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# The Wilson Benesch Cardinal Loudspeaker

By Roy Gregory

**T**he world of high-end loudspeakers is increasingly falling into two camps: the (traditional) one where 'specially modified' OEM drivers are combined with in-house cabinets – and where just about everything is built in-house. But, what happens if you take that recipe a stage further? That's exactly what Wilson Benesch has done in its latest flagship design, the Cardinal; but then, that should come as no surprise, it's a path it has been actively pursuing for nearly two decades.

As befits a company based in Sheffield, it is a design approach dedicated to sound engineering and materials technology. Here you have a speaker that contains a unique cone material, in-house drivers, a composite cabinet and not a bit of wood anywhere. One look at the Cardinal and you can't mistake its high-tech credentials, but what you can see is only half the story.

The massive, extruded aluminium baffle is carefully shaped to reduce diffraction, but also minimize resonance and bending modes. Variable thickness and curved "returns" that extend a full 50mm back from the baffle face make for an incredibly rigid element. Behind this, the rear half of the cabinet is formed from a curved, W-section, formed with combined carbon-fibre and fibre-glass skins, sandwiching a thick structural foam core. The result is incredibly stiff and extremely light, while the foam core material and mixed material skins make for excellent self-damping. This carbon composite channel is the result of a proprietary production process, the materials, expertise and plant required making it an incredibly costly element – a fact that Wilson Benesch off-sets by using it across its range of products.

The composite channel is linked to the baffle by extruded 'cheeks'. By varying the depth of these, the volume can be dialed in for different systems, while again, the extruded profile allows extreme shaping of the elements to increase stiffness and resist resonance. These side panels on the Cardinal are fully 180mm in depth. Finally, the back of the cabinet is finished with a beautifully sculpted and extruded aluminium post that adds another clamping element as well as significant additional stiffness. The end result is an enclosure that involves clamped, mixed materials in a self-damping

sandwich structure, virtually devoid of parallel internal walls, with all the benefits of a stiff material like aluminium, but with none of the ringing that normally goes with it. Throw in the low energy storage characteristics of the composite channel section and this could be a theoretically near perfect cabinet.

The internal volume itself is constructed from two separate elements. The large, upper enclosure houses the tweeter and lower-midrange unit. The lower cabinet contains the midrange driver in its own, separate enclosure, loaded by an electromechanically damped ABR that vents through the slot between the two sections of the cabinet. The remainder of the lower enclosure contains the bass system, comprising a pair of isobarically loaded woofers, in turn loaded by another ABR. The rear isobaric drivers are mounted as closely as possible behind the front units, on their own 35lb aluminium sub baffle, bringing the driver complement in total to nine a side.

The top of the cabinet looks like it would be more at home in the Olympic velodrome than gracing the top of a loudspeaker. Whilst it has an undeniably powerful visual impact, again the purpose is to eliminate resonance and any parallel surfaces inside the cabinet. The Cardinal stands on the most substantial base I've yet come across, machined in-house from a single slab of aluminium. If the purpose of the massive baffle and the stiffness of the cabinet as a whole are designed to offer a stable mechanical reference for the drivers, this is the part that delivers the necessary mechanical ground. It stands on three stainless steel posts, each with a massive but beautifully executed adjusting wheel and tipped with a large tungsten carbide ball. That interfaces with three identical balls captured in the large disc feet provided with the speaker, an arrangement – first seen in the Wilson Benesch tonearm – that guarantees minimal point contact. All these parts, like the driver baskets and motor assemblies, even the four sets of terminals mounted on the speaker's underside, are all produced in Wilson Benesch's own CNC shop.

Which brings us, in turn, to the drivers themselves. At first glance, you could be forgiven for assuming that the Cardinal only uses two different drivers, the in-house tweeter and a 170mm cone unit, but appearances are deceptive.

Although the 170mm baskets, specially designed to minimize rear reflections, are identical, there are four different 170mm units in play here, each with its own specifically tailored cone and motor assembly. The cone material in the Tactic-II drivers is isotactic polypropylene, a unique fibre that can be formed under temperature and pressure. Under the right conditions, the surface of each fibre melts, bonding the whole into a single monocoque element, combining the self-damping of polypropylene with the structural tuning available from a woven carbon-fibre or Kevlar cone, yet without the additional mass of added resin. This material offers both a versatile and elegant solution to the problem of precisely tailoring a driver's mechanical and acoustic properties. Like everything else, cone design is a case of balancing virtues. The isotactic-polypropylene material offers the opportunity to maximize the structure's self-damping characteristics while minimizing the relatively high mass of the material itself. Add in modular neodymium magnet assemblies and motor parts that are also machined in-house and Wilson Benesch is able to create dedicated midrange, lower-mid, bass and ABR drivers, all on the same basket and all precisely tailored to the final system, a factor that becomes particularly critical once you take a look at the crossover topology – or rather, lack of it.

A firm believer that crossovers really are the root of all evil when it comes to loudspeakers, designer Craig Milnes has opted to run both the midrange units wide-open (the upper-mid's ABR loading a more controlled iteration of an open-baffle). Either side of that very broad mid-band, all crossover slopes are simple first order, an arrangement that maintains phase integrity and minimizes subtractive and electrical losses – but does place a heavy emphasis on the mechanical behaviour of the drivers themselves. It's an unusual choice for a multi-driver, ultra high-tech system like this one, one more usually found in minimalist, high-efficiency speakers, but it makes perfect sense of the system's technological strengths – and weaknesses. If you are using a higher order filter with steep slopes and rapid driver roll-off, then, you can concentrate on a narrower pass-band, but the Cardinal's crossover uses either shallow slopes or an entirely acoustical/mechanical roll-off in the case of the mid-band drivers. The





▶ ability to tailor the drivers' mechanical responses so precisely is what makes the approach possible, while the lack of subtractive filter elements between the amp and the drive-unit delivers enhanced control to overcome the heavier mass of the polypropylene cones compared to, for example, ceramics. The result is best described as two-way first-order electrical, but four-way acoustical, with the pseudo-d'Appolito arrangement of upper and lower-mid drivers flanking the tweeter at its heart, an arrangement that Wilson Benesch feels is so critical to the cardinal's performance that they've dubbed it the "Troika concept".

The Cardinal's Semisphere tweeter is relatively low-tech in appearance, with its simple silk dome, but that conceals the carefully engineered carbon-fibre brace behind the dome and the self-contained rear housing, with its incredibly powerful motor and carefully contoured internal chamber. Add in the optimally contoured front plate and you have a unit that delivers the proven benefits of the soft dome approach (excellent tonal and dynamic shading and contrast) with superior dispersion and extension. The Cardinal claims an upper output limit of -3dB at 35kHz, which puts its tweeter not far behind some pretty exotic alternatives – without the complex crossovers those drivers demand, or the tonal and integration issues that so often bedevil their application.

The base is over 60cm in each dimension, while the tall, narrow (20cm wide) cabinet rises 175cm from the floor and is 56cm deep. Each speaker weighs in at 180kg, testament to the sheer amount of aluminium in each cabinet, a sobering consideration given that around half the volume is delivered by the lightweight composite sandwich! Efficiency is quoted as 90dB, underlining the important contribution of that low-loss crossover topology, while nominal impedance is stated as 6 Ohms, with a 3 Ohm minimum. The upshot is a speaker that is neither particularly easy to install or drive – but it is well worth the effort. The ball-bearing interfaces on the feet (together with the substantial weight) made it surprisingly difficult to slide the speaker even on my wooden floor, and I eventually resorted to some felt-based footers for placement purposes, before installing the dedicated feet. The four sets of terminals beneath each base-plate accept both spades

and bananas, which is just as well, as most of you will need jumpers to bridge the gaps left by single/bi-wired cables – as well as a second pair of hands and a ratchet socket wrench to make the necessary connections.

Generally, it is the transducers in any system that introduce the greatest degrees of colouration or character. But the sound produced by the Cardinal is uncannily coherent and well-integrated, musically, spatially and temporally contiguous – to a degree that is frankly astonishing for a speaker system in which each cabinet consists of two enclosures and nine drivers. It speaks volumes for the precision with which Wilson Benesch have been able to tailor the mechanical behavior of their drivers and cabinet, achieving better results across the mid-band transitions than most speaker designers achieve with subtractive crossover designs. It also underlines the special benefits of parts and materials continuity across so many of the drive-units. It's something that is impossible to achieve unless you build all those drivers yourself, specifically tailored for purpose. ▶



▶ The Cardinal's lack of intrusive or identifiable character makes it one of the most self-effacing loudspeakers that I've ever used, surpassed in this regard only by various Avalons. Yet this essential honesty is a double-edged sword, throwing the performance of the driving amplifier into stark relief. In the same way that sugar in tea masks the complexities of its flavor, subtractive crossovers and cabinet colouration draw an obscuring veil across a host of sins. Eliminate them from your loudspeaker and suddenly you have to deal with problems you never realized you had. It leaves the Cardinal in the unfortunate position of a messenger delivering unwelcome news. But rather than "shooting" the speaker, consider how good it can sound with amplification that really does deliver. I was lucky enough to have electronics from Connoisseur/Berning, VTL, Avantgarde and Siltech to hand and the results were spectacular, especially with Siltech's ruinously expensive but stunningly good SAGA set up.

Working at their best the Cardinals simply disappear from the musical equation, physically and sonically. The soundfield that contains the musicians steps away from the speakers completely, with no sense of the mechanics behind the reproduction. Ringing the changes between different amps and source components, you realize that the Cardinal is capable of delivering the full range of instrumental colour

and musical expression, instrumental or vocal – as long as your system delivers the signal. The speaker is so devoid of subtractive/intrusive obstruction that performances arrive intact, with proper form and full of sense and purpose. In no small part that is down to the wide open, lucid and responsive mid-band, but as with all large speakers it's also about the top and bottom and how they integrate with the whole.

The Hemisphere tweeter is a masterpiece, retaining all the proven virtues of silk domes, but using novel bracing techniques and its optimised rear chamber to extend the performance envelope far higher than you'd expect. The result is a natural sense of air and space, positional clarity and musical articulation that, until now, has been the preserve of exotic tweeters and speakers with dedicated super tweeters built in. The seamless transition between the midrange driver and tweeter help in this regard, but like all really good high-frequency units, you also hear their impact at the other end of the spectrum, where the clarity and transparency of the bass is remarkable. Overlapping bass notes are easily distinguished, pitch and placement effortlessly clear. The result is music with a stability, clarity and uncluttered sense of natural pace and timing; the Cardinals let music and musicians breathe. The multiple small drivers don't have the generosity or weight that comes from large cones in even larger cabinets, but they don't ▶

▶ have the additive elements that go with them either. The Cardinal's bottom end is all about poise, information and control. It's not trying to sound bigger than it is and that's one of the principle reasons it doesn't suffer from "big speaker" syndrome; the sense of weight without that weight being quite right...

One implication of the speakers' honesty is that the character and differences between sources becomes significantly more obvious. So, for instance, the different nature of CD and SACD layers of the same disc is more apparent, while the presentational distinctions between vinyl/analogue and digital sources becomes a gaping chasm. Of course, the flipside of that is that good orchestral recordings on CD have a presence, tonality and stability that's all too rare, while vocals from vinyl take on a new sense of natural presence and shape, instruments – especially drums – a new solidity and substance. If the Cardinal has a weakness, it is in the realm of micro-dynamics and instrumental texture, areas in which higher efficiency designs or those with super light drivers excel. But the Wilson Benesch is hardly deficient in these areas, while it's other (considerable) strengths more than tip the balance. So when Joe Jackson sings that, "It's different for girls", he really sounds like he means it, and the band sound like they feel his pain; or when Sonny Rollins exchanges licks with Clifford Brown the richer, rounded tone, the sheer length and volume of his sax is perfectly differentiated from the shorter, sharper bark of the trumpet.

The Wilson Benesch Cardinal is as impressive from a sonic perspective as it is in pure engineering terms – and that's really saying something. Here we have a product where innovation and execution are perfectly in accord with purpose. As expensive as it is, for once it's not hard to see (or hear – or rather, not hear) where the money has gone, in terms of materials, manufacturing or performance. It also represents the tip of a long and perfectly mapped development path, stretching back across multiple models. But the pace of advance isn't necessarily even and the Cardinal represents a genuine step change in both ambition and performance. It might be demanding but it can also be mightily rewarding and is, by some considerable margin and on any terms, the best speaker that Wilson Benesch has ever made.

If you want a product that manages to combine cutting-edge technology with artisanal audiophile sensibilities then this is it. If you want precision engineering fused with artistic nuance, look no further. Me? I just love the unburstable, uninhibited, uncoloured enthusiasm and honesty of the



Cardinal. Any speaker that can deliver this much music with this much conviction gets my vote. On that basis the Wilson Benesch Cardinal joins a very select short list indeed. +

## TECHNICAL SPECIFICATIONS

**Type:** 4-way dynamic loudspeaker

**Driver Complement:** 1x 25mm WB Semi-Sphere HF; 1x 170mm WB Tactic II Mid; 1x 170mm WB Tactic II Lower-Mid  
4x 170mm WB Tactic II LF; 2x 170mm WB Tactic II ABR

**Crossover:** 2-way, 1st order electrical; 4-way acoustical

**Bandwidth:** 25Hz – 35kHz ± 3dB

**Sensitivity:** 90dB

**Impedance:** 6 Ohms nominal (3 Ohms minimum)

**Dimensions (WxHxD):** 620 x 1735 x 640mm

**Weight:** 180kg each channel

**Finishes:** Silk black baffle, spine and foot, carbon-fibre cabinet. Side cheeks in black carbon or black silk. Bespoke side cheeks available in wood and high gloss finishes, at extra cost: Wood Satin: Natural Cherry, Maple, Oak Wood Gloss: White Gloss, Birds Eye Maple, Red Birds Eye, Burr Walnut, Ebonised Walnut, Walnut, Red Tulip, Zebrano. Metal: White Gloss

**Price:** £54,950 pr.

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