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Alex first picked up a bass when studying engineering at university, and his quest for sonic perfection led him to found Barefaced Audio, while also leading The Reluctant, an alt-ska/funk outfit.

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This column is brought to you in association with Barefaced Ltd who manufacture high-output speaker cabs for the gigging bassist. Barefaced have recently launched their new Big Baby and Big Twin cabs, the most accurate and extended range bass cabs ever made. An archive of previous articles plus a glossary of terms can be found at www.barefacedbass.com

But This Goes to 11...

Welcome to the world of bass rigs.

Feeling the bass

One of the great pleasures of being a bassist is being able to feel the lows your instrument produces and control how they support the sound of the music you're playing. Potentially we should be in a golden age of fatness and physicality of our bass sound, with most modern speakers able to move much more air than older designs, but the trend for downsizing our rigs has somewhat curtailed the glorious weighty depth we could be enjoying. However, that needn't be the case!

Ye olde fridge

The venerable Ampeg SVT 810 can be seen on the vast majority of large stages, and if you've been to many big gigs, especially outdoor ones, you may have noticed that the bass sounds like there's about an octave more bottom than what you experience on typical small gigs. Now if you're one of those people that looks at specs and understand what they mean, you may have noticed that the F3 or -3dB point of one of these cabs is about 70Hz. Being a sealed cab it rolls off at 12dB/octave below the Fb (that's the resonant frequency of the speakers once they're inside that box), which means that by 35Hz it's 15dB down. Now this isn't a catastrophic lack of depth but it certainly isn't anything like what you feel and hear out in the crowd – but if you're one of those eagle-eyed bassists that spots microphones you've probably noticed that there's a mic pointing at one of the speakers on this 8x10", so logic would suggest that you're hearing what the cab is putting out ...

The Proximity Effect

As far as I know this isn't the name of a jazz fusion trio, which seems a missed opportunity! In fact it refers to the tendency of directional microphones to produce increased lows when close to the sound source. A typical cardioid (meaning heart-shaped polar pattern)

microphone like an SM57 is much more sensitive to sounds in front of it than sounds behind it, and this is achieved by porting the microphone capsule so that sounds from the unwanted direction are cancelled out. How this actually works in practice is that at higher frequencies the phase difference between the sound hitting the front and rear of the microphone diaphragm causes the output from the rear to be cancelled out, while at lower frequencies the amplitude difference causes the same. However, once the sound source is in close proximity to the microphone the amplitude differences become negligible while the phase differences remain, so although the unwanted highs from behind the mic are cancelled out, the unwanted lows from the same direction actually add to your signal. If you've had the pleasure of singing lead or backing vocals (or murdering a song karaoke-style) you've probably encountered this effect – get too close to the mic and your voice becomes very boomy. However, there are upsides to this as any beatboxer will agree.

The cab/mic interaction thang...

Fig 1 illustrates the low-frequency response curve of a sealed 8x10" cab (vertical Y axis is SPL [loudness] in dB, horizontal X axis is frequency in Hz, with the axis markings every 50Hz) and then how that responds through a typical dynamic microphone when mic'd at varying differences. As you can see, the typical close micing position increases the upper bass and low mid-range content, making the sound thicker but also increasing the risk of unwanted boom. There is still a good amount of fatness due to the strong 100Hz response, but nothing like the depth from the lows that you hear in the crowd at one of these large festival or stadium gigs.

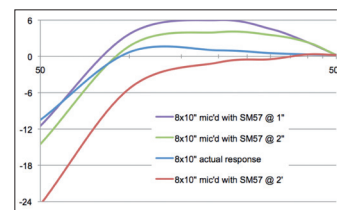


Fig. 1 – Low frequency response of a sealed 8x10" and as mic'd

The not-so-hidden DI

When playing big gigs the last thing you want is for a technical glitch to mean you suddenly lose all the bass out front. Not only is it wise to have a backup in case something in the chain feeding the mixing desk fails (amp, speaker, mic, XLR lead), you can also make many sounds even better by mixing in a portion of the DI'd sound from the bass or the amp. Indeed, at almost all of these large gigs the seriously low frequencies that make the sound so huge are due to the bass being DI'd as well as mic'd. Sometimes it's one of those little passive DI boxes on the floor (the ones with an instrument in, a thru output to run to your amp and an XLR out to run to the desk, and just a simple Jensen transformer for impedance and level matching), but more and more I'm noticing big active DI boxes like Avalon U5s sitting on top of the rig. This allows the sound engineer to either take the direct signal from the instrument or to take the speaker level output from the valve amp, so you get all that valve output stage compression, grit and thump. Some engineers will take all three signals, instrument, amp and mic'd speaker and then balance them for the best possible sound.

The joys of proper monitoring

One of the great things about playing through large PA systems is that you also get good stage monitoring, usually by a host of kickback, aka wedge, floor monitors, a few big full-range side fills and even in-ear monitors.



This means that everyone in the band should be able to hear exactly what they want without relying on the direct sound from the backline amps or the drum kit, so the backline amps become solely used for looking cool, providing the mic'd and DI'd front-of-house sound and monitor feed, and for allowing each instrumentalist to hear more of themselves (and/or mess around with controlled feedback) if they go and lurk back by their rig. So the big piles of cabs often seen on these stages (if indeed more than one is plugged in – empty dummy cabs are still quite a common stage prop) exhibit very directional sound which can be beneficial because each musician has a small part of the stage where they know they'll be very loud without the sound dispersing and messing up everyone else's monitor mixes. (Remember that the dispersion of a sound source is inversely proportional to how large it is compared to the wavelength of that sound.)

And your point is?

Firstly that the sound you think you're hearing out front is unlikely to be identical to that coming out of the backline bass rig onstage, particularly in terms of the depth and weight of the low frequencies, so if you're chasing a particular bassist's sound based on what you've heard at a gig you're likely to be disappointed (notwithstanding that so much of the tone is about how you play the instrument). And secondly that the large piles of cabs you see on big stages which work so well there (and look so genuinely authentic rock 'n' roll) will not necessarily fill a small venue with good bass tone as well as a more sensibly sized rig with superior dispersion and deeper lows.

Hot spots and nulls

This past week in our Bass Cave we've been playing with some PA subwoofer designs, including inevitably seeing how loud these subs would go and how much air they'd move (answer: lots!). However, even when playing a 40Hz sine wave so loud that you feel quite wobbly, it was possible to move around the room and find a number of different

spots where you couldn't feel or hear it at all! Leave the testing room and go for a walk and the bass sounds consistently loud, with the normal diminishing of loudness with distance (SPL drops by 6dB for every doubling of distance). So what's going on here?

One plus minus one equals zero

As you've probably noticed, sound comes from a speaker by virtue of the speaker moving forwards and backwards. You've probably also noticed that if you stand in an unfurnished uncarpeted room and clap your hands you hear a series of echoes. The low-frequency nulls we discovered while playing low sine waves through subs were because the push of air (compression) coming from the woofer was being cancelled out by the pull of air (rarefaction) echoing back from one of the walls. In practice, this is rarely that much of a problem as long as you haven't got too carried away boosting the lows and cutting all the mids and treble from your sound. But it does explain why it's much easier to get great lows at an outdoor gig – no reflections to worry about.

Reflections aren't all bad

Fortunately the bad reflections you encounter indoors have friendly relatives which club together and reinforce your sound, making it louder and fatter without needing as much power or as many speakers. Outdoors we lose the bad reflection but we also lose the good ones. We discussed boundary reinforcement in one of our earlier articles but it's such a big deal for us bassists that it's worth mentioning again. Essentially, if you're playing an outdoor gig, there isn't going to be good PA support, or you never feel like you have tons of headroom at your indoor gigs, then borrow another rig or two (ideally matching ones but almost anything will help) and run them in parallel with your normal rig so you can still have a big, fat sound outdoors.

But what about getting big lows from smaller rigs? That'll have to wait for next month!

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