I would agree that horizontals are important, but then again, if you're sitting in a null, pretty much nothing else matters. So it is important to me that the center-to-center spacing is at least short enough that a crossover can be designed that simultaneously matches horizontal directivity and places vertical nulls outside the pattern. Even if the pattern widens in the vertical in the crossover region, the nulls shouldn't be so narrowly spaced that they make the crossover region have a forward lobe any smaller than the horn's vertical pattern at HF. My goal has always been to provide constant 90° horizontal beamwidth and 40° vertical beamwidth at HF, with nulls spaced at least that far apart.

My loudspeaker designs achieve these goals. They have sound sources placed close enough to keep the nulls outside that 40° arc. The horn/waveguide has constant 90° horizontal beamwidth and 40° vertical beamwidth. As a result, polars are much better. A comparison can be seen in the document below on page 15: