Lansing HERITAGE

SMITH RECALLS

Former JBL Design Engineer David L. Smith

David Smith worked as a design engineer at JBL from 1980 to 1983. During that time, David was responsible for such systems as the L15 and L46 for the Consumer Division and 4401, 4411, 4430, 4435, 4612 for the Professional Division. He would later work for KEF Electronics, Meridian America, McIntosh Laboratories, Snell Accoustics, and currently, Lenbrook Industries. The following are anecdotes provided by David on his involvement at JBL.

I can remember some stories that might interest your readers: I was thinking about the test setup. There was a small anechoic chamber but it wasn't very good. Most measurements were done outside on a large asphalt pad. You could bury a speaker flush in a pit (which created big issues in the design of the L212, (see below) or you could do ground plane measurements. With ground plane measurements the mic is placed on the ground. Outdoor measurements, well away from buildings, are in a semi anechoic environment the exception being a reflection from the ground. If a speaker as placed in a typical position, say a couple of feet above the ground with the mic at a typical listening height of 40 inches there will be a second sound arrival from the ground bounce midway between speaker and microphone. The second arrival is time delayed (it took the longer path down to the ground and then back up to the microphone) and the measurements will have severe comb filtering from this delay. Now as you move the microphone nearer the reflective surface then the time difference diminishes to the point where it is negligible if the microphone is in contact with the surface. The system has to be tilted downward or stood on its head to make sure the measurements are on the system axis that you are interested in. The boundary surface adds 6dB to the measurement that you can easily calibrate out.

Now there were two practical problems to outdoor measurements: airplanes being the first. Unfortunately he Northridge factory is just adjacent to the final approach for Van Nuys airport, one of the busiest private airports in the country. Lots of C130 transports would take off and land there and usually in the middle of an important measurement! Heat was the other issue. The hottest day I remember hit 112 degrees. (Ah, but its a dry heat!) Woofers didn't seem to mind but tweeters would have their materials and glues soften to the point where the highs would roll off prematurely (giving nothing above, say 10kHz). If you had an important project going in the middle of the summer you would start measuring early in the day before the sun was at full height.

We did a lot of large horn design in the early 80's. Don was working out most of his constant directivity horns and needed a means of testing their directivity. He had created a very clever measuring system. B+K had a turntable for speaker rotation that would be used in synch with circular chart paper, but in the end you had a picture of polar performance but no data (DI, beamwidth, Q etc.) Don had built a more sophisticated system from scratch. He had taken a huge multitoothed gear out of an old machine. It was probably 18 inches across with several hundred teeth. A good sized motor would drive it while a micro switch would count teeth and hence the rotation. An early computer ran the device (DOS or earlier software?) and an old two-box B+K 1/3 octave analyzer would take measurements and send the data to the computer program for number crunching.

It ran something like this: Set the device on a stand on top of the turntable with the microphone on the zero axis. Tell the program how many measurements to take or how many degrees per step and let her rip. It would turn to the first position and blast away with pink noise. I think it did three bursts and looked at the nose floor in the intervening silences to confirm the measurement validity. If

satisfied it moved to the next position. SHH...SHH...SHH, turn and repeat. I remember we got complaints and a police visit from the apartment building to the North once. They were convinced we were doing something nefarious (Don just wanted a good signal to noise for the measurements.)

Any of the brochures that show 1/3 octave plots of Directivity Index or power response, such as the 4430/35 monitors or the theater horns, would have been measured on this apparatus.

The picture to the left is of the rooftop measuring pad at Northridge. I think it was reached at the top of the stairwell situated by the old anechoic chamber. I think this preceded the ground level pad and was used less after the ground pad came in, as I can only remember going up there once or twice. The ground plane pad had several test options: one was a 10 cubic foot box with interchangeable baffles for any size woofer, midrange or tweeter. Secondly was a larger pit (4 or 5 foot deep) that full size systems would be placed in. 4x4's of lumber would be stacked up to get the front flush and then a few pieces of plywood would skirt around and give effective 2 pi (half space) baffling.

Measuring a system flush in the ground gives a very clean curve. AR (and others) used the technique for years. Now the only problem with measuring in 2 pi is that you've removed the box edges and baffle area from the equation, factors that definitely exist when you get the speaker home. Text books show a 4pi (full space) to 2pi transition curve that is generally a low frequency rise of 4 to 6 dB that lasts up to a frequency where the system's baffle area is adequate and the box itself represents 2 pi. I say "generally" because there are usually extra wiggles on top of the basic trend. Typically, although there is a 4 to 6 dB gain below,say, 200 there is an octave with a few dB of loss just above that frequency. So a system that is designed to be perfectly flat in 2pi will have significant response aberrations when free space mounted. It would have the mirror of the curve described, that is it would be weak below 200Hz and overly prominent above.

That brings us to the L212.

The original concept for the L212 was devised by Ed May, but he left JBL before the system was developed. Lorr Kramer, Greg Timbers and Terry Sorenson were responsible for engineering of the production model. Terry was a fun guy, one of the crew when I was there. Terry was studying for an MBA at night so he would frequently come in and preach the Religion-of-the-Free-Market to us. Engineers like to debate so that was as good a topic as any.

Anyhow the 212 had a removable base that, once removed, allowed the system to be buried flush in the pit. The crossover was designed to give a highly flat system under those conditions. Unfortunately once removed from the pit the 2pi to 4pi effect was enough to mess up the response to an appreciable degree. Not that it was horrible sounding, just that it wasn't the balance you would have given it if you thought about it. I remember that the system was reviewed by High Fidelity. They used CBS labs for measurements and did a Floyd Toole type axial response/front hemisphere/total sphere set of measurements. Sure enough the response showed a pretty good mound around 200Hz (the secondary effect) that the reviewers commented on. I don't remember if a running change was made to fix it, but at least a lesson was learned that 2pi flat was not the answer and no later systems fell into that trap. This was one of the main incentives for developing the ground plane measuring technique.

By the way I had one of the 212 systems and liked it a lot. It used great drivers including the very expensive 112A mid bass unit. This was the only 8" JBL driver to use a 3" coil. Terry showed me a 3 element passive notch circuit that was developed to fix the response and so it sounded quite good. When I moved to KEF in the UK, this is the system I took with me (I sold my KLH 9's to Randy Patton).

Instead of the 12" subwoofer that came with it, I had a prototype of the domestic 18" sub that we were developing (the 2245 based 460). That was a woofer!

Terry Sorenson was the key guy on the SFG redesign. Terry wasn't a system designer (crossover networks) to the extent that Greg, or even I, was. But he was better with regard to theory and had a Physics background. The SFG story was that the ferrite magnets structures were designed, as you know, because of the rising cobalt prices. Ferrite structures with the same parameters of gap dimensions and flux density were made up but when listened to they sounded different. Further measurements showed much higher second harmonic distortion. The flux modulation ring dealt with the 2nd Harmonic and the undercutting also helped the low frequency distortion due to the symmetry. Mark Gander's AES paper shows typical curves. The potential demagnetization of Alnico was also noticed at the time. I distinctly recall Greg Timbers having fun with modifying the parameters of Alnico woofers at will during development: "I think the Q is a little low on this one. Maybe a 2 dB drop in sensitivity would be about right. Lets give it full output for a second from the Crown DC600....Brrrapp. Curve it again and, yes, that's about right."

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