

JOHN ATKINSON

# TAD Compact Reference CR1

## LOUDSPEAKER

**H**igh-end audio is in some ways a dynastic beast, though without as many “begats.” One of the world’s most successful loudspeaker manufacturers in the years following World War II was the Wharfedale company, from Yorkshire in the North of England. Wharfedale was founded by Gilbert Briggs in 1932, who in the 1950s handed over the reins of Technical Director to fellow Yorkshireman Raymond Cooke. Cooke left Wharfedale in 1961 to found KEF Electronics Ltd., where he subsequently appointed Goodmans designer Laurie Fincham as Chief Engineer in 1968. Fincham led a team of young engineers, including Mike Gough, who eventually joined B&W, and Yorkshire-born Andrew Jones, who became KEF’s Chief Engineer in 1989, before Fincham was lured to Harman’s Infinity division, in Northridge, California, in 1993. Jones followed Fincham across the Atlantic, where he worked on Infinity’s Prelude, Overture, and Reference Series speakers, before joining Pioneer in 1997. The Japanese company had established a state-of-the-art speaker-design facility in Southern California, and Jones was invited to lead the design team.

Andrew Jones designed some superb-sounding speakers for Pioneer, including the S-1EX, which Kal Rubinson enthused over in the March 2007 issue of *Stereophile* (see [www.stereophile.com/content/pioneer-s-1ex-loudspeaker](http://www.stereophile.com/content/pioneer-s-1ex-loudspeaker)); and, more recently, the SP-BS41-LR, which, said Robert J. Reina in his September 2011 review (see [www.stereophile.com/content/pioneer-sp-bs41-lr-loudspeaker](http://www.stereophile.com/content/pioneer-sp-bs41-lr-loudspeaker)), offers astonishingly uncolored sound quality for just \$150/pair.

But it has been two Jones designs for Pioneer’s Technical Audio Devices Laboratories division (TAD) that have

attracted the press’s attention at recent audio shows, both designed with no apparent limit on the bill of materials: first the floorstanding Reference One (\$78,000/pair), then the stand-mounted Compact Reference CR1 (\$37,000/pair plus matching stands for \$3600/pair). I couldn’t envisage how I’d be able to get a pair of 350-lb Reference Ones down the steps into my basement listening room. But the Compact Reference weighs a more manageable 101.4 lbs—when I visited the TAD room at the 2011 Consumer Electronics Show last January, I asked Jones for review samples.

### Technology

Andrew Jones had worked on the groundbreaking Uni-Q drive-unit when he was at KEF, which mounts a dome tweeter on what would have been the midrange unit’s dust-cap at the center of its cone. The benefit of this is that the acoustic centers of the midrange unit and tweeter coincide, and their directivities can be made to match in the crossover region. There are therefore no discontinuities in the speaker’s radiation pattern—no off-axis flares or gullies that can lead to coloration, even when the on-axis output is flat. The trade-off—there are *always* trade-offs—is that the symmetrical acoustic environment for the tweeter means that diffraction effects from the boundaries of that environment all occur at the same frequency. Minimizing these effects requires that special attention be paid to the profile of the midrange cone.

All of the TAD Reference speakers’ drive-units are made by TAD. The midrange and treble are handled by what TAD calls the Coherent Source Transducer (CST). As shown in the exploded diagram on the next page, this

## SPECIFICATIONS

**Description** Three-way, reflex-loaded, stand-mounted loudspeaker. Drive-units: 1.375" (35mm) beryllium-dome tweeter concentrically mounted with 6.5" (160mm) beryllium-cone midrange driver, 8" (200mm) sandwich-cone woofer. Crossover frequencies: 250Hz, 2kHz.

Frequency response: 40Hz–20kHz,  $\pm 3$ dB (frontal average response). Sensitivity: 86dB/2.83V/m. Nominal impedance: 4 ohms. Maximum input power: 200W. **Dimensions** 24.7" (628mm) H (46.7"/1186mm H with stands) by 13.4" (341mm) W by 17.5" (444mm) D. Weight:

101.4 lbs (46kg).

**Finish** Piano-gloss wood veneer, matte black.

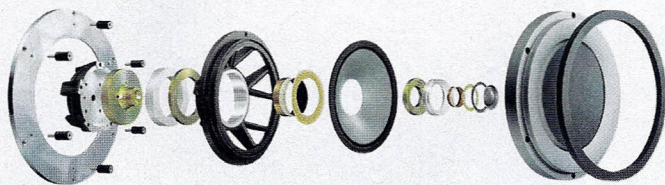
**Serial Numbers of Units Reviewed** 1KMN00003WN & 00004WN.

**Price** \$37,000/pair. Matching stands, \$3600/pair. Approximate number of dealers: 10.

**Manufacturer** Technical Audio

Devices Laboratories, Inc.  
4-1, Meguro, 1-Chome,  
Meguro-ku, Tokyo 153-8654,  
Japan.  
US distributor:  
TAD Laboratories  
2265 E. 220th Street  
Long Beach, CA 90810  
Tel: (800) 745-3271  
Web: [www.tad-labs.com](http://www.tad-labs.com)





TAD's CST drive-unit exploded.

is a concentric driver combining a 6.5" midrange unit with a 1.375" tweeter. Both diaphragms are made of beryllium, which is both a very light metal and extremely rigid, properties that make its use optimal. The diaphragms are produced using a vapor-deposition technique developed by TAD. The profile of the tweeter dome was developed using what TAD calls the Harmonized Synthetic Diaphragm Optimum Method (HSDOM) of computer analysis. The result is a response that is truly pistononic within the audioband, and is claimed to extend to 100kHz. Because beryllium is very brittle, the CST drive-unit is protected by an integral wire-mesh grille, and is mounted within a silver-finished ring that smoothly continues the midrange cone's flare.

Frequencies below 250Hz are produced by an 8" woofer mounted below the CST unit on the CR1's matte-black front baffle. The woofer has what TAD calls a Tri-Laminate Composite Cone (TLCC). This features a central, foamed-acrylic core, with front and back woven coatings of an aramid material. Again, the goal was to produce a diaphragm that

would be light and stiff, but with good internal damping. Unusually in these days of ubiquitous half-roll rubber surrounds, the woofer cone is terminated in a corrugated suspension that TAD claims offers high linearity. The voice-coil is 4" in diameter but only 12mm long, operating in a 22mm-long, magnet gap, which again confers excellent linearity over a wide range of cone excursion. TAD calls this

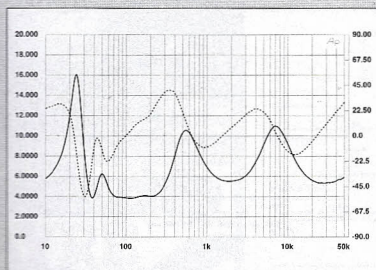
an Optimized Field Geometry Magnet Structure (OFGMS). The woofer is reflex-loaded by a rectangular port at the base of the front baffle that is 9" wide by 1" high, including the flared profile at the port's sides, and is covered by a removable black mesh grille.

The crossover network features air-cored coils and film capacitors in the high-pass feed to the CST driver, and inductors with laminated steel cores in the low-pass woofer feed, to give high power handling and low saturation. Electrical connection is via two pairs of high-quality binding posts on an aluminum-alloy panel set into the enclosure's rear.

The Compact Reference's enclosure is made using what TAD calls Structurally Inert Laminated Enclosure Technology (SILENT). This has a strong internal framework formed by 0.9"-thick, CNC-machined birch plywood clad with high-frequency, hot-press-formed, laminated MDF panels. A 1.1"-thick aluminum base lowers the center of gravity and stabilizes the cabinet. The top of the cabinet and the gently curved side panels are veneered and finished in an attractive transparent coat. The matching, wooden, three-pillared stand has the same matte-black finish as the speaker's front baffle.

## MEASUREMENTS

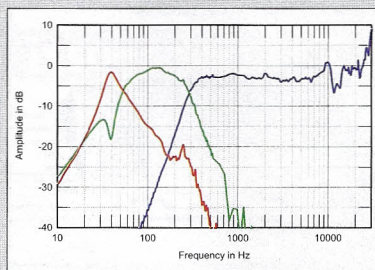
I used DRA Labs' MLSSA system and a calibrated DPA 4006 microphone to measure the TAD Compact Reference CR1's frequency response in the farfield, and an Earthworks QTC-40 for the nearfield and spatially averaged room responses. My estimate of the CR1's voltage sensitivity was 87.5dB(B)/2.83V/m, which is both about average and slightly above the specified 86dB. The CR1 is specified as being a 4 ohm load, but the speaker's impedance remains above 7.5 ohms throughout the upper midrange and treble, dropping to 4 ohms only between 40 and 225Hz (fig.1).



**Fig.1** TAD Compact Reference CR1, electrical impedance (solid) and phase (dashed). (2 ohms/vertical div.)

Though there are some swings in the value of the electrical phase angle, the extreme values occur, as usual, when the magnitude is high, mitigating the effect of the increased current demand. There is one exception, at 34Hz, where there is a value of 5 ohms and  $-48^\circ$  capacitive phase angle, which will put strain on an amplifier with limited current delivery.

Other than a small wrinkle at 42kHz, which is presumably the fundamental "oil-can" resonance of the tweeter's beryllium dome, the traces in fig.1 are free from any discontinuities that would imply the existence of resonances of some kind.



**Fig.2** TAD Compact Reference CR1, acoustic crossover on tweeter axis at 50", corrected for microphone response, with nearfield woofer (green trace) and port (red) responses, plotted below 1200 and 600Hz, respectively.

Indeed, when I investigated the vibrational behavior of the enclosure's panels with an accelerometer, I found nothing untoward!

Fig.2 shows the individual responses of the port (red trace), the woofer (green), and the coaxial upper-frequency drive-unit (blue). Below 350Hz, the latter two traces were taken with the microphone in the nearfield; above that frequency, the traces show the drive-units' farfield responses on the tweeter axis. The saddle centered on 38Hz in the impedance-magnitude trace suggests that this is the tuning frequency of the port; this is confirmed by the minimum-motion notch in the woofer's nearfield output in fig.2 occurring at the same frequency. The port's output is a tidy bandpass covering the octave between 30 and 60Hz, with only a slight hint of a resonant peak at 250Hz disturbing its upper-frequency rolloff. The woofer's output crosses over to the coaxial driver at pretty much the specified 250Hz, with what appear to be 18dB/octave filter slopes. The woofer's behavior above its passband is smooth, and the coaxial drive-unit's response is astonishingly flat, up to the region where the tweeter's output starts to be affected by the fact that it is symmetrically surrounded by the



Two small positioning pegs on the speaker's base fit into corresponding holes in the stand's top plate, and the stand is locked to the base of the speaker with an Allen-head bolt. The result is a visually unobtrusive yet attractively styled piece of furniture.

## Sound

Andrew Jones helped me set up the Compact References in my room. And before you write to complain that this is special treatment, at this price level it should be mandatory for the dealer to set up the speakers in the customer's home. We moved the speakers back and forth and from side to side, using a CD that Andrew was familiar with, until he had gotten a balance between the midbass and upper bass that he felt was optimal. Only then did we screw the carpet-piercing cones into the bases of the stands. Though the low frequencies were extended, they were well controlled, meaning that the speakers could be placed a little closer to the sidewalls than with the Vivid B1s that had preceded them. The centers of the woofers ended up 75" from the wall behind them, 24" from the LPs and books that line their respective sidewalls, and 30" from the floor. This gave a rather wide-angle view into the soundstage, but that stage was stable, without any hole in the center.

Though the CR1 is ostensibly a stand-mounted design, it didn't lack low frequencies. The one-third-octave warble tones on *Editor's Choice* (CD, Stereophile STPH016-2) were reproduced with full weight down to the 32Hz band, but with a fast rolloff below. Listening to the half-step-spaced toneburst track from *Editor's Choice* with a stethoscope



The CR1's woofer uses a cone formed from a foamed acrylic core with aramid skins.

pressed against the enclosure revealed no resonances. The tonebursts "spoke" cleanly, with only a slight degree of blurring at the onset of each burst below 100Hz—excellent performance for a ported design. And again, the signal was reproduced with full weight to 32Hz.

I've been on a Bill Frisell jag since seeing the hyper-imaginative guitarist live at the Village Vanguard a few months ago. I somewhat belatedly picked up a copy of his 2001 *Blues Dream* album (CD, Nonesuch PRCD 300361), which has a Stygian double-bass ostinato underpinning the horn arrangement of "Ron Carter." The CR1 is not a minimonitor, of course, but the impact and weight of David Pilch's bass as reproduced by the TADs would have done a pair of big floorstanders

## measurements, continued

midrange cone. This gives rise to a small peak at 9kHz, followed by an equally small dip in the response at 12kHz. Above that frequency, the tweeter's output continues smoothly until it starts to rise just below the 30kHz limit of this graph.

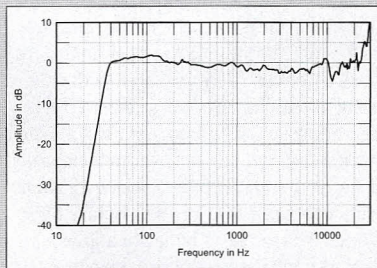
The 6dB boost in the upper bass that results from the nearfield measurement is absent in this graph, suggesting that the TAD Compact Reference's woofer alignment is on the overdamped side. The rolloffs of the woofer and port below the port tuning frequency in fig.3 conforms to the usual 12dB/octave. However, when the woofer and port outputs are summed, taking acoustic phase angle

into account, the CR1's calculated low-frequency nearfield response drops at 36dB/octave below the port response rather than 24dB/octave (fig.3 below 300Hz). The CR1's farfield response, averaged across a 30° horizontal window centered on the tweeter axis, is again superbly flat from the midrange through to the high treble.

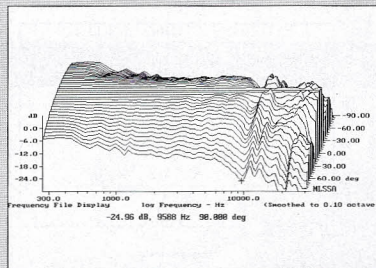
Below the region where the midrange cone starts to affect the tweeter's radiation pattern, the TAD's horizontal dispersion is textbook (fig.4), being wide and even, with no off-axis hot spots or troughs. This behavior always correlates with stable, precise stereo imaging, the

early reflections of the speaker's output from the room's sidewalls not having a different character from the direct sound. Despite its relatively large diameter, the tweeter has wider-than-usual top-octave dispersion. In the vertical plane (fig.5), the TAD maintains its response over a wide window centered on the tweeter height of 40.5", confirming my subjective impression that the CR1's balance didn't change appreciably as I moved up and down in my chair.

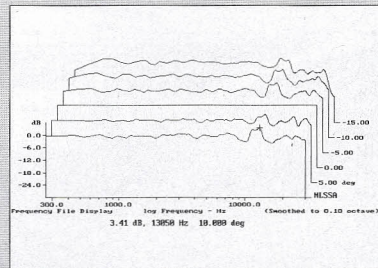
Fig.6 shows how this anechoic behavior translates to the measured spatially averaged response in my listening room. I perform this measure-



**Fig.3** TAD Compact Reference CR1, anechoic response on tweeter axis at 50", averaged across 30° horizontal window and corrected for microphone response, with complex sum of nearfield responses, plotted below 300Hz.



**Fig.4** TAD Compact Reference CR1, lateral response family at 50", normalized to response on tweeter axis, from back to front: differences in response 90–5° off axis, reference response, differences in response 5–90° off axis.



**Fig.5** TAD Compact Reference CR1, vertical response family at 50", normalized to response on tweeter axis, from back to front: differences in response 15–5° above axis, reference response, differences in response 5–10° below axis.



proud—it had me wondering where the subwoofer was!

As well as *Blues Dream*, December's "Recording of the Month," *All We Are Saying* (CD, Savoy Jazz SVY17836), Frisell's collection of John Lennon arrangements, was in heavy rotation while I had the TADs. This album is notable for Kenny Wollesen's natural-sounding drums, the depth of Tony Scherr's double bass, and the telepathic interplay between Frisell's guitar and Greg Leisz's pedal steel guitar. The sense of musical flow in "Revolution" was superb for a ported design, there not being the sense you get with underdamped designs that the bass is chasing the higher regions, trying to keep up. In this respect, the low-frequency behavior of the CR1 was reminiscent of

a good sealed-box speaker. But this was with sufficient low-frequency extension that when Scherr slides down to a low subdominant in "Mother," his instrument retained its weight without losing its definition.

I also very belatedly picked up a copy of *11 Tracks of Whack*, Walter Becker's 1994 solo album (CD, Giant 24579-2). This has a beautifully even bass guitar throughout, especially in

"Down in the Bottom"; the bottom octave was presented in full measure by the TAD monitors, but without any upper-bass boom to obscure the instrument's definition. Another recent acquisition, Busoni's virtuosic transcription for piano of J.S. Bach's *Chaconne* for solo violin, performed by Wolf Harden (CD, Naxos 8.555699), was similarly reproduced with an excellent sense of weight to the piano's lower register. Again, the instrument's low notes spoke evenly and cleanly. This recording also revealed how clean and uncolored the CR1's midrange was: though this is a complex, densely scored arrangement, there was no sense of congestion in the sound of the piano, or the feeling that some notes were being unnaturally projected forward.

This is not to imply that the TAD was reticent or mellow—far from it. While the CR1 was not bright as such, it was far from being reticent in the highs, which means that it worked best with amplifiers that are themselves neutrally balanced. The MBL Reference 9007 monoblocks, for example, are superb amplifiers, but with the TADs, the sound was just too forward in the mid-treble. The Classé CTM-600s worked their usual magic with the CR1s, but with overcooked modern recordings, such as Adele's *21* (CD, XL 446899-2), even a speaker this clean can't do anything about the relentlessly forward vocal balance. (I know this album is not aimed at sensitive listeners like me, but does it really have to be *this* loud?) However, "Take It All," which reduces the mix to just singer and piano, again revealed the excellent combination of low-frequency weight and definition to the piano's left-hand

#### measurements, continued

ment by averaging twenty  $\frac{1}{6}$ -octave-smoothed responses taken for each speaker individually in a rectangular grid measuring 36" by 18" and centered on the positions of my ears in my listening chair. The CR1's treble is smooth and extended—perhaps *too* extended, considering that this response ideally should slope down a little with increasing frequency, due to the increasing absorptivity of the room's furnishings at high frequencies. The low midrange shelves down slightly, presumably due to the interference from the floor bounce of the sound in this region, which leaves the upper midrange a little emphasized. At the other end of the

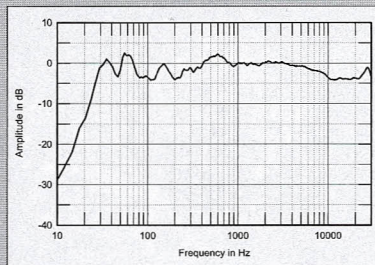
spectrum, the small peaks in the 32 and 63Hz regions are due to room modes that haven't been completely eliminated by the spatial averaging, but the TAD's output extends down to 30Hz before rolling off sharply.

Turning to the time domain, the CR1's step response on its tweeter axis (fig.7) suggests that all three drive-units are connected in positive acoustic polarity, which I confirmed by looking at the individual drive-unit steps (not shown). The speaker's output is not time-coincident, but it is time-coherent, in that the decay of each unit's step on the tweeter axis blends smoothly with that of the next lower in frequency. The result

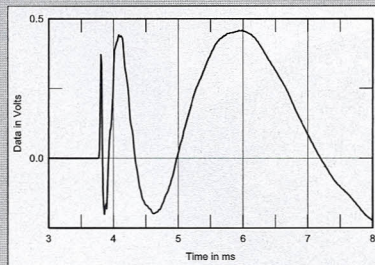
is that, as you could see in the CR1's on-axis frequency response (fig.3), the drive-units' outputs smoothly add in the frequency domain to give a flat response through the two crossover regions. The TAD's cumulative spectral-decay plot (fig.8) has an initially clean decay, but with some low-level hash visible in the midrange. I am not sure where this stems from, and, of course, this is the frequency region where quasi-anechoic measurements have limited resolution.

Summing up the measured performance of the TAD Compact Reference CR1 is easy: This is textbook behavior!

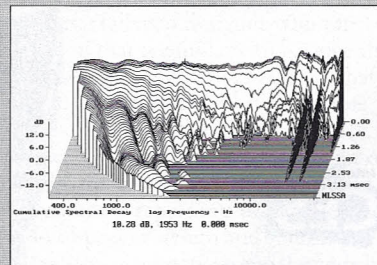
—John Atkinson



**Fig.6** TAD Compact Reference CR1, spatially averaged,  $\frac{1}{6}$ -octave response in JA's listening room.



**Fig.7** TAD Compact Reference CR1, step response on tweeter axis at 50° (5ms time window, 30kHz bandwidth).



**Fig.8** TAD Compact Reference CR1, cumulative spectral-decay plot on tweeter axis at 50° (0.15ms risetime).



register when Neil Cowley plays the “Take it all, with my love” hook in the chorus.

The TAD Compact Reference did have its delicate side. Since I heard Eric Whitacre conduct one of his compositions at Carnegie Hall in 2010, I have been buying as many recordings of his work as I can find, and recently have been enjoying an album of his choral pieces by Noel Edison and the Elora Festival Singers (CD, Naxos American Classics 8.559677). As one by one the voices layered the phrase “my son” in *When David Heard* to create a tonal cluster that steadily crescendos to a climax, they created a transcendent dome of sound between and behind the plane of the TADs, with no sense that the sounds were emanating from the physical positions of the speakers. Instead, the CR1s stood back out of the way to let the music speak without hindrance, coloration, or blurring of fine detail.

In one sense, the Compact Reference’s retrieval of fine recorded detail bordered on the fetishistic, but that detail was not thrust forward at me. Instead, it was just there, as it would be with live sound. I could clearly distinguish the individual brushstrokes on the ride cymbal at the start of “The Mooche,” from the Jerome Harris Quartet’s *Rendezvous* (CD, Stereophile STPH013-2). The subtle illumination of the church acoustic of Blue Heaven Studios by the tom toms was clear, as was the superbly stable stereo imaging, with Steve Nelson’s vibes hanging between the left speaker position and the center of the stage, and Billy Drummond’s Gretsch drum kit extending solidly from stage center to the far right, as both instruments had done at the sessions.

When I recorded *Rendezvous*, I used stereo miking on the drums and vibes so that the recorded soundstage would bear a close relation to the original reality. But even with totally artificial recordings, the CR1s worked their soundstaging mojo. The effective but idiosyncratic mix of close-miked double bass and distantly miked drums in “Ascension Day,” from Talk Talk’s *Laughing Stock* (CD, Polydor 847 717-2), hung in the air between and behind the speakers, and were tangible in their presence. This album was engineered by Phill Brown, who specializes in capturing a real sense of space and true dynamics in his recordings.

I followed this classic Talk Talk track with Steve Winwood’s solo album from 1977 (Apple Lossless, ripped from CD, Island 842 774-2), which Brown also engineered. According to the Pure Music meters, this album has as much dynamic range as a good classical recording. Winwood uses a vast array of guitars and keyboards on this album, but sparingly, to create spatial contrasts, in the way that Gustav Mahler, for much of the time in his symphonies, used huge orchestral forces to produce delicate traceries of sound. The way in which the individual objects in the soundstage on the Winwood album retained their separateness as sounds but blended in the higher-order mental construct representing the music when this album was played through the CR1s was, again, almost fetishistic.

This combination of honesty and transparency is what I feel should be implied by the use of the word *monitor* to describe a loudspeaker. In that sense the CR1 deserves the appellation, so it was

## ASSOCIATED EQUIPMENT

**Digital Sources** Ayre Acoustics C-5xe<sup>MP</sup> & DX-5 universal players; Apple G4 Mac mini running OS10.5.8, iTunes 10, Pure Music 1.84; Shuttle PC with Lynx AES16 soundcard & dual-core AMD Athlon processor running Windows 7, Foobar 2000, Adobe Audition 3.0; dCS Debussy, Logitech Transporter, Bricasti D/A converters; Halide S/PDIF Bridge, Empirical Audio Off-Ramp4 USB-S/PDIF converters.

**Preamplifier** Ayre Acoustics K-5xe<sup>MP</sup>.

**Power Amplifiers** Classé CT-M600, MBL Reference 9007 (both monoblocks).

**Loudspeakers** BBC LS3/5a, Sonus Faber Amati Futura.

**Cables** Digital: DH Labs Silver Sonic. AES/EBU: AudioQuest Coffee, Belkin Gold USB. FireWire: AudioQuest FireWire 400 (prototype). Interconnect (balanced): AudioQuest Wild. Speaker: AudioQuest Wild. AC: PS Audio Lab, manufacturers’ own.

**Accessories** Target TT-5 equipment racks; Ayre Acoustics Myrtle Blocks; ASC Tube Traps, RPG Abffusor panels; Shunyata Research Dark Field cable elevators; Audio Power Industries 116 Mk.II & PE-1, APC S-15 AC line conditioners (computers, hard drive). AC power comes from two dedicated 20A circuits, each just 6’ from breaker box. —John Atkinson

with trepidation that I loaded Peter Gabriel’s new *New Blood* (CD, Real World 84108 00038) into the Ayre Acoustics DX-5 player. I am in love with Gabriel’s musical vision—his *Scratch My Back* was one of my 2011 “Records To Die For”—but this new album consists of reimaginings of many of his songs for voice and orchestra, which with many rock artists has proved a formula for disappointment. Would the TAD’s honesty and transparency unmask pretention?

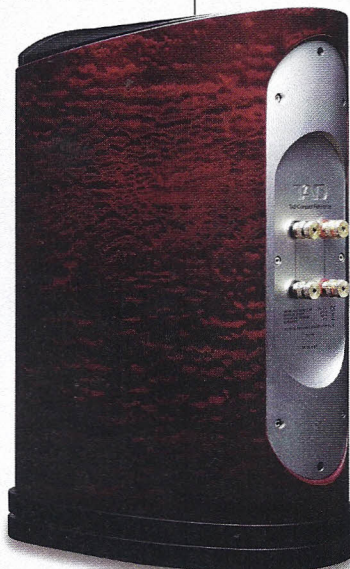
Fortunately, it didn’t. While in songs such as “In Your Eyes” and “Don’t Give Up” the deep, clear view into the recorded stage and the rich low frequencies offered by the TADs did reveal the incongruously large size of Gabriel’s bent baritone when presented against the dome of orchestral sound in Air

Lyndhurst, the speakers also lovingly laid bare the fact that this is music for grown-ups performed by grown-ups and reproduced by appropriately grown-up speakers. Oh my!

### Summing Up

All loudspeakers editorialize. It is an inevitable result of the design principle. Use of appropriate technology can reduce that editorial influence, but what is really required is a talented designer who can make use of that technology to balance the departures from absolute accuracy so that the music is as little disturbed as possible. That is the case with the TAD Compact Reference CR1. It lacks the very lowest octave and is balanced a tad forward, but in all other respects it represents the state of the art of loudspeaker design and sound. Yes, at \$40,600/pair with its essential stands it is *extremely* expensive, but that goes with the territory. Doesn’t it? TAD’s Compact

Reference is hardly compact, but it is a reference. Oh my! ■



Electrical connection is via two pairs of high-quality terminals.