REAL BACKSEAT BASS

By Dennis Colin

If your vehicle's backseat has a floor you hardly use, the removable subwoofer boxes this article describes can add truly high-fidelity bass to your mobile sound, without the boomy resonance of trunk installations.

CABIN FEVER

Anyone can get 12Hz response in a car. *Figure 1* shows the "cabin gain" (a car's low-frequency "room" gain) of my mid-size sedan. (This is the difference between a woofer's response in the car and close-miked in a large room.) Relative to free-air response, the small enclosed space makes frequencies below about 60Hz appear as an almost DC-coupled uniform pressure load on a sealed-box woofer, since the longest interior dimension is shorter than a half-wavelength. Sound pressure below 60Hz is then proportional to cone excursion, rather than acceleration (as in free space).

The result is a 12dB/octave rise below 60Hz, down to 12Hz in my car. (LF cutoff is determined by air leaks; if both car and woofer enclosure were air-tight, the response would extend to DC!) Connecting a battery to the woofer would cause sustained cone excursion, resulting in sustained cabin air-pressure change. So a small sealed box (f_3 of 60Hz) is compensated down to 12Hz or so, making for ease in reproducing subsonic bass.

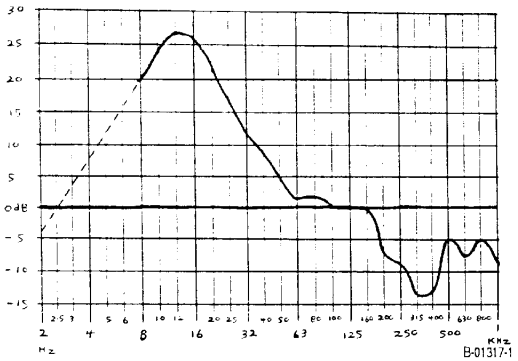

FIGURE 1: Car cabin gain; woofer on rear floor and mike at driver's ear position, versus same woofer closed-miked in room.

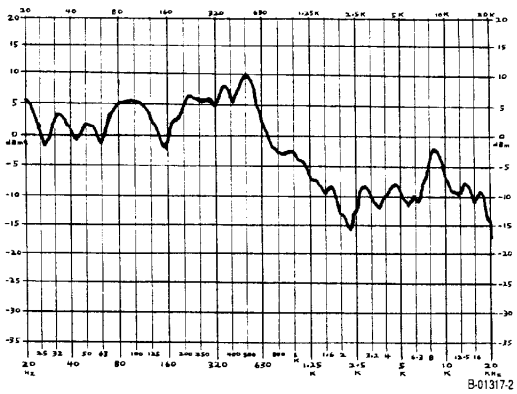

FIGURE 2: Trunk subs (Soundstream reference 10s in 1ft^3 sealed boxes) plus rear-deck 6 × 9s (Soundstream Pro-B69).

NOT SO FAST

You say you would also like smooth bass response? Well, then, this leaves out most car "sub installs" (in English, woofer installations). I had installed such a system in my '94 Dodge Intrepid, along with rear-deck mid/hi units, but was very dissatisfied. The components were good—Soundstream Reference 10s in 1ft^3 sealed boxes, with first-order crossover (CO) to Soundstream PRO-B69 6 × 9 mid/high units in the rear deck. The drivers were probably ±3dB flat over their ranges; in a store-room audition, they sounded very good.

Now look at *Fig. 2*, the response at the driver's ear location (using the Mitey Mike capsule, ±2dB, 10Hz–20kHz, 1/6 octave smoothing, and true-RMS detector). The horrendous 25dB drop from 600Hz to 2kHz, and the 7dB peak at 9kHz, were probably due to the "horn" loading of the rear-deck 6 × 9 location. Naturally, the perceived sound balance was lousy (I can't think of a better word that's fit to print).

But my biggest complaint was poor bass clarity—sometimes an octave drop from E2 to E1 (82Hz to 41Hz) on an electric bass guitar would be inaudible! And all bass transients (strings, drums) were very

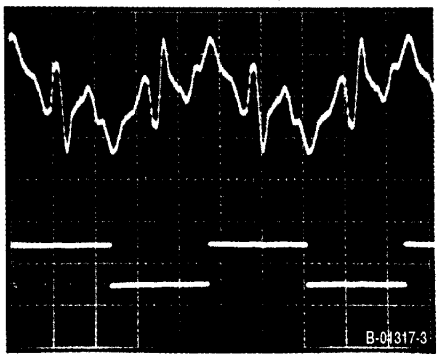

FIGURE 3: Trunk/deck, 41Hz squarewave.

blurry, more than you would think from the 6dB pk-pk variations in the curve from 20–320Hz.

Figure 3 shows why. This was the response to a square wave at 41Hz (bass guitar open E-string frequency). Do you see any semblance of a coherent acoustic pulse here? I don't, nor did I hear any!

Figure 4 shows the same thing over a longer time, with a 10Hz square wave. Note that the main resonant oscillations

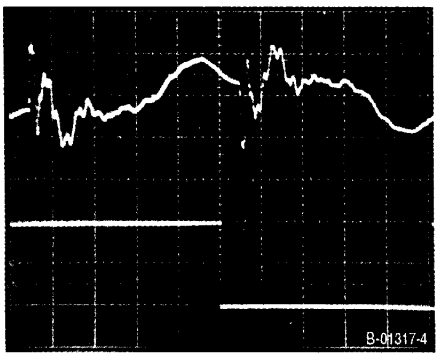

FIGURE 4: Trunk/deck, 10Hz squarewave.

ABOUT THE AUTHOR

Dennis Colin, an RF engineer by trade, has pursued the perfect speaker dream since childhood, when he enjoyed live symphonies with his father playing the violin and flute. He has been a band keyboard musician, recording engineer, and designer of the (analog) ARP 2600 music synthesizer and a 1kW audio amp for a/d/s/. He published an article on a voltage-controlled filter (JAES, 1971), and made a presentation on the audibility of phase distortion (Boston Audio Society, circa 1973). He has also written some articles and a review (Audax A651) for *Speaker Builder*.