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# The *dCS* Story

Celebrating 25 Years at the  
Forefront of Digital Audio

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“It’s a research-led company, and the people know what they are talking about.”

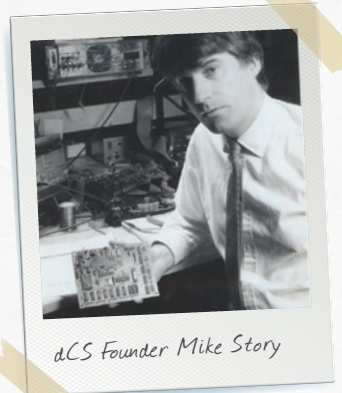
**So says legendary recording engineer Tony Faulkner about *dCS*, and he’s not the only one. What defines this company is what separates it from virtually all other specialist high end hi-fi companies, its background in hard science. Its history and culture – from its formation in Castle Park, Cambridge in 1987 to the present day – is steeped in top level digital engineering.**

The clue’s in the name. Data Conversion Systems did not set out to manufacture exotic digital music playback systems. “We did a lot of work for the Ministry of Defence,” remembers Technical Director Andy McHarg. “We were primarily a consultancy, and people would come to us with interesting and challenging problems, and we would attempt to fix them.”

The company was started by Mike Story, who – as well as being a hard taskmaster – is remembered by those who worked with him as something of a firebrand, a maverick design engineer of the very highest order. “In his technical field, Mike was world class, truly ‘A-star’ material,” recalls former *dCS* Executive Chairman Derek Fuller.



*dCS formation in Castle Park, Cambridge in 1987*



*dCS Founder Mike Story*

Mike studied physics at Oxford because, “you couldn’t really take electronics as a subject back then, it was still nascent.” He then went to Imperial College to do a PhD in electrochemistry, but duly realised that, “electronics was for me.” With venture capital backing and some other bright people from Cambridge Consultants, *dCS* launched and immediately began working on important contracts from Ferranti, Marconi Avionics and British Aerospace.

The company’s area of specialisation was radar, and specifically the analogue-to-digital conversion process at its heart.



Fuller remembers how the company’s work made a vital difference in the Yugoslav Wars during the mid-nineties. “Royal Navy Sea Harrier FA2’S flew, as I recall, 108 missions looking for Serbian helicopters, while the US Air Force flew F15s alongside. The Harriers either picked up enemy helicopters before the F15s could, or picked them up when the F15s didn’t.”

“The performance of the *dCS* system was a generation ahead,” agrees McHarg, “and we had to get the performance right, because the MOD have very stringent procedures for testing things – they tend to be serious.” When he joined in 1993, the company was just beginning its transition to audio. It was a kind of happenstance that the company got into this field; the ‘peace accord’ after the end of the Cold War meant that government spending on defence began to plummet. But at the same time, the digital audio revolution was taking hold, and *dCS* were proven experts in the technology.



## Sound Effects

**The company's involvement with music actually started as a sideline; the BBC came to *dCS* for some work on their DAT machines – quite a contrast to the RAF Typhoon radar test equipment they had just been working on. McHarg adds, “Every now and then, the Beeb would come back to us, and then there was a shift when we realised the consultancy stuff wasn't paying the bills.**

So in 1988 we started designing the first *dCS* 900, applying a lot of what we had done for the military in it. With radar you need extremely high signal to noise ratio, and we'd got that with our analogue-to-digital converters we had in the Harrier and Typhoon.”



“What a weird company,” remembers Director of Product Development Chris Hales, adding that,

**“at the time it wasn't always clear what we were trying to achieve.”**

But the eventual launch of the 900 analogue-to-digital converter focused minds and opened up a whole new vista for the firm, effectively pushing it down the road it is on today. It was at this point that *dCS* gave its technology a name, its new converter being the world's first 24-bit design, using the now legendary Ring DAC circuit.

It didn't take long to catch on, the new 900 causing a sensation in professional audio circles worldwide. Gateway Mastering Studios supremo Bob Ludwig recalls,

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**“when I heard my first *dCS* converter it immediately shot to the top of the pack”.**



Bob Ludwig



Tony Faulkner in HWH London with George Lloyd (composer)

Arranger/composer Tony Faulkner agrees, noting that, “*dCS* were the first people who came up with an A-to-D converter that we could plug into our PCM gear and make it sound better. They are innovators with their roots in technical engineering theory, and build the whole thing from first principles.” He recalls hearing the difference, for the first time.

“The top end was sweeter, the noise floor was more even and less crunchy, and it sounded cleaner at low levels. I also noticed that the bottom end had more extension, because if I put *dCS* in on a piano recording, then suddenly there was an extra octave of bass. The company's experience of radar must have given them linearity to very low levels.”



Bert van der Wolf at Northstar Recording was another early adopter of *dCS* 900 converters.

“I still believe these vintage units beat even the most recent chip converters on the market as far as the digital processing is concerned,” he declares.



Bert van der Wolf

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“These units were the only digital devices at the time which had a decent performance in comparison to the still-current analogue recording options we had. Most rival companies used off-the-shelf chips which were by far not up to the job in the nineteen eighties,” he adds. “They all sounded rather brittle and did not behave well with dynamic signals and certainly not with true acoustic information. It showed in many CD productions on the market back then, that aside from *dCS* analogue was in most cases superior in tonal quality and micro detail.”



Children's opera *Brundibar* recording in Prague 1991

The next step of course had to be a digital to analogue converter, and *dCS* naturally oriented it for professional studio use. “It was quite clear early on that this was going to be the best in the world, because of the Ring DAC performance and the flexibility and modularity of the *dCS* control board, which used Field Programmable Gate Arrays,” said McHarg.

Being the world's first 24-bit DAC, the **950** was unique, and put the company **straight** to the top of the specialist digital class. It got a rapturous reception from recording professionals like Bob Ludwig. “A mastering studio's motto is ‘first do no harm’, and it's imperative that we use the best sounding gear we can for our work, so there are no weak links in the system,” says Ludwig, “so we began routinely using the 950.”

**24** BIT  
**192** kS/s

Faulkner adds, “What we got from *dCS* was a piece of glass that let us see what we wanted from the other side; that's what they do.”



Founder Mike Story was a strong character. “Undoubtedly one of the cleverest people I have ever met,” says McHarg. However, still the company wasn't completely secure, the view being that it was still obsessing with technological challenges rather than the imperative to pay the bills and keep the wheels turning. “He regarded software as a necessary evil to make hardware, and would much rather do something that was technically interesting, rather than something that was profitable!”

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Happily for *dCS* however, the 950 **was** profitable, but it only really became so when the company managed to jump from professional audio to domestic high end hi-fi. Derek Fuller remembers how the company's Japanese distributor took it to various recording people who said,

**“Wow this box is amazing, it sounds far more analogue than anything we’ve heard before.”**

This turned the specialist audiophile press on to it, and, “Japanese hi-fi magazine reviewers found that when they put this ugly box into their systems, it sounded fantastic, and way better than a lot of far more expensive beautiful boxes!”

Still, there's no denying the quiriness of the first 950. “Here was a DAC in a box with rack ears and industrial design that could have been done by the local primary school, but people got excited about it because it was such a special sounding product,” recalls Fuller.

Mike Story remembers it with similar affection. “The 950 just didn't sound digital. Digital audio sounds pretty good when you first listen to it, but can be fatiguing. The 950 didn't, and it was particularly good with classical music.” This new 950 duly went on to win the first audiophile award for *dCS* in Japan.

At this point, the company realised its future was in high end digital audio. Rapturous reviews – rarely given to companies with little or no history in the hi-fi industry – indelibly stamped the brand into the minds of discerning listeners around the world. Suddenly the company was seen as one of the key protagonists of digital music playback. “That was the moment when we made the shift,” remembers McHarg.



**“Our consultancy work wasn't paying the bills and our Japanese distributor was selling vast amounts of *dCS* to audiophiles...”**



## Ring Tone

**The secret of *dCS*' success was of course its digital conversion technology, something it had already proven in mission-critical military applications. The 900 ADC and 950 DAC pro products were simply audio-specific implementations of this, and where the term Ring DAC first appeared.**

By the mid nineteen nineties, there was no shortage of digital-to-analogue converters on sale, virtually all of which used bought-in, off-the-shelf digital conversion technology, usually from the inventors of the Compact Disc format itself, Philips and Sony. However, the *dCS* DAC used no off the shelf technology whatsoever; every part of the hardware and software design and development at its core was done in-house by the company's R&D team. This is precisely why it sounded, and measured, so special.



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To understand why the Ring DAC design was and is unique, it is helpful to look at a normal DAC chip you can buy from any number of manufacturers. When the Ring DAC appeared, ladder DACs and binary-weighted DACs were ubiquitous. They involve feeding the digital data to a resistor array with values accurately trimmed to either 1:2 or 1:2:4:8:16:etc. The currents flowing through the resistors are added together to reconstruct the analogue signal.

This works reasonably well, but isn't bullet-proof, because the resistor values are not exactly matched and will vary in accuracy over temperature slightly.

"And if you have an error," explains Andy McHarg, "that will always be linked to the audio signal, and this manifests as distortion which the ear is very good at picking up. It's hard to get right, he says, and crucially it is particularly hard to get right over time and over ranges in temperature."

The Ring DAC oversamples to about 3MHz, noise-shapes to 5 bits and decodes the binary data to 32 balanced lines. Instead of requiring sixteen high-precision resistors, the Ring DAC drives 32 pairs of standard resistors. In fact early 900 series converters used 32 pairs, from 950 to Debussy used 44 pairs, and now Vivaldi uses 48 pairs.

**"The key thing is that you turn on different current sources randomly, so any error is not related to any particular signal coming in – you de-correlate the signal from the error," he explains.**

Doing things this way does generate a little more noise, but it is random background noise rather than something tied to the music. "The brain has a very effective way of filtering this out," he adds, "so we felt quite proud of the 950. It was totally different to what else was available."

Music producer Tony Faulkner agrees. "The problem with digital is the nature of things that are wrong, it's not de-correlated noise which your ears hear from conventional DACs. Indeed, with digital the errors manifest themselves as a type of noise that isn't easy for the human brain to filter out. We can hear filters, non-linearities and sweeps, and the ear is very sensitive to transients, and phase differences in transients." Faulkner's earliest high-end digital weapon of choice was a *dCS* 900, basically a hand-built prototype, which he got his hands on in the 80s.

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"It was a remarkably powerful thing, one of the first oversampling converters, with technology only used in radar at that time." What I found most attractive about the advent of digital technology was the fact that it kept real control of the recording in the hands of the engineer. "When I first started, we would be literally cutting and splicing bits of tape together; in the studio you might put the treble up or down to change the shape of the sound but that was pretty much it. Digital gave me direct control."

All well and good, but as Derek Fuller noted, "the *dCS* 950 was an ugly box." What was needed was a far more elegant and easier-to-use product, and in 1996 the new **Elgar** became precisely this.



"We had assumed the only people interested were recording studios, but when the 950 came out we started realising there were consumer applications too," recalls Mike Story.

With its casing designed by distinguished industrial designer Allen Boothroyd – stylist of the Design Council Award-winning Lecson AC1/AP1 pre-power amplifier – it was a far more aesthetically and ergonomically appealing machine.

"In 1996 we hatched a plan," Fuller says, "which was to take the guts of this box and make it a high end consumer product."

Needless to say, it was a fight to get the Elgar to market on time, and the Herculean task of making it ready for its official debut at the New York hi-fi show really took its toll. Still, the industriousness of the design team prevailed and a working prototype was ready **just** in time. Tragically however, glory was never snatched from the jaws of defeat, as that very first Elgar was damaged in transit to the show. Instead, professional *dCS* converters were demonstrated, while the internally damaged Elgar sat sheepishly on a display plinth. Still, even this caused a stir!

"I reviewed the original Elgar DAC in July 1997," remembers *Stereophile* editor John Atkinson. "It floored me with its sound quality – both with CD-sourced audio data and the fact that it would play back digital data with up to 24-bits word length and a sample rate of up

to 96kS/s". At the time, he wrote, "it was when I abandoned 16-bit CDs and DATs that the Elgar scaled the highest sonic heights. Not only did my 20- and 24-bit master tapes sound delightful in their analogue-like sense of ease; that delicious sense of detail when the processor was used straight into the power amplifier was invaluable."





*dCS* live demonstrations were becoming special events in themselves. Whenever the company went to hi-fi shows they were always extremely well attended, and treated with a kind of reverence that professional hi-fi journalists don't always display.

*"We had a demo where we recorded 16/44 and a 24/96 at the same time," remembers Fuller, "and if you dragged people off the street then they'd come in and hear the difference easily."*

"You only needed a bar of the music before people said 'wow, that's amazing!'. Indeed, one of the mastering engineers who was present at one of our live demonstrations even said 'wow' before the music itself started, because he could hear the chapel where the recording was made!"

1996 was a big year for *dCS* then – indeed you might call it the first of its modern era. The company ended its consultancy work to focus exclusively on design and manufacture, and to do this it relocated to the Great Chesterford manufacturing site, south of Cambridge. "That was the time when we decided that we'd cut the company back and just do audio, which we all enjoyed so," remembers Mike Story.



*dCS relocates to Great Chesterford manufacturing site, 1996*

Despite the success of Elgar, *dCS* had its sights set square on the pro market, and forged further links with the BBC. Its archive was stored in Windmill Road, Brentford, and the engineering department had a dedicated analogue line to Broadcasting House in London.

The BBC used tape machines that ran at six times normal speed to transfer from the archive to Broadcasting House, but found they needed to move everything to Perivale Park, but couldn't – as Andy McHarg puts it – "dig up half of London to move the dedicated line." Instead the BBC leased a digital line, and duly needed a way of sending the high speed tape audio over it.



*dCS* developed a special analogue-to-digital converter and DAC running at 192kS/s (unheard of at that time) to link up the Beeb's new archive site and Broadcasting House.



## Up and Away

Another landmark product arrived in 1997. The *dCS 972* was the world's first 24-bit, 96kS/s-capable digital-to-digital converter, and something Andy McHarg describes as a sort of, "digital audio Swiss army knife," able to convert a digital signal of one particular bit-depth and sampling frequency, to another at a different one.



At first sight, one might be forgiven for dismissing this as a rather arcane recording studio tool, but a sequence of events unfolded to make the 972 arguably one of the *most* important digital products of that decade. It proved just as important in the great digital scheme of things as the original 950 DAC, perhaps even more.

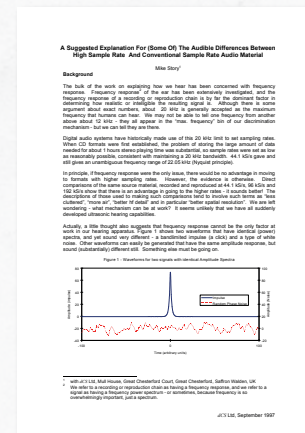
Technical Support Manager Martin Reynolds takes up the story. "During a round of software verification I was using a 972 between a Transport and DAC and the results were astounding. I suggested that one of our golden eared distributors in Asia play around with a similar setup. He duly did, using the new 972 with his Elgar and a CD as the source.

He called me up and said it sounded better if you upsample the signal. We tried it in the factory, and he was right – when you pushed it from 16/44 to 24/96 in the 972, there was a definite sonic improvement.

So I phoned up the boss, Mike Story, and told him. "Bullshit," he replied angrily, telling me that you couldn't make CD sound any better because its digital ceiling was only 16-bits high..."

Martin persuaded Derek Fuller to get involved at this point. "I rang up Henry Dienn in Japan, and Steve Lee in the United States, and told them exactly what we'd done and asked them to replicate it with the kit they had out there. Both guys came back to me and said it sounded so much better than the non-upsampled sound without the 972. Mike grumpily accepted that it *was* possible that upsampling was improving the sound, and went away to figure it out technically. He eventually produced a paper on it!" The news seeped out into the hi-fi press, and suddenly the idea of 'upsampling' caught on.

Andy McHarg thinks the 972 was a very "industrial" component, but despite this *dCS*' prolific Japanese distributor managed to get the journalists fascinated. Still, for all the difference it made, the company soon realised it wasn't going to have universal appeal if it stayed in its 900 series work clothes, and so the **Purcell** upsampler was born. Costing around £4,000, it was a lot of money for a black box, but the improvement in sound that upsampling brought was enough to win it many friends.



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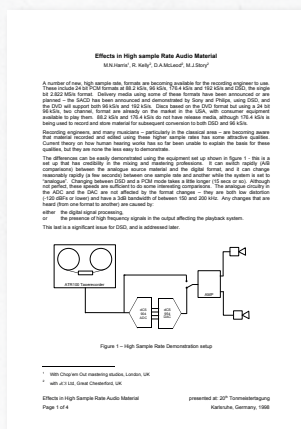


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Although Mike Story was right to insist that you couldn't retrieve any more data than what existed on the disc – because it's fixed at 16-bit, 44.1kS/s as per Philips' original Red Book specification – upsampling proved that CD could, if processed intelligently, be made to sound less like digital and more realistic. This is where Upsampling came in as it presented listeners with a more spacious, organic and detailed sound than previously heard. The 972 featured a dedicated processing platform that increased the bit depth (from 16 bit to 24 bit) of any chosen digital source and raised the sampling frequency far beyond the audio band. At the same time, the heavy filtering required in the DAC was now processed by the Upsampler meaning that the DAC had a much gentler and higher frequency cut off.

This step removed a lot of the artefacts of digital processing to which the ear is sensitive, which is not the case with standard, non-upsampled CD. "It's not hard to hear the benefits" says Martin Reynolds. "Standard audio played at CD standard 44.1kS/s is good, but there's always some forwardness and blur to the upper midband and treble, as the inevitable phase inconsistencies of the standard digital filtering come into play. But switch on upsampling, and it's as if the sound has been 'tidied up'; CD suddenly gains clarity, smoothness and coherence that it previously lacked." It's a simple idea really, but *dCS*' products first made the discovery possible, then the company discovered it and finally theorised the scientific explanation.



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Upsampling CD players and DACs are now almost ubiquitous thanks to this, the second bright idea the company had come up with in as many years. *dCS* was still dining out on the brilliance of the 24/96-capable Ring DAC based converters, then suddenly it was first to market with digital upsampling too. "I think we did quite a good job here," remembers *dCS* founder Mike Story, with typical British understatement.

The *dCS* 904 and 954 had both arrived in 1997, being updates of previous 902 and 952 24/96 series products, but were now able to offer 192kS/s sampling rates.



This was regarded by the hi-fi press as little short of fantastical at the time, for both these units were the first on sale with 24/192 – continuing a pattern that *dCS* was becoming famous for. The hi-fi world may have been impressed, but it wasn't regarded as a particularly glorious moment inside the company, simply because all *dCS* converters had been built to be thoroughly extensible and future-proof from the outset. This was simply the next iteration of the Ring DAC technology, which Andy McHarg says was originally designed with higher sample rates very much in mind. "The internal oversampling rates were chosen so that they would still work at 352.8 or 384kS/s," he confides.

In 1998, there was a whole tranche of upgrades. DSD capability was added to the 904 and 954, the 972 software was updated to add 24/192 plus DSD, and the Elgar was upgraded from 24/96 to 24/192.

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Now Director of Product Development, all *dCS* products have Chris' fingerprints all over them, metaphorically speaking.

He recalls that the company seemed quite baffling when he first joined, with so many projects flying around the ether. "We were churning out lots of software updates – the 954s, the 904s, the Elgar, the sample rate converter – and I was testing the new releases of software, making sure they worked as intended and generally making a nuisance of myself by being 'fairly inflexible' when I thought things weren't working correctly!"

Chris's background was in designing power amplifiers and professional studio mixing desks, so he remembers that, "all the high level digital stuff was a steep learning curve." Still, he soon become intimately involved with production and testing, "I made it my own business to keep an eye on gremlins bubbling under the surface, which you get during the early phase of the design cycle," he says. Nowadays, "I'm still very attuned to and concerned with product quality, reliability and consistency – it's almost as if you have a sixth sense for problems. One intuitively feels when a product isn't right, and I am like a dog with a bone when I find a fault!"

Around this time, *dCS* decided to make its unique technology more affordable – and tried a two-pronged assault. First, the company licensed its Ring DAC technology to Arcam



1998 - Chris Hales joins *dCS* as Verification Engineer

for use in the £1,000 Arcam Alpha 9 CD player, and the £1,500 FMJ CD23 that followed it a year later. The world's hi-fi press was beguiled, saying the new Arcam Ring DAC players had a unusually smooth, open, clean and even sound. Reflecting the different standards that *dCS* works to, Andy McHarg remembers it with less enthusiasm. "The Ring DAC on a chip was a bit too noisy to be a *dCS* product," he says sniffily. However, the new *dCS* **Delius** which appeared in 1999 was very much up to par, being an oversampling DAC based on Elgar DAC technology, styled to match the Purcell Upsampler. Now, fifteen years later, oversampling DACs are ubiquitous.

*dCS* founder Mike Story recalls that, "we put a lot of effort into making things software-controlled. I think other people have realised this now, but at this stage this was almost unheard of." This meant it was possible for the company to continue to upgrade its products in the following years. Field Programmable Gate Arrays – essentially easily reprogrammable logic chips – are initially expensive to design and implement but make life so much easier when upgrading or updating products. For example, *dCS* do S/PDIF decoding in an FPGA rather than buying a general chip with preset functionality in from an OEM supplier such as Wolfson.

"The upside to this is we know exactly what it is doing, so we can design it to do the job required, rather than a generic one." explains McHarg.



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**24**<sup>BIT</sup>  
**192**<sup>ks/s</sup>

It also makes updates easy, so taking *dCS* DACs from 96kS/s to 192kS/s sampling frequencies was done by the simple expedient of a software update. “The downside is that you have to do all the design work yourself, and it is quite a bit more expensive, in terms of both the hardware, and the effort needed,” he adds.

The use of FPGAs has been key to *dCS*’ success, because it not only allows the company to instil its knowledge into its products at an almost atomic level, but it makes these expensive boxes – as much as possible – future-proof. *dCS* understands that when you spend this much money on a ‘black box’ then the last thing you want is for it to be obsolete or irrelevant in a few years’ time.

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“The entire digital signal path is done via a combination of FPGA and DSP,” says McHarg, “both of which are reconfigurable in the field, so a *dCS* product will typically evolve quite dramatically during its lifetime, whereas most other manufacturers use a selection of off-the-shelf components which are fixed function – their products will have very limited ability to change over their lifespan”.

The Elgar is a perfect example of *dCS*’ approach – its platform has gone through three or four major architecture improvements according to Chris Hales, with increased processing power and flexibility in the hardware bringing superior sound and functionality.



## Pro-Lific

In the late 1990’s, the *dCS* 990 and 992 Professional Master Clocks were released, providing pro audio multi track systems with a really accurate, clean clock source in the quest to eliminate jitter. Another fascinating product almost appeared at the turn of the new millennium too; the new *dCS* Grieg was supposed to be a consumer analogue-to-digital converter/up-sampler based on the 904 and Purcell, but sadly never made it into production, the company feeling there wouldn’t be sufficiently strong demand.



Meanwhile, behind the scenes, *dCS* engineers were busy putting their expertise to use by developing their own automated in-house test facilities. This was vital for the company as their converters were performing way beyond the limits of conventional audio test equipment.

Called, predictably, ‘AutoTest’ this system used their expertise in FFT analysis to allow automated parametric testing of *dCS* products that covered all aspects of outputs, functionality and configurations.



‘AutoTest’, *dCS*’ own automated in-house test system

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# DSD

Direct Stream Digital

1999 also saw the birth of P3D, a format developed by *dCS* for Philips to store Direct Stream Digital recordings natively. "We were developing a rack of three ADCs and three DACs to make six-channel DSD possible, but there was no method devised to store DSD. P3D allows a stereo DSD stream to be stored in three lots of 24/44.1 stereo streams, which can be stored on non DSD-aware hardware. The extra 8 bits/sample of excess capacity was used for error correction, so the playback system could be sure that the stream was intact," explains Andy McHarg.

The **972** was already capable of 176.4, 192 & DSD operation in 1998 but soon after the new *dCS 974* arrived, which was effectively a 972 able to run 192, 176.4k, P3D and 4-wire DSD formats.



Gateway Mastering Studios' Bob Ludwig is one satisfied owner. "*dCS* were pioneers in high resolution digital recordings. They had the world's first 96kS/s-24-bit DAC and ADC which I used for the world's first commercial high resolution digital mastering session (88.2kS/s-24-bit) in 1996 and I also used *dCS* converters to master the world's first commercial Super Audio CD (Guano Apes 'Don't Give Me Names')."

"To this day I still use my *dCS 974* digital-to-digital sample rate and format converter box. I believe it is still one of the only ways to sample-lock six channels of surround sound



Bob Ludwig's *dCS* kit

and sample frequency convert the signal in real time using a user-selected choice of anti-aliasing filters. We had the *dCS 972* before these, and also own a *dCS* Master Clock and various *dCS* AES and S/PDIF distribution amplifiers. That's a lot of boxes from *dCS*!"

Despite the company's recent successes in the domestic hi-fi market, it didn't shirk from its involvement in the professional recording industry side. Indeed, *dCS* was exceptionally prolific at this time, with numerous new products and updates at the turn of the new millennium, and new formats too.

The early noughties saw the launch of the 995 Master Clock for studio use closely followed by the Verona Master Clock for home use. 2004 kicked off with another world first for the company with the new *dCS 905*, which was the world's first 24-bit analogue-to-digital converter running at up to 384kS/s.

Rene Laflamme of Fidelio Technologies is a huge fan, and a regular user of the 905 in his studio to this day. "They have the most realistic tonal colour I have heard," he says. "They convey the true colour of the music and also have great energy and body. I've only come across a few others that do this, but they have a very 'hi-fi' sound with less richness. I love the soundstage and depth perspective of *dCS* converters, too."



Rene Laflamme



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Back in 1997, the *dCS* 954 DAC replaced the 952, adding 176.4, 192k, P3D and 4 wire DSD. In 2002 the 955 DAC appeared with a vacuum fluorescent display instead of the former's seven-segment LEDs, plus a more powerful control board.



**DXD** DXD was first prototyped on the 974, 954, 904 – it's a name given to 24-bit/352.8kS/s PCM digital audio, and the sonic results were spectacular. This feature was soon added to the company's pro products as DSD is extremely difficult to work with natively in a workstation/mixing desk, according to McHarg. "It gives very similar transient performance to DSD, but doesn't have the same difficulties manipulating it, so it is a convenient format to work in to generate a final DSD release."

2005 saw the company develop yet more pro units – the *dCS* 578 and *dCS* 978, which helped the BBC out with its W1 local radio refurbishment programme, and more tweaking was done to the innards of converters, with a new 'V7' control board with new FPGA chips giving beefed up processing performance. Commercially, the company went from strength to strength, cementing its reputation amongst the world hi-fi press as the pre-eminent digital conversion specialist, 'stopping the traffic' at hi-fi shows with its legendary demonstrations of what was possible in tomorrow's digital world. 'It Just Doesn't Get Any Better Than This!' proclaimed *Stereophile* magazine about the **P8i** Upsampling CD/SACD Player which was launched in April 2005.



## New Life

**2006 saw a major change at the top, with Mike Story stepping down.**

There's a sense that he wasn't quite as comfortable in the sometimes cultish world of specialist high end hi-fi as he had been with earlier incarnations of *dCS*. Colleagues report that his immense engineering talents were ideally suited to the more rarefied, academic climes of aerospace and the linear world of the recording professionals – but consumer hi-fi wasn't such an easy fit. "I really enjoyed working in the professional audio world," he remembers, "but I personally found the high end hi-fi world a bit more difficult because I had less empathy. Contrast that to pro audio and the fact that serious musicians were going out of their way to use our stuff, which I personally found very uplifting."

Unsurprisingly, Story moved on to do great things with CSR Ltd., a pioneering designer and developer of silicon and software for consumer electronics – specialising in leading edge wireless connectivity chips.



*Andy McHarg is appointed Technical Director*



*Chris Hales becomes Product Development Director*



*David M Steven is the new Managing Director of dCS*

Taking over the big chair was never going to be easy. A management buyout saw David M Steven installed as the company's new managing director, and he brought a different style. Steven was far more at home in the specialist hi-fi market than Story had been, and felt confident enough to consolidate the fine foothold that it had already achieved.

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This led to his audacious decision to produce the **Scarlati** CD/SACD player system, something his successor David J Steven describes as visionary and brave. Here was a £33,000 three-box transport, DAC and clock designed without compromise.



In 2014, there's an abundance of cost-no-object 'statement' products around, but in 2007 this wasn't normal industry practice. "It was so scary and adventurous that it might have seemed foolhardy, and yet it was so monumentally changing for *dCS*, and gave *dCS* the confidence and platform to develop the range it has today," adds Steven.



What Hi-Fi magazine described it as,

**"the finest-sounding digital player we've ever heard."**

So it should have been, considering it was *dCS*' **very** best. In the company's already eventful history, it was another major moment. It not only sent a clear signal to the hi-fi industry that digital audio was capable of a sonic performance that people had not previously imagined, it also underwrote *dCS*' position right at the top of the food chain.

"The Scarlati platform was a huge chunk of work, where we redesigned absolutely everything," remembers Andy McHarg. It made a big impression on those running the company too, because they elected to leave the pro audio market entirely, to focus on hi-fi. Effectively, the page had been turned, and the third chapter of the company had begun.

David M Steven brought about a different culture inside *dCS*. Whereas Mike Story wasn't in the habit of debating strategy with his colleagues, Steven was different. "There was quite a ground shift when David grabbed the reigns, particularly with the shop floor guys, most of whom had worked alongside David in his previous Sales role, and so knew he was approachable, tolerant and good company. He laid foundation stones for *dCS* that others could only dream of, both in terms of envisaging that *dCS* could not only survive but grow, and also in leaving a little room for a little fun too," recalls David J Steven. He adds, "He was a kind, considerate boss who always listened, although if he didn't like what was being said, he had a habit of putting his fingers in his ears and humming..."

"I first met him at a Frankfurt High End Show, where we used the *dCS* converter to very good effect," remembers Wilson Audio's VP of Marketing, Peter McGrath. "It was extraordinary – at that time I was bringing my own recordings along and I recognised things I'd never before heard. He was very open and flexible, and they couldn't be a nicer group of chaps, bottom line."

"I talked with David Steven Senior at an audio show, soon after he took over the company," adds John Atkinson. "I was impressed both by his analysis of the high-end audio market, and the strategic direction he outlined for me." Indeed one key aspect of this was the Japanese market. It became an increasingly key territory for the company. Sheen Uchida of Taiyo International remembers why he decided to fight for – and win – *dCS* distribution in Japan.



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“Trust is the key, and David Senior was a very sincere and honest person. He even took time to help my son out with his English literature study, kindly explaining the special expressions in a Truman Capote novel! The personality of the president is very important. We got on very well and by our second meeting he had already decided to go with us.”



David M Steven, Sheen Ushida, Nobuyuki Fu, Tokyo 2007

2008 was a prolific period for the newly energised R&D team led by Hales and McHarg as *dCS* set about developing an outboard Upsampler for the Scarlatti range that would use innovative USB technology aimed at the emerging computer audio market.

In addition to the Scarlatti Upsampler there was a trickling down of the Scarlatti technology into two new product ranges; the Paganini system comprising dedicated CD/SACD Transport, Upsampler, DAC and Clock and the integrated Puccini CD/SACD Player and Clock. These ranges saw a departure from the industrial design usually associated with *dCS* to a much more elegant yet timeless look.

Puccini, a one box DAC and CD/SACD Player, was a revelation as it contained everything that was special about *dCS* inside one box. Word spread and Puccini was soon winning awards worldwide, going on to become the company's most successful product of all time.



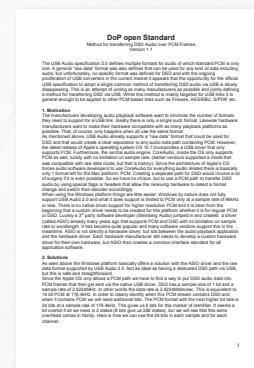
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“It's almost unfair; *dCS* seem to play in a league of their own” proclaimed Stereophile magazine. Still, it's wrong to see the increasing prominence of *dCS* and arrival of David M Steven as a softening of the company's engineering edge. Because during this period, *dCS* did it again, going back to its old trick of inventing something that was to change digital audio.

Andy McHarg remembers that at the time, people had started using computers as a high resolution music source; the growing availability of hi-res files had rather left optical disc transports behind. “It seemed like a logical step,” he says, “as there were a few USB DACs about at the time, but just about all of them used an off-the-shelf USB to I2S or USB to S/PDIF chip. These used a mode called ‘adaptive isochronous’ where the audio timing is derived from the USB frame generated by the PC, which is sub optimal at best.” *dCS* discovered that the protocol also provided the ability to send clock signals too, in ‘asynchronous isochronous’ mode. However, none of the chipsets used this, so the company set to work on developing special software and firmware to implement it.

“This was the **only** thing worth doing with USB,” reckons McHarg. It's not an ideal way of sending digital data, but can be made to work surprisingly well in asynchronous mode. The first *dCS* product ever to use this system was the **Scarlatti Upsampler** at the end of 2008, and then in 2010 Arcam licensed it for use on its fine little £300 rDAC. As soon as this happened, every budget DAC had to have the *dCS* system, and it spread like wildfire. Just as with high resolution digital and upsampling, the company once again helped to transform the digital audio landscape.



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Note: In 2013 McHarg then led a group that developed the DOP standard, a novel and very easy to implement method of carrying DSD audio data in a PCM frame.

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## The Fourth Age

**Then in 2009 tragedy struck. Managing Director David M Steven, still in his mid-50s, suddenly died.**

His son, also named David, somewhat earlier than planned took up the reins of the company and the audiophile world waited to hear what this would mean for the future of *dCS*.

With a family history steeped in audio and having moved from a Software Product Development role in the US to join *dCS* in early 2008 David already had a firm grasp of where *dCS* was headed. Realising the need to introduce certainty into this uncertain situation, the new Managing Director made it immediately clear to the world that he was totally committed to ensuring that *dCS*' benchmark position in the audio market should not only be maintained but even extended.



*David J Steven becomes new Managing Director in 2009*

*“2009 was a very difficult year for all of us at *dCS* as my Father had helped to turn the company around and built the foundations that allowed the extremely talented team at *dCS* to flourish. My first act was to gather the team around and develop a strategy that we would collectively own.”*

The strategy that he then developed and pursued has led to three major outcomes:

1. He relocated the company from its increasingly cramped facility south of Cambridge to much larger, custom designed premises in Swavesey, west of Cambridge. Although by no means luxurious this new HQ has offered the company far more space for world class assembly / testing facilities and the development team, as well as enabling David to realise a long-held ambition: to build a customised listening room.
2. As a result of a comprehensive review of the *dCS*' product range, he concluded that *dCS* would need to become 'source agnostic' by being able to support digital audio received from any source – be it silver disc, PC or streamed via a home network. The first product to embrace this strategy was the beautiful **Debussy DAC**, a state-of-the-art one box system that Jeff Dorgay of Tone Audio described as, “a triumph, bringing world-class digital performance to a price point previously out of most audiophile's reach.”



*The new custom designed premises in Swavesey*



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3. He told his R&D team that the company needed to use the success and confidence gained from the Scarlatti generation of products to push the state of the art in DAC technology even further. The original design goal for this research project was to improve the Ring DAC on every important technical dimension (noise, crosstalk, distortion) as well as improving the dCS Digital Processing Platform (capacity, speed, jitter). After 3 years of intensive development and listening tests a new flagship generation of electronics had been born – the dCS Vivaldi Digital Playback system.



The technical challenges that had to be met to create Vivaldi were very substantial as was made clear by Andy McHarg, dCS Technical Director. “It’s probably our biggest ever upheaval in technology, the new digital processing platform is fifty times as powerful as the last, and the analogue board offers improved performance in every measurable aspect”.

Northstar’s Bert van der Wolf adds, “I suspect because the requirements in the military area are much higher than the music business, that this gave dCS a tremendous head start and a completely different philosophy to most other companies. In my opinion, this philosophy has been maintained over all these years, and it shows in the latest Vivaldi system.”



Vivaldi was another step change for the company, once again causing a stir in the prestigious Japanese market. According to distributor Sheen Uchida, the brand gained in popularity significantly subsequent to its release.



“It got the Golden Sound award from Stereo Sound magazine, which is the most respected press in our country, and is translated into Korean and Chinese.

Of course, both the sound and aesthetic looks are very attractive to our market. The build quality supports the sound and reputation, as well. Most Japanese Vivaldi customers play discs, and the system reveals Vivaldi to be totally different to other digital players.”

He believes that Vivaldi is dCS’ most important product, and is utterly effusive over its sound, adding that, “I think it is the most analogue sounding digital gear I have heard, although in many ways it betters it because the dynamic contrast is much more defined than an analogue system. It has more shades of grey, but still keeps the smoothness; this is especially clear when you listen to solo violin. No other digital systems that I have heard locate the orchestra between the loudspeakers as well, no others carry the strong fundamental bass notes or are able to slot the pieces of the musical jigsaw puzzle together so well.”





It hasn't gone down badly in the United States of America either, as Stereophile's John Atkinson attests.

“Even as the big chip manufacturers caught up with the original Ring DAC, *dCS* moved ahead with the new generation of products. The combination of Vivaldi DAC, which uses that new Ring DAC technology, with the Vivaldi Upsampler and Vivaldi Master Clock, is the most transparent and least fatiguing digital playback system I have experienced.”



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This view was strongly reinforced by Wilson Audio's Peter McGrath who commented "What is really interesting is that I have been unearthing many treasures from my early Nagra D digital recordings made as far back as the late 80's and early 1990's. I only had the ability to hear them in situ back then and over the course of many years I've listened to them with the many different DACs I had at my disposal. What is really gratifying is how wonderful many of these recordings really are and this was not ever revealed to me to such an extent before using the Vivaldi. This has inspired me.

Simply put, if you have a significant collection of any kind of digital media, recordings, DAT's, CD's, or anything that was made digitally from the early days of digital, you have no idea how much music there is to be extracted from those recordings until you experience playback through Vivaldi! Clearly the Vivaldi is not only a device to maximize

the capabilities of present and future digital media, but it is for me as equally important as a device to illuminate the hidden glories of past digital recordings.”

The Absolute Sound Editor Robert Harley was equally as impressed.

“The Vivaldi system is in a class of its own in every category – technical sophistication, capabilities and, most importantly, sound quality. There is simply nothing else like it. It is truly, and by a wide margin, the *ne plus ultra* of digital playback.”



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Now in 2014, *dCS* is a far more complete company than it has ever been – able to mix its unique technological expertise with beautifully packaged products which appeal to audiophiles unwilling to compromise on quality.

Stereophile editor-in-chief John Atkinson sums up by saying,

*“dCS epitomises for me what a high-end audio company is about: high technology in the service of high art.”*



*Click to play video*

So what then does the future hold for this small but world-beating British company. Let us leave the last word with Managing Director David Steven: “This is an exciting time for digital audio as music lovers begin to focus more on the sound and due to advancements in technology high resolution audio becomes more accessible to all.

We are proud that here in the UK we are maintaining the *dCS* tradition of designing and developing products from the ground up so that we can continue to advance the state of the art and define digital audio.

Downloading and streaming means that more people than ever before have the opportunity to access the original bits. As we begin to move from silver disc to new ways of playback, for *dCS* the challenge remains the same; to deliver the music in these digital files so that the listener can experience them with their full

emotional impact perfectly reproduced – exactly as the artist intended. It’s a challenge we are happy to accept!”



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**David Steven**  
Managing Director

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