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Subject: Re: MTM Pi midhorns

Posted by [Wayne Parham](#) on Thu, 13 May 2004 21:00:15 GMT

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There are a few things that happen when you array horns or place them near boundaries. As long as the two horns are less than a quarter wavelength apart, you can consider them tightly spaced. In fact, this is true up to about a third wavelength spacing. The idea is that the difference between each sound source and the listener shouldn't be a half wavelength or multiples of a half wavelength because that causes cancellation nulls. When placing horns near a boundary or other similar horns, it changes their radiation angle. This has several effects on their performance, potentially changing their response and dispersion and making them act like a larger horn. This is like the way some antennas work, having a single conductor but forming a dipole using a large metal surface or the ground as a reflector or "ground plane." Every car antenna is done this way, with the body of the car functioning as a ground plane. It effectively doubles the length of the antenna. This same situation is also true of the boundary conditions for horns. A sound source

the baffle restricts output towards the rear. If placed in a 90° reflector, like the floor/wall or

themselves are fundamentally devices that reduce the radiation angle to some fractional amount. Other sound sources act as reflectors too. Using another antenna example, look at what is used for beam antennas. Not many homes have them anymore, but just twenty years ago, you'd see an array antenna on every home for the television. It's formed by having a series of dipole antennas spaced so that parasitic radiation from each element interacts with the other adjacent elements to control the pattern. The situation is similar with horns, in that if you take two similar horns and mount them one above the other on a baffle, the horns will act as reflectors to one another. Assuming each horn is driven with the same electrical signal and they are tightly spaced, each horn will only have to cover quarter-space. The baffle reduces radiation angle to half-space, and each horn takes half that. In the case of loudspeaker horns, I find the most common reasons to use methods that decrease radiation angle are directional control, increased output and improved low-end response. Prosound applications often focus on directional control and increased output. But high-fidelity applications almost always have the priority on frequency response. Folks put their basshorns in corners so the bottom end is made deeper and less peaky. In fact, the corner does most of the job and the part of the horn that's inside the cabinet does very little. Midbass and midrange horns are also often improved using similar approaches, baffle mounting or near proximity to room boundaries. Even into the lower midrange, wavelengths are still pretty large. Middle C is 260Hz, with a wavelength of over 4 feet. Just one octave down, you're at 130Hz, which I'd consider to be roughly the start of the midrange band. This is nearly nine feet long. So a midrange horn that doesn't have dimensions of this general scale is really undersized somewhat. You'll sometimes find midrange horns that large in theaters, but most of even the largest home speakers get nowhere near this big, certainly not for a midrange horn. That's where boundary conditions and reduced radiation angle can really help. At low frequencies where the mouth may be too small to control dispersion, output is still limited to the radiation angle formed by the environment. This is why small horns receive more benefit from reduced radiation angle than larger horns do. A small horn becomes less effective at low

frequencies, and the boundary conditions themselves become a significant part of the horn. Using room boundaries, close proximity to other horns or even baffle mounting, the horn is made to act like a larger horn, particularly at the lowest frequencies where it becomes weak. This is true not only for basshorns, but also for midbass and even midrange horns up to a few hundred Hertz. Most of them are really a bit small. As the frequency drops, the horn becomes too small to maintain the directional pattern of its side walls and the pattern widens. At the lowest frequencies, it becomes practically omnidirectional. So an undersized horn is unable to perform at the lowest frequencies unless it is used in an environment where radiation angle is constrained in some way. Hope this have given you some thoughts to ponder, and helps with some ideas for implementing your midbass and/or midrange horns.

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