Subject: Throat distortion, air pressure
Posted by Adrian Mack on Fri, 02 Apr 2004 16:51:27 GMT
View Forum Message <> Reply to Message

Hi Tom> This effect is also seen in a sonic boom, here, on the leading > edges, the air is compressed over 1atm at supersonic flight. Here, > because of the same temperature/speed relationship, what finally > reaches the ground as radiated sound is also a saw tooth (on the > front edge), over all, the waveshape of a sonic boom is like a > capitol letter N. > Throat distortion is pretty much a non-issue in bass horns though, > cone and coil drivers generally cannot produce enough acoustic > pressure to cause this. When a direct radiator, I agree that a loudspeaker of this world cannot increase the general air pressure of the entire atmosphere very much (which I'm pretty sure step response shows, showing sound pressure when voltage step function is applied). In a basshorn though (or any horn), cant you think of the piston being a moving 'pump', forcing air through the throat? A smaller throat would be creating more compression at the peaks or crests on a sine waveform, and so theres more distortion if air pressure is increased to much due to a small throat (caused by high SPL). On the other hand, a larger throat would create less compression at both low and high SPLs because of less restriction, so less changing in the temperature/speed relationship (causing volume changes to be unequal when pressure is changed), so less changing of waveshape. I dont know if a basshorn has the ability to increase air pressure much past 1 atmosphere, I guess it must compress to some degree though. I think I'm getting mixed up with midrange and HF horn throat distortion though... does one need more acoustic pressure to compress the peaks of a very long low frequency wavelength? Why is this? Is it because, for example a 600Hz wave vs 20Hz wave. The peak area/region on the 600Hz wave is a lot smaller than the peak region on a 20Hz wave, which would be very wide. So at the same SPL level, the compression of air atmosphere in the 20Hz wave is more 'spread out' than on the 600Hz wave, so the speed/temp relationship is not changed as much on the low frequency wave, so distortion doesn't occur until you feed the 20Hz wave a lot more power to get a lot more acoustic power to compress the air to the same level? But on the 600Hz wave, compression is now restricted to a smaller area, so it air pressure is compressed by a greater amount when played at the same SPL level as the 20Hz wave. I would think then, looking at just direct radiators now, if we had a magical direct radiator which could produce HEAPS of acoustic pressure/SPL, and ignoring distortion caused by the driver itself, the mere unequal compression and rarefaction of air pressure will cause distortion of the sine waveshape all by or in itself. Getting back to the horn now... I'm trying to understand how the throat size distorts the waveshape. I know that it does, but I've managed to confuse myself. Is it because, the throat size itself has the ability to change air pressure? It is the only thing I can come up with that seems to make sense. Amplitude of the pressure wave increases at the throat where air pressure is maximum? Then air pressure decreases as you move away from the throat and down the horn? So the a smaller throat increases air pressure over a larger one, causing more throat distortion/modification of the sine waveshape to a saw tooth wave. But on a basshorn, weather there is a high compression ratio or a low compression ratio, because of the very large wavelengths of low frequencies, you still need a ton of acoustic output for the crest region of the sine waveform to become compressed enough to distort the waveshape? Since the amplitude/SPL of the fundamental decreases with distance, then compression of air at further distances is less than compression of the air close up. One would then consider that this waveshape distortion is not linear with distance, even if we disregard the fact the horn throat changes air pressure itself. EG: Just consider a sine wave travelling outside, tying back with my previous note/example about the 'magical' direct radiator. Maybe I've

got this all wrong... you've really got me thinking about this, I'm trying to convince myself to believe that throat distortion in a basshorn is not an issue because it is not there!I've heard of some people breaking their woofer cones from high compression ratio's even if distortion is not an issue, its one reason to keep the compression ratio low. What comp ratio did you use on the labhorn? Have you ever damaged a woofer before because of high comp ratio at high power?> This distortion is the sum of the VC motor and mechanical system's > non linearity. > The "bad" effects of the latter can be minimized by choosing a > driver with a low Fs which then requires a small Vb to end with > the right compliance. > Depending on the sealed volume more means that a more linear > spring is dominating over the drivers relatively non-linear > suspension (by comparison) spring. > Generally, stay away from High Fs driver for bass horns if low > distortion is a goal. I remember you telling me before, the idea is to get the reactances to offset each other, leaving the resistive components to interact with each other. What I am saying, is how can you say a larger Vb dictates that the suspension of the driver is not as linear as a driver requiring only a smaller Vb? So basically, the idea is to get a load as stiff as the throat, but behind the driver instead using a rear chamber - to get even loading on each side, so its more linear on each side, resistive only. Did you mean to say the compliance of the rear chamber Vb should be matched to that of the throat instead and not the driver suspension? As a matter of interest, the rear Vb which cancels or balances out the capacitive reactance from the mass reactance of the throat, may not be the volume which provides the best/most even frequency response, even though it may be the most linear for the driver/lowest distortion combination...I am pretty sure that in smaller box volumes, the air inside it is stiffer (inductive reactance?) which may be needed to balance out the capacitive reactance from the throat. Just 'how stiff' do you need it though? That is hard to know, unless there are formula's around, which there probably are. I think though that to generalize to say that you must have a small rear volume to make the system linear is a bit of a stretch. It could even be made too small...which would not be good, because then the reactances wouldn't balance. The 'right' rear volume may even be relatively large by comparison... How come a driver with lower Fs will end up with smaller rear volume? I would think driver Qts would play the biggest part here...By the way, would you mind checking my horn length in my first post? It is in the 3rd diagram down. I have the horn length measured right down the dead middle of the horn... is this how you would normally measure it? Have you got any comments on horn/path length? http://www.audioroundtable.com/HighEfficiencySpeakers/messages/481.htmlBTW: It's almost 2am here in the morning now, don't be too harsh on me if this post sounds like baloney :pCheersAdrian