Floor Loudspeaker Reviews

Audio Artistry Beethoven loudspeaker system

Shannon Dickson | Nov 25, 1997

Audio Artistry's Beethoven is the banner model of the company's Composer series (footnote 1), which includes the entry-level Vivaldi as well as the Dvorak I reviewed in the April 1996 *Stereophile* (Vol.19 No.4, p.204). Like the Dvorak, the Beethoven is a four-piece, bi-amplified, dynamic dipole design; unlike the Dvorak, the Beethoven has been taken to the *n*th degree of refinement.

Since many of the major design features common to both speakers were described in depth in the Dvorak review, only the most salient characteristics shared by the Beethoven are revisited here. Those interested in a more complete analysis of the fundamental principles behind these unusual speakers are encouraged to track down the Dvorak review.

The Beethoven...
...is essentially a Dvorak on steroids. Each main panel contains five top-of-the-line ScanSpeak drivers. Two custom-made 10" paper/carbon-doped woofers handle the panel's bass response up to 200Hz, at which point they cross over to two 8" Kevlar-coned midbass units arranged in a symmetrical array above and below a custom version of the Revelator, ScanSpeak's premier silk-dome tweeter.

The 8" and 10" drivers are not attached to the front baffle with screws. Audio Artistry pressure-fits these drivers via the rear spine; the drivers are sandwiched between the spine and the back of the baffle, where their front rims fit into precisely routed cavities filled with a special damping material. This mounting technique is said to reduce driver distortion and the transfer of vibrations to the front panel, and gives the baffle a beautifully clean appearance. Each of these drivers has a vented pole-piece; corresponding holes along the spine accommodate the required venting.

Two wide strips of grillecloth run from top to bottom on either side of the rear spine to give the speaker a neat, finished appearance. This cloth also conceals absorptive material used to attenuate higher frequencies radiating from the rear wave of the 8" midrange drivers. In conjunction with the use of a monopole tweeter, this damping is consistent with Audio Artistry's contention that dipole radiation of treble frequencies is undesirable.

Seated on the rear two-thirds of each main-panel plinth is a detachable passive crossover box. This enclosure is chock-full of very-high-quality passive components. Large polypropylene caps, heatsunk Caddock power resistors, and air-core inductors handle frequency division and impedance compensation between each of the main-panel drivers. Three sets of quality Cardas binding posts are mounted on the top rear of the crossover box for optional (and recommended) tri-wiring of the main panel. A harness of Cardas conductors connects the binding posts to a three-way Neutrik SpeakOn connector, which in turn attaches the crossover to the speaker via its mating half, located near the bottom rear of the main panel. This arrangement provides flexibility and allows easy upgrading of the crossover without having to send the speaker back to the

factory. In addition, the crossover box is isolated from panel vibrations via effective E.A.R. damping feet.

Rather than assign each speaker a serial number, Audio Artistry mounts a large copper nameplate engraved with a unique name, typically related in some way to Beethoven's music, on the top of each passive crossover.

Each Beethoven subwoofer cabinet is open to the front and back and contains four 12" drivers. David Copperfield must have been consulted to figure out how to squeeze four large woofers inside a box this compact. The drivers are arranged so that their back-and-forth motion partially cancels vibrations generated by each driver, resulting in very little transfer of resonant energy to the cabinet and floor.

The two main panels and tops of each subwoofer cabinet are finished in gorgeous mirrorlike "piano black" lacquer. Solid rosewood is used for the narrow side panels and rear center spine, and is grain-matched to the veneer on the side of each woofer.

The active crossover, housed in a metal chassis fitted with a black anodized faceplate, can feed either a pair of stereo amps or two sets of monoblocks. This crossover handles the 100Hz transition between panels and woofers and performs equalization both above and below this crossover point. The EQ above 100Hz helps achieve a smooth frequency response from the panel's dipole drivers, while below 100Hz the EQ corrects for the dipole woofer's natural rolloff, resulting in a nearly flat response down to 20Hz. If you have a very small room or a limited budget, you can use the main panels alone. In such cases the woofer section is turned off, extending the main panel's response down to around 40Hz.

Footnote 1: As of 2000, the Audio Artistry company was no longer trading. Enquiries about the Beethoven and other Audio Artistry loudspeakers should be addressed to their designer Siegfried Linkwitz.—**John Atkinson**

Audio Artistry Beethoven loudspeaker system Page 2

On the faceplate you'll find a blue operating LED and a button labeled "Video." Pressing this button minimizes subwoofer excursion when playing back very loud explosions on some laserdisc and DVD soundtracks, or the intense subsonic rumble occasionally heard on LPs. This is accomplished through a gentle 6dB/octave rolloff from 40Hz on down.

On the rear of this chassis are a DIN connector for attaching the external power supply, and switches to turn each subwoofer on or off. Separate woofer-level knobs are also provided for up to 12dB of adjustment in order to match the system to amplifiers of different gain structures and/or to a wide variety of rooms. Also, a pair of jumpers located on the circuit board allow an additional 10dB of woofer-level control, though I've never heard of anyone needing to use that feature.

The active crossover is fitted with XLR connectors and a superbly balanced interface topology comprising a pair of Jensen JT-10KBD input transformers and a clever output circuit design, resulting in a true universal interface. In other words, the crossover is equally happy receiving or driving a balanced or single-ended source or load. Jensen's transformers are highly linear, wide-bandwidth devices that present an input impedance of around 39k ohms for the driving preamp. A version of the crossover employing an RF filter and actively balanced input stage is available

as an option in place of the input transformer. The crossover circuitry was optimized for maximum dynamic range and signal/noise when used only between a preamp and amplifier. Don't feed a high-output (over 2.7V RMS) source component directly into the crossover.

As with the passive crossover, only first-class components are used. Every resistor is a Precision Resistive Products high-precision, low-noise design with 0.1% tolerance and a 10 parts per million temperature coefficient. In addition, 2% custom film caps are used throughout the audio signal path. The board contains extensive local power-supply filtering and decoupling, along with effective RFI filtering applied at each input and output. Audio Artistry chose Burr-Brown's excellent-sounding OPA-2604 amplifiers to handle EQ duties.

While the Beethoven system is a true full-range design and contains far more components than the typical speaker, it is not visually imposing in a listening room. The low-profile woofers can be located along either side wall, and the elegant main panels are very easy on the eye, blending well even into rooms of modest size.

Sonic splendor

Though the Dvorak reviewed last year was designed to a price point, I came to prefer it over many more expensive models, even if some had a slight performance edge over the Dvorak in one particular area of another. My preference stemmed from the open perspective and overall naturalness with which the Dvorak portrayed so many forms of music despite several minor flaws, among them a less transparent resolution of soundstage detail compared to the very best, and an upper midrange that, while certainly not overtly bright, leaned a bit in that direction.

That first-generation Dvorak was an excellent work-in-progress, but the Beethoven is a milestone achievement. It possesses every positive attribute of the Dvorak (except its lower price), yet manages to improve on each of those assets while either minimizing or eliminating that speaker's shortcomings. Beethoven virtues—such as an enhanced sense of rhythmic swing, awesome transparency, effortless resolution, and a more solid, dynamic bass—expand upon the Dvorak's reduction in room-induced colorations (footnote 2).

Compared to previous box speakers used in my room, the relative lack of standing-wave excitation and midrange masking from the Dvorak and the Beethoven produced a pronounced feeling of being enveloped in the soundfield of good recordings. The music seemed to flow out from the soundstage, fill my listening room, then decay back into the silence from whence it had come without the usual sensation of the room pressing in on me from all sides during dynamic passages—a quality that greatly enhances the sense of "being there." Most significant, though, the Beethoven brought to the party some extraordinary refinements I'd not experienced in any other speaker.

But to keep things in perspective: We're still a good distance from flawless sound reproduction, and likely will be for the considerable future. The limitations imposed by two-channel stereo remain the foremost barriers. Nevertheless, the Beethoven is the current prime candidate for Low-Distortion Champ when replaying full-range music at realistic levels—especially when all forms of significant masking and room interaction are taken into account. However, Siegfried Linkwitz is quick to acknowledge that the search continues for components of even lower distortion. Further improvements in driver construction and crossover design remain to be realized, along with solutions to a number of other challenges.

Footnote 2: As more affordable direct precursors of the Beethoven, both the Dvorak and smaller

Vivaldi have recently undergone significant revisions resulting from the trickle-down of insights Audio Artistry gained while developing the Beethoven. Currently I'm also using a pair of revised Dvoraks in my second reference system, and can report that the change to a soft-dome tweeter, new 8" midbass drivers, and changes in the crossover produce an upper midrange/treble that's cleaner, smoother, and more transparent than the original version. Also, the Dvorak's overall tonal balance is now closer to the Beethoven's.—**Shannon Dickson**

Audio Artistry Beethoven loudspeaker system Page 3

This perennial problem is a little like peeling an artichoke. As you strip away successive layers of coloration and distortion, the taste becomes increasingly subtle and succulent, yet there always seems to be another layer to remove. I've no doubt that the same analogy will apply to future refinements in the art of speaker design, yet the amalgam of attributes resulting from the many choices embodied in the Beethoven constitute much more than an incremental step forward. Indeed, the overall results are so compelling that one can be forgiven for mistaking a wonderful late-night symphony heard through these speakers for the true heart of the vegetable!

I'll spare you a recitation of the list of virtues one should rightfully expect from any "statement" speaker worthy of the name. Rest assured that the Beethoven is extremely well balanced, from its awesome bass and superbly natural midrange to its extended, delicately transparent treble. Instead, I'll highlight those areas of sonic performance alluded to earlier, in which the Beethoven exceeds that of every other system I'm familiar with, in some instances by a wide margin.

A study in contrast: In addition to the many qualities carried over from the Dvorak, perhaps the most stunning hallmark of the Beethoven's sonic prowess was the complete effortlessness with which it conveyed the subtlest nuances, even in the midst of intensely dynamic, complex musical passages. Specifically, the timbral characteristics of and spatial relationships between instruments and/or voices were fully delineated, conveyed with often startling exuberance. Perceptions like the shimmering decay of a triangle were plainly evident, simultaneous with the climax of mass strings, brass, and timpani, all of which were, themselves, distinctly defined as individual instruments tying the many disparate threads of the music into a complete tapestry.

Above all, the discrete dynamic contrast of each instrument was clearly resolved, instead of the homogenizing effect commonly heard through otherwise excellent speakers when playing back complex music at high volumes. What often happens is that the masking effect of room interactions combines with extra tones generated by nonlinear distortion to "fill in" the transitions between expression and silence that give music so much of its life. Such compression of dynamic shading is, without doubt, one of the principal differences distinguishing typical playback from the real thing.

Most top-shelf speakers I've heard can, when played at moderate levels, convey wonderful resolution of detail and contrast so long as the music's ranges of dynamics and frequency are not too great. Put on some hard-driving rock or large-scale classical works with complex bass-rich content, however, and the perspective often collapses, becoming more congealed and indistinct from the midrange on down during dynamic peaks, even as the upper midrange and treble remain consistent. This striking difference between the relatively clear and well-proportioned presentation during less challenging passages, and the congestion of the music's very foundation during a climax, tends to truncate the full expression of a performance. It's a stark reminder that you're listening to a mere stereo.

The Beethoven didn't do this. Instead, its remarkable and concurrent reproduction of each instrument's unique dynamic range often conferred a profound musical experience. The essential

character of the sound was maintained from top to bottom throughout dramatic changes in dynamics, regardless of the musical style. In the Doobie Brothers' recent live CD, *Rockin' Down the Highway* (Columbia/Legacy J2K 64996), such faint nuances as the mechanical sounds from the drummer's hi-hat pedal, and the delicate harmonic extension of the driving bass line, were as clear as a bell, even when the average volume level was raised to well over 103dB! For your hearing's sake, I caution against listening to any music at such sustained levels, but the Beethovens never seemed the least bit fazed while doing so. I'm sure it will come as a surprise to dipole fans that the Beethovens proved to be awesome rock'n'roll speakers. In a related effect, when I listened to cleanly recorded music at very high levels, the volume seemed almost normal, the texture remaining delicate and refined. After spending some time with this speaker, it became apparent that what frequently determines the perception of loudness and often passes for "slam" or "dynamic range" in more traditional designs is, in part, the limitations imposed by that system's inherent distortions.

Any well-made live recording demonstrated the Beethoven's synergy of superb contrast, natural tonal balance, and rhythmic drive. In Peter McGrath's new recording of the first Cello and Piano Concertos of Shostakovich (Audiofon CD-72060), the interplay between Valentina Lisitsa's vibrant piano and the tactile sensation of real trumpets and brass toward the end of the piano concerto was a total mind-bender through the Beethoven. The piano's tonal character and complex harmonic richness were spot-on down through its lowest registers, while, at the same time, the trumpet's pure, smooth tonality exploded into the bite and blare of that instrument in full voice.

Human vocals provided another excellent example of this speaker's resolution of subtle inflections amid larger dynamics. The swell of many voices heard in choral music will often generate loads of intermodulation distortion in a speaker, making it sound like one large sea of barely distinguishable singers. Playing one of Keith Johnson's excellent choral recordings of the Turtle Creek Chorale on Reference Recordings was a revelation through the Beethovens. From the most delicate passages to full-tilt crescendos with organ and orchestra, the characters of individual singers never lost focus or distinctness. Now that I can fully appreciate such expansive emotional swing from the sublime to the exalted, better choral recordings have become some of my favorite music.

Audio Artistry Beethoven loudspeaker system Page 4

Another benefit of the Beethoven's resolving power was that I could hear the tangible nature of good music whether I turned the volume up or down. When gradually turning the volume up with my remote-controlled Rowland Coherence preamp, I had the distinct sensation of my chair being pulled closer to the stage. Turning the level down, the perception was reversed: I felt slowly drawn back up the aisle, all the while still experiencing the spooky sensation of breathing the same air space as the performers! Also, without the averaging impact from room-masking, I discovered that favorite recordings "locked in" over a wider range of volume settings than before, making a remote-controlled preamp a highly recommended asset.

Landmark bass: Earlier I mentioned how deep-bass extension helps establish the rhythmic drive, natural tonality, and perception of "presence." Certainly, with eight 12" and four 10" drivers, you hope that genuine low-end extension would be a given. But it's the naturalness with which this region is reproduced that sets a new standard in my experience. Listening to a typical speaker, one's attention is often focused first on the upper midrange and treble; only afterward does one notice whether the bass is tight or loose, articulate or bloated. With the Beethoven, everything sprang from the bottom on up, the higher frequencies naturally in sync with the power of the music.

The Beethoven's majestic presentation of the lower region had such a powerful influence because much of the emotional feeling of music is established by the ebb and flow of the mid- to upper bass. When the deep bass is absent, and the quality of the mid- to upper bass is smeared by turgid room interactions and box distortions, the full expression of the music is short-circuited. The Beethoven's mastery of this region establishes an irresistible rhythmic drive that had me logging far more hours of air guitar and air baton than ever before.

Full-bodied imaging: A key characteristic accompanying the Beethovens' openness and clarity is their precise delineation of the spatial relationships between individual instruments within a continuous soundfield. I heard none of the exaggerated soundstages projected from speakers whose sidewall and ceiling reflections skew the illusions of width and depth. Instead, imaging took on a tactile realism. With good recordings the speakers simply vanished, leaving solid, fully dimensioned performers ensconced in my living room—instead of the "cardboard-cutout" style of etched and layered imagery as viewed through a window framed between two speakers. Though this latter, layered style of imagery can be initially impressive, it wears thin when one hears the same "image signature" on nearly every recording.

The actual physical sensation of sonic images was also quite different through the Beethovens than what I've typically experienced. Perhaps it was the combination of the system's stunning dynamic contrast, natural tonal balance, and appealing openness that resulted in the tangible sense of "body" reproduced. Or maybe the lack of "room pressure" mentioned earlier allowed the textures of instruments to develop and decay in a more natural fashion. Whatever the cause, it was as if I could physically "feel" the skin of a drum, the air shimmering off of a cymbal, or the vibration projected from a piano's soundboard.

A further testament to the quality of this system was its chameleonlike character. Every speaker, including this one, possesses *some* "sonic flavor." But with its low inherent distortion and the ability to adjust the woofer levels, the Beethoven's signature was submerged by that of each recordings. The payoff of the neutral in-room response was that all sorts of music continued to sound refreshingly different and interesting.

The combination of qualities described so far would make the Beethoven an invaluable reference tool for reviewers and recording engineers alike. I could discern the subtleties of microphone type and recording technique with pinpoint accuracy. Comparing different preamps, DACs, and amplifiers also became a far easier task—not to mention more enjoyable—through the Beethovens. Characteristics of both the updated version of the Ayre V-3 amplifier and BAT's new VK-3i preamp were instantly apparent, as was the outstanding resolution of Muse Electronics' new Model 5 transport and Model Two-Plus digital processor, equipped with their clever implementation of an I^2S interface. The Beethovens also showed off the exceptional low-frequency power and overall transparency of Jeff Rowland's new Cadence phono stage/Coherence preamp combo playing Classic Records' killer vinyl reissue of Miles Davis' *Kind of Blue*.

Practicalities
There are, however, a few things you need to know to get the most from the Beethovens:

• The only significant caveat I have for prospective Beethoven owners concerns the break-in process. Though the system sounds fine right out of the box, the drivers require considerable exercise before they're fully supple and relaxed. As they break in, dynamics, the sense of ease, rhythmic pace, and tonal balance all improve.

More important, though, is the aural break-in often required by the listener with this class of speaker. Without the room masking and excess bass many audiophiles have become conditioned to, you'll hear both a lot more and a lot less than you're accustomed to hearing from favorite recordings: less coloration and more musical detail, particularly in the lower midrange and bass. My experience was that, as I listened to an ever-greater variety of music running the gamut of recording quality from poor to awesome, the deeper my appreciation grew for the "rightness" of the Beethoven's performance. So give yourself some time to discover the Beethoven's special qualities.

• The absence of typical pressure variations in the room often takes a bit of adaptation as well, as mentioned above. However, this speaker is so dynamic and moves so much air that most people familiar with live music will adjust rather quickly to its more natural presentation. Indeed, after a few months with the Beethovens I was shocked when I heard just how distorted the bottom third of most systems really sound when played in normal rooms.

Speaking of bass: Don't turn the woofer levels up too high to try to "hear" the subwoofers. That's a mistake commonly made during the adjustment phase. When the subwoofer level is properly set, you should hear no directional clue that any sound is coming from the two woofer cabinets.

• The Beethovens are very easy to set up for good sound, particularly compared to most other large systems. When a speaker demands a difficult, ultra-precise placement scheme to sound decent, it usually signals a fundamental problem with the system's design and/or some room anomaly. In any event, good details are given in the Beethoven's informative owner's manual. Just place the woofers outboard of their respective main panels and adjacent to the side walls, with your ear the same relative distance to the center of the woofer cabinets and to the front of the panels.

The woofers can be either flush against the side wall or somewhat toed-in. If space allows, place the main panels a good 8' or more apart (measured between the two tweeters), and toed-in so that the tweeter axis is aimed across the outside of your shoulders. Also, while the tonal character sounds remarkably similar from just about any position in a room, make an effort to raise your listening position so that your ears are nearly level with the rather high-placed tweeters. This can be done with extra cushions, or an improvised platform under your chair. Doing so will enhance image focus.

• Since this system stimulates the room less and reflects very little from the side walls and ceiling, be careful not to overdo absorptive acoustic treatments. Some flutter-echo control is fine, and a pair of Tube Traps in the corners might be welcome in some rooms, but an overly dead environment will impair the vibrant life these speakers are capable of. I'm all for acoustic treatment when called for, but, like speakers that are difficult to set up, those that require a ton of room treatment to sound good usually have some anomaly.

Final thoughts

The Audio Artistry Beethoven captivated me as much by its grace as by its grandeur, opening up new levels of musical appreciation. After using the system for more than nine months, I'm still continually amazed at just how much information the brain can sort and the emotions assimilate at one time when listening to it.

Certainly, several among the elite of world-class speakers share a number of the Beethoven's superb qualities, such as low-distortion drivers, outstanding resolution, near-holographic imagery, and a beautiful tonal balance. Most of these designs are also immensely satisfying. However, when you add those attributes to this speaker's lack of room interaction, stunning low-

frequency performance, and superior real-world dynamic contrast, I know of no other commercial offering that possesses as many virtues and blends them so successfully, regardless of price.

Whether valued from the objective perspective of its parts count, or by the subjective pleasure I've experienced with it, the Audio Artistry Beethoven system is, at $24,750, a bargain! That's a lot of money any way you slice it. The Beethoven, though, remains the single most impressive audio component I've yet encountered—an instant classic, sure to make a real contribution toward future advances in the art of speaker design. Enjoy!

Audio Artistry Beethoven loudspeaker system Specifications

Sidebar 1: Specifications

Description: Four-way, bi-amplified dipole system consisting of two dynamic main panels, two subwoofers, a pair of passive crossovers, and a unity-gain, noninverting, balanced, active (line-level) crossover. Drive-units: one 1" soft-dome tweeter, two 8" Kevlar-cone midrange drivers, two doped paper-cone 10" woofers (main panel); four 12" cone woofers (subwoofer). Crossover frequencies: 200Hz, 2kHz (main panel); 100Hz (subwoofer). Frequency response: 20Hz-25kHz, ±2.5dB (complete system); 40Hz-25kHz (main panels used without subwoofers); 100Hz-25kHz (main panels used with subwoofers). Sensitivity: 89dB/W at 1m. Impedance: 5 ohms nominal, 3.3 ohms minimum at 100Hz (main panel); 13 ohms nominal, 11 ohms minimum (subwoofer). Input impedance (active crossover): 39k ohms.
Dimensions: 55" H by 13.75" W by 6" D (main panel); 29" H by 14.75" W by 21.5" D (subwoofer); 2.5" H by 17" W by 8" D (active crossover). Weight: 85 lbs each (main panel); 95 lbs each (subwoofer); 18 lbs (passive crossover). Recommended amplification: 150-200W (main panel); 50W (subwoofer).
Serial number of review samples: Ninth Symphony, Egmont Overture.
Price: $24,750/system. Approximate number of dealers: 16.
Manufacturer: Audio Artistry, Inc., 8312 Salem Dr., Apex, NC 27502. Tel: (919) 319-1375. Fax: (919) 319-1416.

Audio Artistry Beethoven loudspeaker system Associated Equipment

Sidebar 2: Associated Equipment

Analog Source: Immedia RPM-2 turntable and improved RPM-2 unipivot arm; Sounds of Silence Crown Jewel and Lyra DaCapo phono cartridges.
Digital Sources: Muse Model 5 with I^2S interface, Theta Data Basic 2, Sonic Frontiers SFT-1 transports; Wadia 16 CD player; Muse Model Two-Plus with I^2S interface, Theta Gen.Va, Sonic Frontiers SFD-2 Mk.II processors.
Preamplifiers: Jeff Rowland Design Group Coherence-Cadence battery-powered line/phono combo, Muse Model 3, Sonic Frontiers SFL-2, Audio Research LS22, BAT VK-3i.
Power Amplifiers: Jeff Rowland Design Group Model 6 battery-powered monoblocks (two pairs), Ayre V-3, Muse Model 160 stereo amplifiers (two), BEL-1001 Mk.II.
Cables: Cardas Golden Cross speaker cable and interconnects, TARA Labs Decade speaker cable, Discovery 1-2-3 cable and Signature interconnect, Kimber 8TC speaker cable, Nordost Flatline Red Dawn speaker cable.
Digital cables: Cardas AES/EBU, Illuminati-Kimber Orchid, Aural Symphonics AES/EBU, Audient Audit and Tactic, Marigo Reference.

Accessories: API Power Wedges and Power Enhancer, Cardas and Marigo power cords, Vibraplane and Newport Benchtop pneumatic isolation platforms (source components) fed by a Jun-Air compressor, Townshend Seismic Sinks, Signal Guard platform, Arcici Airhead platform, Black Diamond Racing plinths (line-level components), D'Feet SH-22 damping pucks, Marigo Bear Feet, ASC Tube Traps, and a slew of other pointy things and compliant supports.—**Shannon Dickson**

Audio Artistry Beethoven loudspeaker system Measurements

Sidebar 3: Measurements

The Beethoven is quite sensitive, 2.83V of B-weighted noise generating an spl of 88.5dB at 1m on the tweeter axis. The impedance of the panel, however, (fig.1) drops significantly below 4 ohms between 45Hz and 210Hz, and to 4 ohms in the mid-treble. A good solid-state power amplifier would best drive this speaker, as suggested by Audio Artistry themselves. The impedance peak at 22Hz I assume is due to the free-air resonance of the twin woofers.

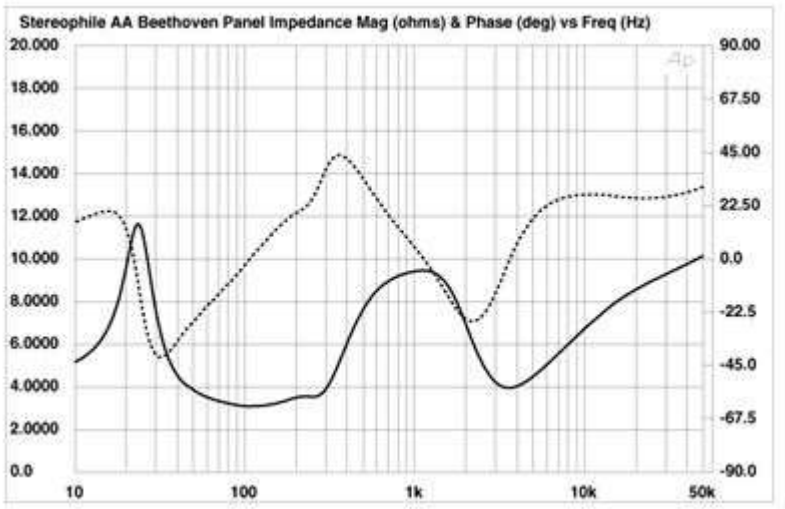

Fig.1 Audio Artistry Beethoven panel, electrical impedance (solid) and phase (dashed) (2 ohms/vertical div.).

The impedance plot of the subwoofer module (fig.2, plotted with a 50 ohm vertical scale) reveals the unit to be very easy to drive, the minimum value being a benign 11.8 ohms at 57Hz. The wrinkles in the trace between 100Hz and 400Hz, however, indicate the presence of some cabinet resonances. Whether or not these will have any audible consequences will depend on the rolloff supplied by the active crossover. The low-pass feed to the subwoofer with the control set to its "Normal" and "Video" positions is shown to the left of fig.3: in the first position, a boost of 14dB at 10Hz is applied to compensate for the dipole rolloff; set to "Video," the boost is curtailed to 2.6dB at 19Hz.

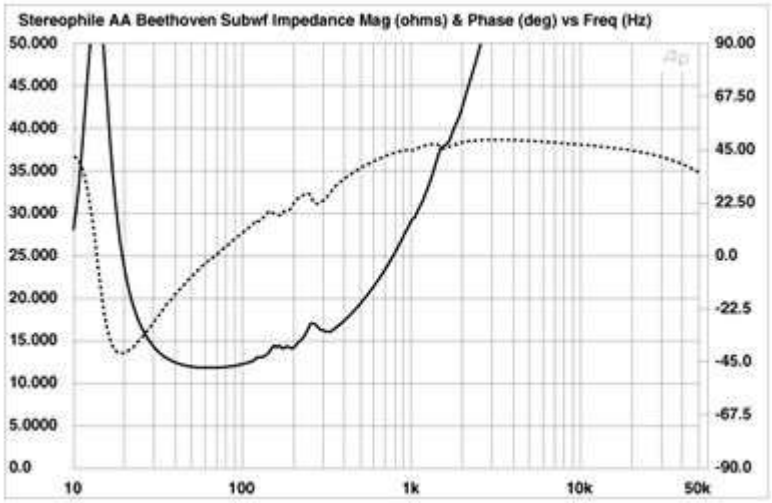

Fig.2 Audio Artistry Beethoven subwoofer, electrical impedance (solid) and phase (dashed) (5 ohms/vertical div.).

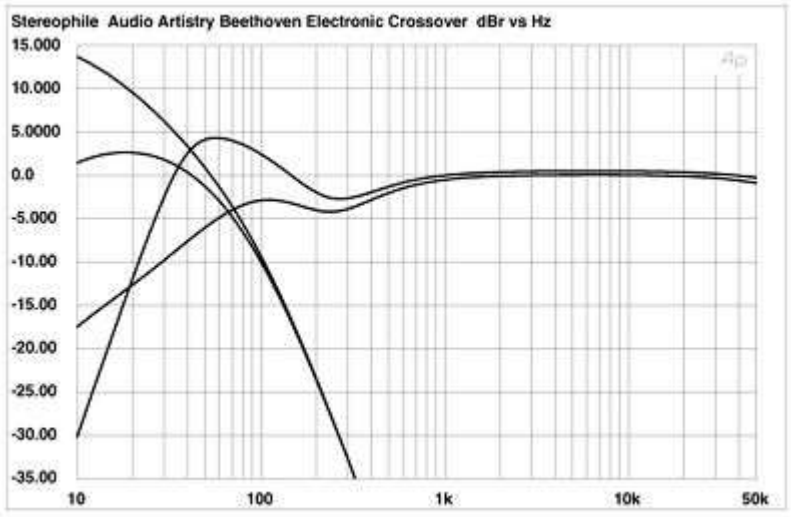

Fig.3 Audio Artistry Beethoven, electronic crossover, high- and low-pass responses with subwoofers switched on and off (right-hand traces, bottom and top, respectively) and with subwoofer switched to "Normal" and "Video" (left-hand traces, top and bottom, respectively).

Fig.4 shows the subwoofer's intrinsic response, measured in the nearfield without the crossover (bottom trace below 40Hz, top trace above 70Hz). Flat through the bass, it rises in the lower midrange due to the resonant behavior noted in the impedance plot. However, as shown by the equalized responses (bottom two traces above 40Hz), these peaks are well suppressed by the crossover, allowing the subwoofer effectively to cover just the mid- and low-bass regions.

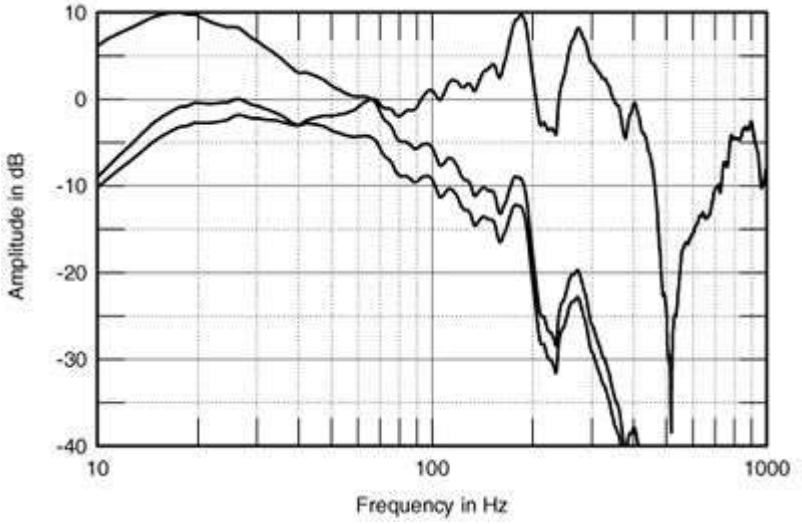

Fig.4 Audio Artistry Beethoven subwoofer, nearfield response without crossover (bottom trace below 40Hz, top trace above 70Hz) and with electronic crossover switched to "Normal" (bottom trace above 40Hz) and "Video" (top trace below 70Hz)

Audio Artistry Beethoven loudspeaker system Measurements part 2

To the right of fig.3 are shown the crossover's complementary high-pass responses for the drive to the Beethoven panel, with the woofers turned on and off. A small degree of tonal shaping can be seen between 200Hz and 1kHz. Without the subwoofers, the crossover adds a modest amount of boost below 150Hz to flatten and extend the panel's output, with then a steep rolloff below 40Hz. When the subwoofers are used, the crossover gently rolls out the panel woofers below 100Hz. The crossover's input impedance was a high 86k ohms (balanced), while its output impedance was a low 450 ohms. The insertion loss at 1kHz was 0.8dB, due to the response shaping.

The individual responses of the panel's drive-units on the tweeter axis are shown in fig.5. The crossover between the twin midrange units and the tweeter can be seen at 2.2kHz; the midrange/woofer crossover is placed at 100Hz, but this is obscured by a rise in the midrange units' output at the bottom end of their range. The crossover's tonal shaping appears to compensate for this, which can be seen in fig.6, which shows the overall response of the Beethoven panel on the tweeter axis, equalized by the crossover and spliced to the nearfield response of the woofers with the crossover set to subwoofers on and off. The speaker is quite flat on-axis through the upper midrange and treble, but the apparent excess of energy in the bass is due to the fact that the nearfield measurement does not allow for the dipole cancellation typical of open-backed enclosures.

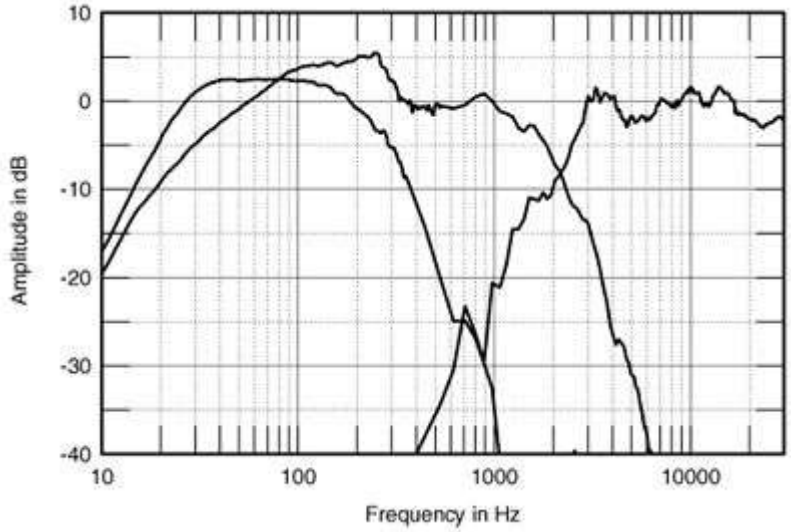

Fig.5 Audio Artistry Beethoven, anechoic responses on tweeter axis at 50" of tweeter, midrange units, and woofers, corrected for microphone response, with nearfield midrange and woofer responses plotted below 500Hz and 300Hz, respectively.

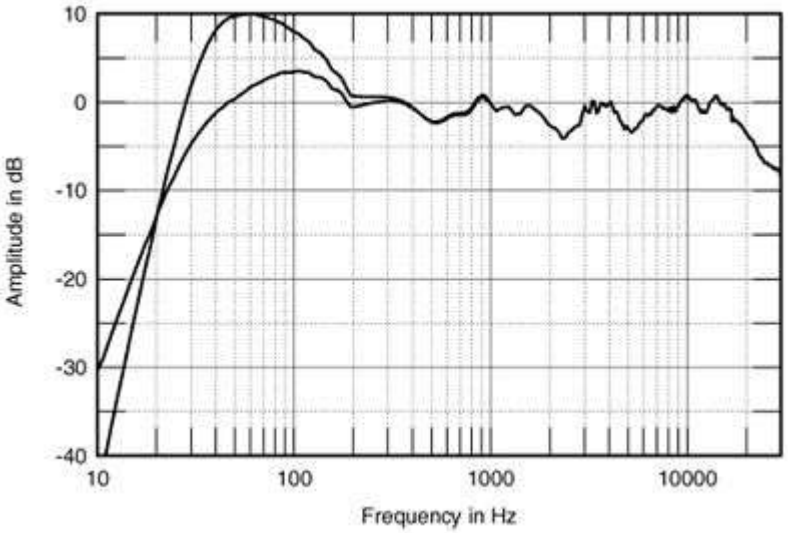

Fig.6 Audio Artistry Beethoven, anechoic response on tweeter axis at 50" with crossover EQ, averaged across 30 degrees horizontal window and corrected for microphone response, with the nearfield woofer response plotted below 300Hz.

The Beethoven panel's dipole design means its off-axis behavior will be very different from that of a normal monopole design. Fig.7 shows the differences in the response as the measuring microphone moved round to 135 degrees on either side of the tweeter axis. Other than in the mid-treble region, around the cursor position at 4616Hz, the speaker output falls off evenly across the band to the panel's sides. Below 2kHz, it reaches a minimum between 90 degrees and 100 degrees to the side. Vertically (fig.8), the response doesn't change much as long as the listener's ear is between the centers of the two midrange units (middle three traces), around 36"-45" from the floor.

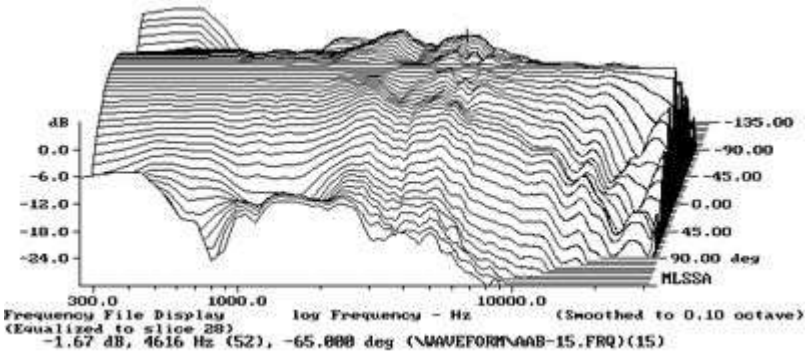

Fig.7 Audio Artistry Beethoven, horizontal response family at 50", normalized to response on tweeter axis, from back to front: differences in response 135 degrees-5 degrees off-axis; reference response; differences in response 5 degrees-135 degrees off-axis.

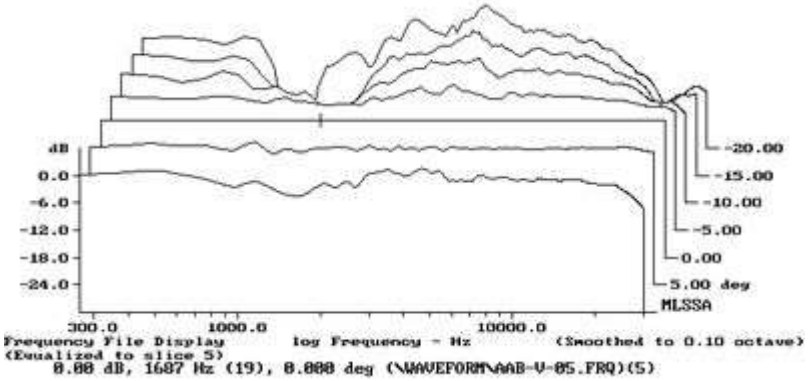

Fig.8 Audio Artistry Beethoven, vertical response family at 50", normalized to response on tweeter axis, from back to front: differences in response 20 degrees-5 degrees above-axis; reference response; differences in response 5 degrees-10 degrees below-axis.

Audio Artistry Beethoven loudspeaker system

Measurements part 3

In the time domain, the Beethoven's step response (fig.9) is not coherent. The tweeter and midrange units appear to be connected with inverted acoustic polarity, the woofer with positive polarity. Fig.10 shows the cumulative spectral decay plot calculated from the Beethoven's impulse response. It is superbly clean throughout the treble, but there is some hash present in the low treble, which I suspect is due to early reflections from the speaker's structure. However, as SD had nothing but praise for the Beethoven's sound, I assume this is benign.

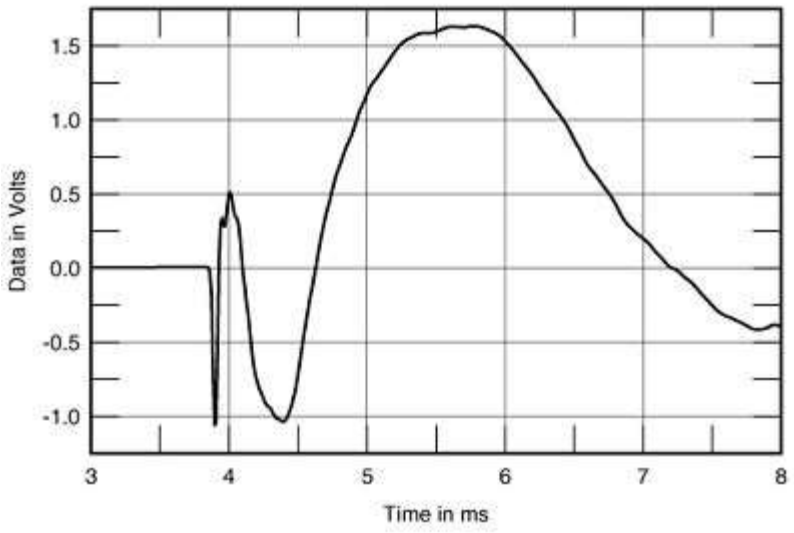

Fig.9 Audio Artistry Beethoven, step response on tweeter axis at 50" (5ms time window, 30kHz bandwidth).

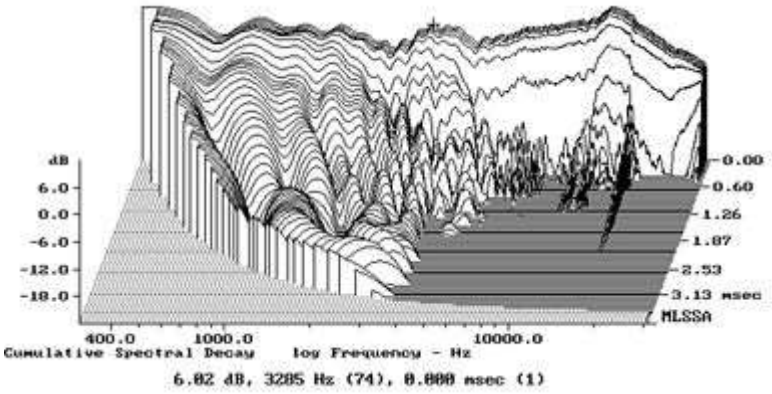

Fig.10 Audio Artistry Beethoven, cumulative spectral-decay plot at 50" (0.15ms risetime).

Measuring large dipole speakers is always problematic, because the underlying assumptions about the measurement techniques and their relationship with the device under test are no longer completely valid. Given that caveat, the Beethoven's measured performance is excellent.—**John Atkinson**