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## **dCS Vivaldi State of the Art Digital**

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***DCS Vivaldi  
Digital  
Playback  
System  
Ne Plus  
Ultra***

***Robert Harley***

*photography by Joel Salcido*



# ***There are few companies in high-end audio that can be considered unique.***

By that I mean a company that creates technologies unlike those of any other brand, and designs products that are fundamentally different from the innumerable “me-too” components that flood the market.

Take the important job of digital-to-analog conversion, for example. Virtually all DAC manufacturers buy from the same menu of available chips and configure them in slightly different variations of the same theme. Some are more successful than others in creating good-sounding products, but none builds a digital-to-analog converter from the ground up with technologies invented entirely in-house.

An exception to this rule is the British company Data Conversion Systems (dCS). Every key element in every product it manufactures is designed and built by dCS using proprietary technologies. You won't find an off-the-shelf DAC chip, digital filter, or input receiver in a dCS product. What you will find are circuits, techniques, software, and engineering unlike that of any other product.

The ultimate expression of dCS' unique approach is embodied in the new Vivaldi, the most advanced and ambitious digital-playback system yet created. This \$108,496 four-box *tour de force* takes dCS' proprietary technologies to their ultimate realization. It is impossible to overstate the Vivaldi's technical sophistication—or its revelatory musical presentation. dCS has wrapped all of this advanced technology in stunningly bold and elegant metalwork that is as unique as the circuits inside.

## **Overview**

Describing the Vivaldi, its capabilities, and how it functions is quite a challenge. This is by far the most complex, technical, intricate, and feature-laden product I've ever reviewed. I'll give you a brief overview here, with more technical detail in the sidebars.

The complete Vivaldi system is a four-box design, but not all four boxes are required. Those four units are the Vivaldi Transport (\$39,999), Vivaldi DAC (\$34,999), Vivaldi Digital-to-Digital Upsampler (\$19,999), and Vivaldi Master Clock (\$13,499). You could, for example, buy just the Vivaldi DAC and drive it with a computer source (it has a USB input) or connect your CD

player (if the CD player offers a digital output). A big step up is the Vivaldi Transport and DAC combination; when used together the two units offer unique features including upsampling in the transport and the ability to transmit encrypted high-resolution audio (DSD or upsampled PCM) from the Transport to the DAC. In fact, a Vivaldi Transport and Vivaldi DAC will get you much of the way toward the sonic performance described later in the review. In addition to reading CDs, the Transport is compatible with SACD.

The Vivaldi Upsampler converts any common sampling frequency to any other sampling frequency, each user-selectable. Moreover, the Upsampler adds network capability, allowing you to integrate the Vivaldi with a music server, control the system via an iPad/iPhone/iTouch, and play music directly from a USB stick. The Vivaldi Clock simply serves as a high-precision master-timing reference to which all the other units are locked.

Each unit is housed in a gorgeous chassis featuring a three-dimensional sculpted front panel. Raised flowing lines grace the front panels like gentle waves. My review sample was silver, but black is also available. A full-color display toward the left side of each front panel shows, under normal use, the operating status (input selected, sampling frequency, whether the unit is locked to the Master Clock, etc.). But when you put one of the units into menu mode the display shows a myriad of details for setting up and configuring the component. The menu structure is so extensive that dCS provides a plastic-coated map in addition to the owner's manual.

Connecting and configuring a Vivaldi is best left to your dealer; a typical setup requires 12 digital cables, and that's without adding networking capabilities. The four units that make up the Vivaldi have collectively a mind-bending 56 rear-panel connectors. Moreover, the settings on each unit need to be optimized for the best sound. These include the upsampling options, whether the clock is dithered, and which of the six digital filters is selected, to name just a few of the many, many settings that are required to make the system work and realize its sonic potential.

Once the system is set up and has settled in, however, operation is quite simple. The DAC remembers the filter chosen for each sampling rate, for example, so there's no need to





## dCS Vivaldi Digital Playback System

adjust these settings (although you may want to change filters for different recordings—more on this later). The only button you'll probably need to press on a daily basis is the DAC's input selector to switch between CD and SACD from the transport, or the Upsampler's input-select button to play music from a server. You can select DAC and upsampler inputs from the full-featured remote (supplied with the DAC). This hefty and well-designed unit controls transport functions, adjusts the DAC's output level, selects the DAC filter, fine-tunes the left-right balance, and changes the upsampler's output sampling rate, among other functions.

I received a very early production model that had a couple of minor glitches, but a software update (easy to do from a CD or USB stick) fixed them. Interfacing the Vivaldi with a music server via a wireless network was considerably more challenging. My setup included a wireless router and an AVA Media Zara Premium ripping server connected to the Upsampler via an Ethernet cable. Downloading dCS' iPad app from the Apple store allowed me to browse music on the server, choose music for playback, and assemble playlists. Although this sounds simple, it took many frustrating hours of troubleshooting to get the whole thing working. My experience might not be typical, particularly as dCS continues to improve its software.

### Listening

The Vivaldi is built like no other digital source, and it sounds like no other digital source. Although there are obvious similarities between dCS' Puccini CD/SACD player and the Vivaldi, this new cost-no-object implementation of the company's best technologies vaults the sound quality into the stratosphere. The Puccini is the only other dCS product with which I'm familiar; many of you will want to know how the Vivaldi compares with dCS' former flagship, the Scarlatti. I asked our reviewer Jacob Heilbrunn, who owned a Scarlatti for many years (and bought the Vivaldi after hearing it) to make that comparison (see sidebar).

One of the key characteristics of any dCS product is the sheer density of information it conveys. By that I mean not just resolution of fine detail, but the impression that the fabric of the music is intricately woven from the finest silk. By contrast, other digital sounds somewhat less "continuous" in texture, as though, to expand on the cloth analogy, it were woven from coarser, less tightly woven threads. With the Vivaldi, instrumental timbres have a richness and saturation that more convincingly create the illusion of hearing the instrument itself and not a digital reconstruction of it. This increased density of tone color and impression that the sound is organic and continuous—unique among digital playback systems in my experience—goes a long way toward narrowing the gap between digital and analog. The

Vivaldi renders timbres with a vividness and immediacy that are startling, even from CD and 44.1kHz/16-bit files. What the Vivaldi does better than any other digital source I've heard is to make a piano sound more "piano-like" and a sax more "sax-like." I could have chosen any two instruments for this example—the Vivaldi simply portrays every instrument more realistically and less synthetically. Part of this quality is due to the increased density of texture and tone color mentioned, but also to the lack of a mechanical tincture that makes digitally reproduced timbre sound slightly unnatural. When at the front end of a chain that includes the ultra-transparent Constellation electronics, MIT interconnects and cable, and Magico Q7 loudspeakers (along with state-of-the-art power conditioning and vibration isolation), the Vivaldi offers an absolutely gorgeous and lifelike portrayal of instrumental textures.

There's another reason why instruments and voices sound so "there" with the Vivaldi, and that's the system's tremendous clarity and transparency. The old cliché "veils were lifted" could have been coined to describe the Vivaldi's startling sense of nothing between you and the music. Frankly, the Vivaldi makes other digital sound somewhat thick and opaque. This clarity and crystalline transparency not only increases the impression of timbral vividness and immediacy, it also contributes to the Vivaldi's astonishing spatial presentation. This transparency isn't just between you and the lead instruments; it extends to the far reaches of the soundstage. The ability to see deep into the hall and hear instruments at the back of the stage sound just as vivid and alive as instruments at the front is unprecedented in my experience.

Think all digital sounds flat and lacking in dimensionality? Listen to the Vivaldi and you'll hear just how much space, air, depth, and bloom is encoded in your music library just waiting to be liberated. I've repeatedly been amazed over the years to discover greater spatial fidelity and musicality from familiar discs after hearing those discs through better and better components, but never to the degree of the dCS. The Vivaldi represents a huge leap forward in rendering digitally reproduced music with dimensionality, depth, and a sense of transparent space between instrumental images. Listen to the first track on the amazing *Playing With Fire* from Reference Recordings. The wall behind the loudspeakers completely disappears; the low brass sounds as though it's twenty feet behind the loudspeaker plane. Not only does the Vivaldi recreate depth, but there's an organic continuousness to the presentation of depth along a continuum. I can vividly hear the placement of each instrument in the soundstage. Not only is the soundstage deep, it's also expansive, in the sense of top-octave air riding "over" the music. I'm not referring so much to musical information in the top octave, but rather to the impression of a



# The Vivaldi's Technology

The Vivaldi Transport is built around the massive Esoteric VRDS Neo disc mechanism. I attended a detailed technical presentation on this mechanism several years ago at Esoteric's California office and can tell you that it's built like no other disc-playback system in the world. The 14-pound device (conventional transports weigh a few ounces) is made from parts cut from solid-steel blocks. Most transports hold the disc at the center with a flimsy clamp; the VRDS Neo mechanism features a clamp just bigger than a CD that is made from machined Duralumin. The disc is clamped from above via a solid steel "bridge," securely holding the disc as it is spun and read. The laser pickup is mounted on a sturdy sled and only allowed to move in three directions (horizontal, vertical, and circular) to reduce vibration and servo activity. The sled is mechanically isolated from the rest of the transport mechanism. Each mechanism is made by hand in Japan, and undergoes two days of quality-control testing.

The Vivaldi Transport is unusual in that it can upsample 44.1kHz/16-bit data read from a CD to DXD or to DSD. DXD (Digital eXtreme Definition) is PCM data at 352.8kHz/24-bit. This format offers a data rate of 8.4672Mbs, considerably higher than DSD's 2.8224 Mbs. DSD is Direct Stream Digital, the encoding method of SACD. The Vivaldi Transport outputs DXD or DSD on dual AES/EBU jacks. When outputting DSD, the data are encrypted with a proprietary encryption scheme. To use the Vivaldi Transport's upsampled DSD outputs, you'll need to connect it to the Vivaldi DAC (the DAC decrypts the signal). For those of you who prefer no upconversion, you can connect the transport to the DAC via a single AES/EBU connection, or better yet, with the SDIF-2 interface. Not to be confused with SPDIF, SDIF-2 is a three-cable interface developed for professional audio. The three cables carry, respectively, left-channel audio, right-channel audio, and word clock.

This connection method, with the clock signal on a separate line, greatly reduces sonically degrading clock jitter.

The Vivaldi DAC is highly flexible and capable, able to convert digital data of any commonly found sampling frequency or signal format to analog. In a typical configuration one pair of the DAC's AES/EBU inputs is connected to the Transport for decoding DSD, and another pair to the Upsampler's outputs. The latter is selected when listening to CDs played in the transport, to an Apple device connected to the Upsampler, or to network attached storage under iPad control. The analog output is available on independently-buffered balanced and unbalanced outputs, and is variable via a front-panel knob or up/down buttons on the remote control. In a nice touch, a menu setting allows you to set the full-scale output level to 6V or 2V to match your power amplifier's input sensitivity and avoid large amounts of digital-domain attenuation. A useful display indicates the volume level. Of course, you can leave the volume at maximum and adjust the level with your preamplifier. Six filters are offered for PCM decoding and four for DSD decoding. The PCM filters include one with no pre-ringing. The DSD filters vary only in the filters' cutoff frequencies. Digital-to-analog conversion is performed by dCS' famous Ring DAC, a novel and ingenious solution to a fundamental problem in digital-to-analog conversion (see sidebar).

The Digital-to-Digital Upsampler fits between the Transport and DAC, upconverting audio from its native sampling rate to high-resolution PCM (up to 192kHz/24-bit) or DXD (352.8kHz/24-bit). The Upsampler's AES/EBU, RCA, and BNC connections can output PCM up to 192/24, with the dual AES/EBU jacks supporting DXD. It is also a digital hub with multiple inputs that can stream audio from a computer or a network-attached storage device such as a hard drive. The inputs include the network connection on an RJ45 jack, two asynchronous USB inputs (one Type A, one Type B), four SPDIF (two RCA, one BNC, one TosLink), and one SDIF-2. The Upsampler also supports the emerging DSD-over-USB protocol (which dCS developed and offered to everyone free

as an open standard). This means that you can play DSD files from a server through the Vivaldi. The Upsampler also supports direct-digital playback from Apple devices, bypassing the Apple device's internal DAC. The Type A USB input will play files stored on a USB stick, with navigation and music selection provided by the front-panel display. dCS offers an iPad app that allows you to browse and play your music library from a server or network attached storage device through the Upsampler.

The Vivaldi Master Clock isn't in the signal path, but instead sits outside it generating a reference clock to which the Transport, DAC, and Upsampler are locked. Without the Vivaldi Clock, the Transport, DAC, and Upsampler run on their own clocks (which are themselves high precision), but those clocks are not perfectly synchronized with each other. In addition, the Vivaldi Master Clock improves the clock precision by an order of magnitude, from +/-10 ppm to +/-1 ppm. The advantage to the Master Clock is that all the digital operations occurring in the various chassis are all locked to the same, higher-precision, reference. Note, however, that when using the Transport and DAC alone, the Transport will lock to the DAC via the SDIF-2 interface's separate clock line.

Each of the four chassis has a display window showing operating status, including which input is selected, the upsampling ratio, whether the unit is locked to the Master Clock, etc. It took some experience with the system before I understood fully how it operated. The menu system is so extensive that the Vivaldi is, as previously noted, supplied with a menu hierarchy map. The Vivaldi is without question the most sophisticated and complex piece of consumer-audio hardware I've ever used. With one network cable and one USB cable attached, a fully loaded Vivaldi requires 14 cable connections—not counting the analog output cables. In addition, there are so many different combinations of settings that it's easy to find yourself listening to one that is less than optimum. After a few weeks, however, I had it down to just selecting the input on the DAC or Upsampler and occasionally changing filters. **RH**



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lid being taken off the top of the soundstage, with a resultant opening-up of the presentation. The impression of air around cymbals, for example, makes them more vivid and alive than a rendering that presents just the instrument itself. The latter sounds flat and lifeless, paradoxically being simultaneously bright yet lacking in treble extension. The Vivaldi's top-octave air and soundstage openness are unlike any other digital I've heard, and much closer to a great analog front end.

The Vivaldi's soundstaging pays tremendous dividends in the ability to hear individual musical lines and shift focus between instruments no matter how complex the music. The presentation is the antithesis of homogenized, thick, congested, and confused. This clarity of instrumental lines was apparent, and musically significant, on even small-scale music like the acoustic guitar and violin duet "Northern Lights" from the Dixie Dregs' *Freefall*, where the interplay between instruments suddenly became clearer, and the musicians' intent more palpable. Listen also to Joe Pass' comping during the muted trumpet solo in "Contractor's Blues" from the XRCD of Count Basie's *88 Basie Street* through the Vivaldi and any other digital playback device. The dCS conveys every nuance of his expression and in doing so, restores the energy, the unbridled swing, and sense of contemporaneous music-making that other digital sources dilute.

I would characterize the Vivaldi's treble balance as leaning toward the incisive rather than the relaxed. I'm generally intolerant of a bright or forward treble—it's a deal-breaker in my book. Yet the Vivaldi manages to present a full measure of treble information with no sense of forwardness or aggression. That's partly because the treble is so well integrated with the rest of the spectrum, is finely woven in texture as described earlier, and is presented in its proper spatial perspective within the soundstage. Bright digital sources force the treble forward and make it sound like a separate component riding on top of the music. The Vivaldi's treble is at once delicate and refined, yet full-bodied and



unrestrained. Moreover, the top end is richly and finely detailed, particularly at very low levels. It is also extremely clean and free from glare, another factor that allows the Vivaldi to sound fully alive in the top end yet not cross the line into brightness. When thinking about the Vivaldi's upper-midrange and treble I was reminded of Jonathan Valin's wonderful phrase "illuminated from within," which he first used to describe Audio Research electronics. That's exactly how the Vivaldi sounded—infused with light and air. The treble resolution sounded completely natural, devoid of etch, grain, glare, and mechanical artifice. Nonetheless,

## Technology: Scarlatti vs. Vivaldi

The Vivaldi came to life as the result of dCS engineers asking, "What are the limitations of the Scarlatti?" That four-box flagship was designed in 2007 as a cost-no-object project, and has stood the test of time. Still, six years is a long time in today's world given changes in component parts, increasing options for accessing high-res music, as well as advances in dCS' thinking and expertise. The decision was made to examine every aspect of the Scarlatti and create a new reference that would transcend Scarlatti. The Vivaldi is the result of that three-year development effort.

For starters, the digital-signal processing platform in each of the four chassis was redesigned from the ground up to take advantage of new field-programmable gate arrays (FPGAs) and DSP chips. The new chips enabled dCS engineers to greatly increase the system's maximum processing capacity, speed of data transfer, and overall performance. The Vivaldi hardware platform has 200 times the processing power of its predecessor. The additional power not only streamlines operations, but allows for future capabilities via software updates. In addition, some parts of the code that were previously in firmware are now in software, allowing easier upgrades. An example is the software that converts PCM or DSD data to the five-bit Ring DAC code; when dCS improves upon this algorithm you can load the new code via a CD update rather than replacing ROMs. The control-system circuit boards are now eight-layer rather than four-layer. Eight-layer boards are quite rare in high-end audio products.

One of the biggest differences between the Scarlatti and Vivaldi is the latter's use of new single-element latches in the Ring DAC (see sidebar). The Scarlatti employed 22 latch chips, each containing four individual latches. The Vivaldi's 96 separate latches confer a significant advantage in that there's no crosstalk between the latches as occurred when four latches were contained on a single chip. In addition, the new discrete latches offer higher performance.

The analog output stage is all new. It is 6dB quieter and has 20dB greater channel separation than the Scarlatti (100dB vs. 120dB). The two halves of the balanced signal are also more closely matched in performance, as are the left and right channel characteristics. The analog board's traces are routed by hand, not by an automated computer program. This allows the designer to optimize the layout and parts placement for the best performance.

The user interface is also more intuitive and streamlined. Certain functions that the user once had to manually perform when switching inputs, for example, are now automatic. The Vivaldi's greatly improved industrial design and cosmetics are readily apparent to anyone familiar with the Scarlatti. **RH**





## SPECS & PRICING

### VIVALDI TRANSPORT CD/ SACD TRANSPORT

**Outputs:** Dual AES/EBU with DXD or proprietary dCS encrypted DSD, AES/EBU, SPDIF (one RCA, one BNC), SDIF-2, word-clock in, word-clock out

**Dimensions:** 17.5" x 7.8" x 17.2"

**Weight:** 51.1 lbs.

**Price:** \$39,999

**Clock frequencies:** 44.1, 48, 88.2, 176.4, 192kHz

**Dimensions:** 17.5" x 5" x 17.2"

**Weight:** 29.9 lbs

**Price:** \$13,499

### ASSOCIATED COMPONENTS

**Digital Sources:** MacBook Pro;

AVA Media Zara Premium ripping server, Pure Music and Audivana playback software

**Analog Source:** Basis

Inspiration turntable with Basis Vector 4 tonearm, Air Tight PC-1 Supreme cartridge; Simaudio Moon 810LP phonostage

**Preamplifiers:** Rowland Corus, Constellation Perseus, Absolare Passion

**Power Amplifiers:** Rowland 725, Lamm ML2.2, Constellation Centaur monoblocks, Absolare Passion 845

**AC Conditioning and Cords:**

Shunyata Triton and Talos, Audience aR6TS conditioners; Shunyata Zitron Anaconda and Audience Au24 AC cords

**Cables:** Shunyata Anaconda interconnects and loudspeaker cables; MIT MA-X2 and MA-C interconnects, MIT MA-X SHD loudspeaker cables; AudioQuest WEL Signature interconnects, Transparent XL Reference interconnects; AudioQuest Diamond USB and WireWorld Platinum Starlight USB

**Equipment Racks:** Stillpoints, Critical Mass Systems amplifier stands

**Isolation:** Stillpoints Ultra SS and Ultra5

**Acoustics:** ASC 16" Full-Round Tube Traps, 10" Tower Traps

**Accessories:** VPI 16.5 record-cleaning machine; Mobile Fidelity record brush, cleaning fluid, stylus cleaner

### VIVALDI DAC

**Inputs:** Four AES/EBU (each can be used independently or as dual pairs to accept DSD or DXD); SPDIF (two RCA, one BNC, one TosLink); SDIF-2; one USB Type B; three Word Clock In

**Outputs:** One stereo pair balanced on XLR jacks, one stereo pair unbalanced on RCA jacks

**Output level:** Variable (maximum of 2V or 6V output user selectable)

**Digital filter:** Selectable, six for PCM and four for DSD

**Dimensions:** 17.5" x 6" x 17.2"

**Weight:** 35.7 lbs

**Price:** \$34,999

### VIVALDI DIGITAL-TO- DIGITAL UPSAMPLER

**Inputs:** Network (RJ45), USB (Type B connector), USB (Type A connector), AES/EBU, SPDIF (two RCA, one BNC, one TosLink), SDIF-2

**Outputs:** Two AES/EBU (can operate independently or as a dual pair to carry high-res PCM or dCS-encrypted DSD); SPDIF (one RCA, one BNC)

**Dimensions:** 17.5" x 5" x 17.2"

**Weight:** 31.3 lbs

**Price:** \$19,999

### VIVALDI MASTER CLOCK

**Outputs:** Two groups of four independently buffered outputs on BNC connectors

**Inputs:** Reference In (one BNC)



## The dCS Ring DAC

The Ring DAC, invented by dCS in 1987, is a brilliant solution to the challenge of converting digital data to an analog output signal. To understand the Ring DAC, let's first consider how conventional DACs work. You can think of a multibit DAC as a ladder, with as many rungs on that ladder as there are bits in a sample. A 24-bit DAC will have 24 "rungs," each one a resistor that corresponds to each bit in the digital sample. The resistors are connected to a current source through a switch; the digital data representing the audio signal open or close the switches to allow current to flow to the output or not. The currents of each rung are summed, with that summed value representing the audio signal's amplitude.

The resistor values are "binary weighted." This means that each resistor lower down on the rung must have double the resistance of the rung above it, and so forth, corresponding to the binary progression 1, 2, 4, 8, 16, and so on. Because each bit in the digital code represents twice the value of the next lower bit, each resistor must have a value exactly half that of the resistor on the rung below it. One problem with these so-called "Binary-weighted" DACs is that it's impossible to make resistors with the precision required for perfect binary weighting. The result is that the tolerances in resistor values introduce amplitude errors in the analog output. Moreover, those amplitude errors will occur in the same places on the audio waveform.

This problem becomes more acute the greater the number of rungs on the ladder. In a 16-bit resistor-ladder DAC the value of the lowest resistor rung should be exactly 0.0000152 the value of the highest resistor rung. In a 24-bit converter the lowest resistor value should be precisely 0.000000119209289550781 the value of the highest resistor. It is obviously not possible to achieve anywhere near this level of precision in resistor manufacturing, and any deviation from the resistor ratios translates to amplitude errors in the analog output.

The now-defunct UltraAnalog company addressed this challenge by driving its 20-bit DACs (which were composed of two off-the-shelf 16-bit DACs ganged

together) with 100,000 different digital codes, measuring the DAC output at each code value, calculating the degree of error in each specific resistor, and then having technicians hand-solder tiny precision metal-film resistors on the ladder rungs to bring them closer to the correct value.

A DAC technology that doesn't rely on binary-weighted resistor ladders is the one-bit DAC. This device converts a multi-bit code into a single-bit data stream that has two values, one and zero. Unlike a multibit DAC, the one-bit DAC's amplitude precision is very high, but the one-bit DAC suffers from very high noise that must be "shaped" (shifted away from the audioband). One-bit DACs are also very susceptible to jitter. dCS's solution is the Ring DAC, which can be considered a hybrid of the two approaches. It is based on a five-bit code that drives resistors of identical value. Because the resistors in dCS' Ring DAC are all the same nominal value their actual values are very close to one another. The five-bit code has a much higher signal-to-noise ratio than a one-bit datastream and requires an order of magnitude less noise shaping.

Digital signal processing first "maps" whatever datastream is coming in (192kHz/24-bit, or the 2.8224MHz 1-bit code of DSD, for examples) into a unique five-bit code. This five-bit code opens and closes latches connected to a current source that drives one of 96 resistors of identical value. Because these resistors can never have *exactly* the same resistance, the Ring DAC employs an array of resistors and randomly shifts the audio signal between resistors in the array. The Ring DAC gets its name from this "passing around" of the signal from one resistor in the array to another, as in a ring. The effect is to convert what would be amplitude errors in the analog output into a very small amount of random white noise.

The Ring DAC is brilliant in concept, and achieves its highest realization in the Vivaldi. The commonality in sonic character between all dCS products—the density of information, the resolution of fine detail, the unique spatial qualities—are probably attributable in large part to the Ring DAC. **RH**

I should mention that in my system I preferred the slightly softer-sounding DAC Filters 4 and 5 rather than the brighter and "sharper" Filter 1 (which dCS claims is technically "correct"). As you scroll through the filter choices, moving to higher numbered filters, the sound becomes increasingly more relaxed. Filter 5 has no pre-ringing (the filter's ringing energy is shifted so that it occurs *after* the transient rather than before *and* after the transient) and is useful when listening to hard-sounding 44.1kHz/16-bit sources. This illustrates the utility of having multiple filters available at the press of a remote-control button.

In the reproduction of bass—extension, weight, dynamics, articulation, pitch definition—the Vivaldi is simply in a class of its own. The bottom end is big and powerful, yet fast and delicate. The entire bass region has a clarity that, again, is unlike any other digital I've heard. This quality alone makes the Vivaldi revelatory—it conveys the texture, the body, and life of low brass, cello, acoustic and electric bass, piano, and kick drum. The Vivaldi doesn't dilute the timbre, dynamics, power, weight, or clarity of bass-rich instruments. The thundering left-hand lines of *Nojima Plays Liszt* [Reference Recordings], for example, conveys the piano's size, power, and authority, as well as Nojima's commanding mastery of this music. I had the same goosebump-raising experience with this recording as when I stood a few feet from a 9' Steinway while pianist Fan Ya Lin performed with powerful ferocity at the last Rocky Mountain Audio Fest. These bass qualities combined with the transparency, bloom around image outlines, and textural finesse described earlier to create a more credible illusion of an acoustic bass in my listening room than any other digital I've heard—by a wide margin. Listen, for example, to Edgar Meyer's superbly recorded instrument on the CD *Hop, Skip & Wobble* [Sugar Hill], a trio album with Jerry Douglas and Russ Barenberg. Rather than hearing a mere source of low-frequency sounds, I got an uncanny impression of the instrument's large wooden body resonating, and the attacks of each note expanding out into the room.



## dCS Vivaldi Digital Playback System



dCS' new factory



The oven and clock-measurement system.



The production shop.

### Inside the dCS Factory

I visited dCS' sparkling new factory last September to get the full technical briefing on the Vivaldi and to see first-hand how this extraordinary product is built. In 2010 dCS moved from an older building south of Cambridge to a brand new and very modern facility ten minutes north of the city. The new factory was built-out specifically for dCS to give the company greater efficiency of manufacturing.

dCS was founded in 1987 to build high-precision electronics for military applications, including ultra-precise analog-to-digital and digital-to-analog converters. The company then began applying its technology to professional audio, where dCS earned a reputation for extraordinary sound quality. dCS introduced its first consumer product, the Elgar DAC, in 1997. Since then the focus has been on pushing the envelope in high-end digital-playback systems. The company has 17 employees, five of them in engineering. The two leading engineers have between them more than 40 years at dCS. When visiting a company I always note the ratio of engineers to sales and marketing personnel; it gives you an idea of whether the company is technology-driven or marketing-driven. dCS is most assuredly an engineering-led firm.

The Vivaldi's industrial designer, Ray Wing, gave me a fascinating in-depth look at the design process via 3-D drawings on his computer. dCS wanted a distinctive new look for the Vivaldi and it achieved that goal. The front panels have gentle three-dimensional waves that are elegant and visually interesting, but exceedingly time-consuming to machine. Creating one front panel for a Vivaldi component takes four hours of CNC machine time.

As with all dCS products, the Vivaldi is software-intensive. All the control systems, upsampling, digital filtering, input receiver, and the algorithm that converts PCM or DSD to the five-bit Ring DAC code are created in-house. The metal work and printed-circuit board stuffing



Inside the Vivaldi-DAC



One of several testing stations.

are performed by local outside vendors, with assembly in dCS' factory. Each board undergoes testing before assembly, and repeatedly during the build process. Some of these tests take four hours to complete on an automated test-jig. The critical clocks inside Vivaldi are individually calibrated by putting them in an oven for four days, varying the temperature, and monitoring the clock's frequency drift with the changing oven temperature. A support circuit is individually calibrated for that particular clock's characteristics based on the measured data. Each component of the Vivaldi system (Transport, DAC, Upsampler, Clock) is visually inspected by three different individuals before the unit is boxed—the test technician, the production manager, and either someone from marketing or the president of dCS himself. RH



## dCS Vivaldi Digital Playback System

The Vivaldi's SACD performance was off-the-charts-great. Fabulous-sounding SACDs were sublime in their resolution, clarity, and lack of a "digital" signature. I recently discovered the Japanese label Eighty-Eights (distributed by Eastwind Imports). Judging from the first two discs I've heard from its catalog—*The Great Jazz Trio* (Hank Jones, John Pattitucci, and Jack DeJohnette) and Roy Haynes' *Love Letters*—the label is recording great music in state-of-the-art sound. All the titles are recorded originally in DSD and released as hybrid SACDs. The disparity between CD and SACD was not as great as I've heard from other players, but not because of any limitation in the Vivaldi's SACD performance. Rather, the Vivaldi's ability to make CDs sound so great vaults their performance closer to SACD territory than I thought possible. In comparisons between SACD and the same titles in 96kHz/24-bit PCM played from the server I'd have to give the edge to the SACD format for its smoother, more lifelike treble and concomitant greater ease. The PCM file, by comparison, has a hint of hardness in the treble not present in SACD playback. Cymbals reproduced in the SACD format are more delicate, airier, and lack the slightly hard timbre of PCM.

I was able to play native DSD files from a computer but didn't have the equivalent SACDs to make comparisons. I was also unfamiliar with the limited selection of music available. I can, however, report that the sound was superb and that the Vivaldi played DSD files with no problems.

High-resolution PCM files with which I'm very familiar were taken to another level by the Vivaldi. The low-level detail, spatial cues, and dimensionality of *Exotic Dances for the Opera* [Reference Recordings] at 176.4kHz/24-bit were stunningly portrayed. The Vivaldi revealed these spectacular recordings in all their glory. The qualities that make high-res better than standard-resolution—transparency, low-level detail, dimensionality—were fully realized via the Vivaldi's stunning resolution, timbral fidelity, dynamics, bottom-end weight and precision, and particularly, its tremendous dimensionality and sense that the soundstage is infused with air and light.

If you're wondering whether it's worth spending the money for the Transport in this age of computer audio, my view is that the transport is essential for several reasons. First, the Transport will allow you to enjoy the large catalog of SACD titles. There are enough great SACDs to make it worth investing in hardware to access this format. Moreover, the Vivaldi represents the highest realization of the SACD format now and in the foreseeable future; I doubt that anyone will ever build a player that eclipses the Vivaldi. And when dCS inevitably discovers new techniques for extracting higher performance from the format, those

techniques will likely be available via a software upgrade. Second, in comparisons between playing a CD in the transport and listening to a ripped file of that CD I thought that the Transport had a small but noticeable sonic advantage. You wouldn't think that reading data from an optical disc on the fly could be preferable to accessing a file from a hard drive, but to my ears the CD had a slightly greater sense of musical flow and involvement. It was hard to pin down to a specific sonic attribute, but the file sounded very slightly mechanical by contrast. The difference was small—less than that between USB or Ethernet cables, for example—so the disparity could have been my particular setup.

You might also wonder what contributions the Upsampler and Master Clock make. The Upsampler gives you more options for upsampling (the Transport's upsampling choices are limited), a networking capability, and an improvement in sound quality similar to that offered by the Master Clock. Adding either unit sharpens

the soundstage focus, deepens the spatial presentation, increases dimensionality, resolves more fine detail, and renders timbres with greater realism. Even without the Upsampler and Clock, the Vivaldi Transport and DAC pair deliver the best-sounding digital I've ever experienced. The Upsampler and Clock just take what is already a spectacular presentation to an even higher level. Note that when listening to SACDs the Upsampler isn't in the signal path; the Transport connects directly to the DAC via dual AES/EBU cables.

The Vivaldi sounds in many ways like the Magico Q7 loudspeaker: ultra-transparent, ultra-realistic in its rendering of timbre, precise without being analytical, wide in bandwidth, tremendous in clarity and resolution, with a bass presentation that combines authority with definition. The

Q7's transparency and neutrality allowed me to fully hear the Vivaldi's remarkable musical performance. The Vivaldi's clarity and textural density gave me a new appreciation for the Q7's resolving power and realism.

After listening to the Vivaldi for a month with it connected with generic digital cables (AES/EBU and BNC-terminated clock cables), I replaced the signal and clock cables (one at a time) with AudioQuest digital cables (Wild AES/EBU and Eagle Eye BNC). It wasn't a big surprise that the AudioQuest AES/EBU cables elevated the performance, but I didn't expect replacing the cables carrying the clock would make such a difference. The sound with the Eagle Eye clock cables became more coherent, relaxed, and more musical. It wasn't so much that the digital cables improved specific areas, but rather that the sound become more engaging and expressive. The Vivaldi is such a finely tuned instrument that it reveals everything, and at this level of quality, every improvement is significant.



### Jacob Heilbrunn On the Scarlatti and Vivaldi

Digital playback has long been the problem child of high-end audio. Suggest to a diehard vinyl lover that there might perhaps be some redeeming qualities about digital recordings and, more than likely, you will be met with a frozen or even pained smile. The implication is clear: For the true connoisseur seeking the audio truth and nothing but the truth, it is a foolish deviation, a trap and a snare, to listen to digital recordings. And for a number of years the disdain has not been wholly unjustified. Vinyl has always had an inherent relaxation and warmth that digital can only envy from afar. And yet in recent years, the gap has been narrowing between the two formats.

One company that has been at the forefront of that welcome development is dCS. A few years ago I sat up with a jolt when listening to the dCS Scarlatti playback system. There was a resolute quality to the bass and an abundance of detail that I had simply never heard before on digital. I bought it. Now dCS has upped the ante with its new Vivaldi system, which I first heard in New York at Ears Nova, where dCS introduced it to an American audience. Since then, I have had the opportunity to audition it in my own system.

Actually, that's baloney. I haven't been auditioning the Vivaldi. I've been reveling in it. While the Scarlatti was an excellent performer, the Vivaldi visually and audibly surpasses it in several important respects. For one thing, its casework is more impressive than the Scarlatti's—heavier and more inert, rendering it less susceptible to vibrations. It also looks more attractive than the Scarlatti.

But none of that would matter so much if the Vivaldi didn't offer superior performance. The differences with the Scarlatti are instantly apparent. It seems to be even tighter in the nether regions than its predecessor—on Christian McBride's sensational CD *Conversations with Christian* I was awestruck at the speed and energy of his bass. The notes seemed to fly into my room at warp speed. The Vivaldi also has more control and grip than the Scarlatti. It has more extended decays that seem to linger on into infinity. And it has a much more refined and

extended treble. Slam and dynamics are second to none. I could keep going down the audio checklist, but it's like breaking down a fine painting and discussing its individual attributes without recognizing its overall beauty.

Which is to say that these sonic attributes result in the most significant aspect of the Vivaldi when contrasted with the Scarlatti. The Scarlatti was unable to efface the sense of a slightly aggressive treble region. Not so with the Vivaldi. Plunk a CD in the tray or stream a high-resolution file, and the music seems to simply appear out of the ether with a sense of utter relaxation. The Vivaldi has, by and large, banished the sense of electronic reproduction and it has a nuance and filigreed sound in the treble that the Scarlatti lacked. There is an addictive and sensuous quality to the sound that approaches what, for better or worse, is usually called analog-like. Mind you, I'm not saying that the Vivaldi is superior to the Continuum Caliburn I use or other top-flight 'tables. What I do mean to say, however, is that given the quality of the Vivaldi, I am perfectly happy listening to CDs and that I don't find quarreling over the distinctions between the two formats particularly rewarding or edifying.

The blunt fact is that digital playback is reaching new heights. There is a gentleness and absence of grain, particularly in the mids and highs, that place the Vivaldi on an entirely different plane from the Scarlatti. Listen to the Lorraine Hunt Lieberson on Handel's *Julius Caesar* [Harmonia Mundi] and I defy you not to feel goosebumps at the pellucidity of the sound.

To my mind, the Vivaldi represents a revolutionary advance in digital playback. Over the past several decades, dCS has steadily refined its digital products. Each generation has represented an improvement over the previous one. Now dCS has surpassed itself with the Vivaldi. Indeed, when listening to it, I was reminded of the immortal remark by *Gilligan Island's* Thurston Howell III: "No one can pull the wool over my eyes. Cashmere maybe, but wool, never." Friends, the Vivaldi will pull cashmere over your eyes.

### Conclusion

After living with dCS' Puccini CD player, and then learning about the Vivaldi's technology, I had expected this new flagship to raise the bar in digital playback. I just didn't expect that it would raise it so far above the current state of the art. The Vivaldi is in a class of its own in every category—technical sophistication, capabilities, and most importantly, sound quality. It was mind-blowing to hear well-worn references brought to life with such realism; I never thought that I would hear such dimensionality, clarity, and timbral fidelity, or experience such musical involvement, from standard-resolution digital.

In addition to reference-class sound from CD, SACD, and high-resolution files sourced from a computer, the Vivaldi also sets the benchmark in functionality. There's nothing the Vivaldi won't do—PCM to DSD conversion, PCM to DXD, play DSD files, upsample any sample rate to any other rate, connect to a network for music-server integration, play files from a USB stick—the list goes on and on. Moreover, the Vivaldi's hardware platform is overbuilt for the current software; new features and capabilities can be added with software updates without taxing the hardware's capabilities. This state-of-the-art functionality, however, comes at a price: The Vivaldi is a highly complex and sophisticated instrument that asks much of the user in terms of selecting the operating parameters and monitoring the displays to be sure that the settings are optimized. In addition, I was not entirely satisfied by the music-server integration function. It was a challenge to set up, and the dCS iPad-control app is not as intuitive as, for example, the free Apple Remote app for iTunes.

If you are in the fortunate position of being able to afford it, there's no better sounding, more capable, more technologically advanced, or more future-proof digital source than the dCS Vivaldi. There's simply nothing else like it. It is truly, and by a wide margin, the *ne plus ultra* of digital playback. **tas**

# Introducing VIVALDI



It's almost unfair;  
*dCS* seem to play in  
a league of their own.

STEREOPHILE



Vivaldi redefines state-of-the-art in digital playback and represents the pinnacle of our 'no compromise' approach to product design – setting a new standard for the future of digital audio.

***dCS* Vivaldi is a complete digital playback system that offers unmatched sonic and measured performance.**

Designed for maximum flexibility with an array of input and output configurations it is easily set up and optimised for music systems with various digital sources.

Featuring the latest groundbreaking technology from *dCS*, Vivaldi will transform your listening experience, taking your music collection to levels you have not heard before.