dCS Varèse DAC

BY ROBERT HARLEY

THE recently introduced Varèse digital-to-analog converter from England's Data Conversion Systems (dCS) is an incredibly sophisticated system that introduces a host of innovations along with significantly improved execution of the company's established technologies. Varèse comprises five chassis: the Core that performs nearly all the digital signal processing, the Master Clock that synchronizes the system, the User Interface, and the dual Mono DACs.

Varèse requires the equivalent of five AES/EBU interfaces, five BNC connections, and two RS232 cables to connect each of the five chassis and allow them to work as a unit. Given the number and complexity of the signals transmitted between the components, dCS created its own interface called ACTUS (Audio Control and Timing Unified System) to simplify connection and to improve performance. A combination of a new multi-pin connector and software, ACTUS carries asynchronous and error-corrected digital audio, control signals, and master clock signals. The ACTUS interface allows the five components that comprise Varèse to communicate with each other and act as one. ACTUS doesn't rely on any standard interface protocols; instead, it creates an entirely new system that fits the demands of Varèse's architecture.

Housing the left- and right-channel DACs in their own chassis creates a challenge in precisely clocking and synchronizing the two channels. This isn't an issue with a stereo DAC, where the same clock feeds both DAC channels that are housed in the same chassis. To overcome this challenge, dCS developed a technology called Tomix. Here's how it works. The Varèse Core sends a clock to each Mono DAC but adds a time stamp to each audio sample before sending it to the DACs. A field-programmable gate array (FPGA) in each DAC reads the time stamp embedded in the clock so that the two DACs can be perfectly synchronized. Significantly, Tomix doesn't just align the clocks' leading edges with each other; that could result in one DAC being exactly one or more clock cycles out of sync with the other DAC. The time stamp embedded in the clock's trailing edge allows both left and right clocks to ensure that one DAC isn't leading or lagging by one or more samples. How dCS embeds the time stamp in the clock is extremely innovative, but beyond the scope of this description. dCS has been awarded a patent for Tomix.

VARÈSE IS THE ULTIMATE REALIZATION OF DCS' RING DAC

dCS is justifiably famous for its Ring DAC architecture, which has proven itself in countless products over the past three decades. It is essentially a hybrid of multi-bit and sigma-delta (one-bit) conversion techniques that randomize the inevitable conversion errors, turning what would be audible distortions into very low-level noise. dCS has taken this core technology and reimagined it in a cost-no-object execution. Specifically, the Varèse's ring DAC is now differential, meaning that the circuitry is doubled, with one half of the circuit processing the audio signal and the other half processing the same signal but with polarity inverted. Each channel has its own differential Ring DAC along with its own power supplies (and separate clock supplies)

Varèse is the ultimate realization of dCS' Ring DAC; it introduces the sophisticated custom ACTUS interface; and realizes the highly sophisticated technology that makes the Mono DACs possible. It is an amazingly sophisticated product that advances digital audio playback technology, and a worthy recipient of our Technology of the Year Award. tas

BY JACOB HEILBRUNN

Left to right: Jane Simpkins, John Went, Steven Butler, Chris Hales, Andy McHarg, Ben Ashcroft, Chris Ward, Chris Jones. Absent from photoshoot: Dammon Butler, Harry Sawyer, Ross Bowman.

dCS Engineering Team

David Steven, Managing Director

Jacob Heilbrunn: When did you first become interested in audio?
David Steven: I'm really not sure, as I grew up around audio. When I was a kid, my dad worked for various audio brands as well as having his own audio store for a few years. On school holidays and weekends, I'd often be in the shop or tag along on road trips as he visited stores and customers across Scotland and England. Then, as I got into my teens, I would help out in the family business as well as working part time in stores. Talking to people about gear and music, listening to all kinds of music on different systems, experimenting with different equipment, setting up and troubleshooting systems are things I've always been around and loved to do, so I suppose the interest in audio has always been there.

JH: Did your father shape your interest in the high end?
DS: My dad's real passion was music, especially blues and rock, so he was always messing around with gear, going to gigs, and playing music in the car or at home. After high school, I went off to university, graduated, and ended up working for a really interesting software company based in Scotland. They sent me out to the U.S. in late 2002, where I lived for six years, working in product development. While I was in the U.S., my Dad and I would stay in contact and talk about stuff like sports, music, audio, and of course dCS.

My dad had taken over as Managing Director of dCS from Mike Story in 2005 and along with Andy McHarg and

INNOVATOR OF THE YEAR

David Steven/DCS

Chris Hales and Andy McHarg,

Chris Hales was trying to move the company forward and develop a new range of products (the dCS Scarlatti system). We would talk a lot about dCS, his vision for the company and the challenges he faced. Right from the start he told me how dedicated and amazingly talented the team at dCS were and how unique and special the core technologies were. During this time, I worked on the odd project for dCS and would visit various audio shows and retailers in the U.S. to see what was going on in the high end, but it wasn't until 2008 that my wife and I decided the time was right for us to come back to the UK and join dCS.

JH: What do you see as the primary technological foundation of dCS?

DS: Without doubt the Ring DAC is unique to dCS and is still the core of our technology stack. Without the Ring DAC, I doubt there would be a dCS as we know it.

"THAT FOR ME IS WHAT TRUE INNOVATION IS, NOT BEING SCARED TO FAIL OR CHANGE, THINKING BEYOND THE LIMITS OF WHAT IS CONSIDERED POSSIBLE, AND BEING RELENTLESS IN THE PURSUIT OF PERFORMANCE."

The Ring DAC is the technology that launched dCS into the pro and consumer audio space in the 1980s and is the key technology that has been present in some form in all dCS D-A converters since then. The Ring DAC itself has obviously advanced massively as technology has improved, but the underlying principle has remained the same.

Every area of a dCS product uses bespoke hardware and software, with no third-party solutions for I/O decoders, clocking, PLL circuits, DSP, D/A converters, and output stages. This provides us total control of the entire signal path, which means every stage of a dCS DAC can be optimized to work together cohesively (be that A-D or D-A), instead of being a number of separate technologies combined on a generic PCB.

Operating a technology as unique as the Ring DAC has a number of advantages, but also a number of challenges that need to be overcome. Control of the whole signal chain inside of a dCS product allows each stage to be optimized so that we can creatively leverage the Ring DAC's advantages while overcoming any challenges. The result is a D/A converter which is unrivaled in its performance; each Ring DAC iteration for the past 35 years has represented the pinnacle of signal conversion at that time.

JH: When you took over the company, what was your primary objective?

DS: Obviously my taking over dCS was not planned at all, so my first objective really was to assess the business, listen to the key people across the company, and with that input develop a short-, medium-, and long-term plan that we all bought into.

I believe that understanding who you are, what you stand for, and how you want to do things helps to give you consistency and a degree of control, allowing your products to embody your vision and values. Right from my first day at dCS, I was blown away by how talented and driven Chris and Andy were. They were and remain dedicated to advancing the state of the art in digital playback, so my role early on was to harness that drive and creativity and develop a shared vision and roadmap for dCS.

I think when you are driven by purpose it helps you to solve problems and make new discoveries and effective decisions. There is a lot of questionable technology and BS in high-end audio, whereas dCS has always been about measurable and demonstrable performance. This is core to everything we do and the products we make. Back in 2008, we had to decide whether we were going to be a technology company or a product company, as we could see where digital playback was heading with the transition from silver disc playback to computer audio. DACs could no longer be black box products, and if dCS was serious about converting audio data into music more accurately and faithfully than any other technology, then we had to up our efforts on performance, reliability, and user experience, which meant investing in and scaling up the engineering team. The first product we worked on was the Debussy DAC, and when we began to look at where audio was going in the future, Vivaldi was our answer.

Ultimately, it is about the musical performance and the ability of the system to communicate but in audio I think you always have to start from a solid technology base. Chris, Andy, and I have tried to instill a discipline and process in how we develop products—from ideation all the way through prototyping and voicing to launch and ongoing updates and support.

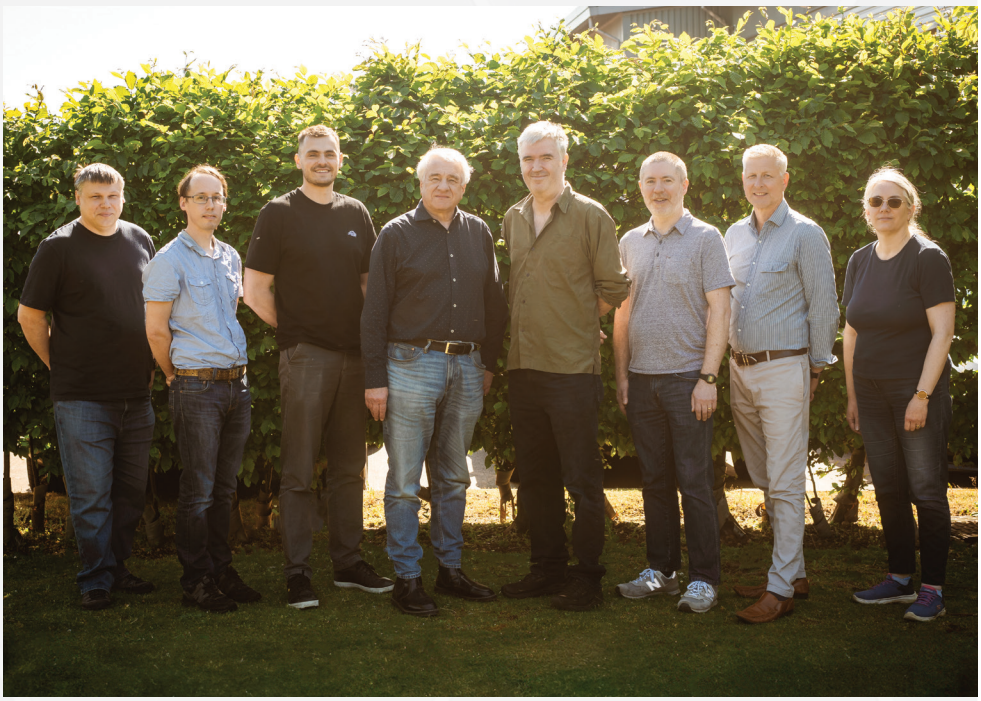
David Steven/DCS

JH: dCS remains an individual firm rather than one owned by a holding company. How do you ensure its future?

DS: Interesting question! I see my stewardship of dCS as being the third generation of leadership at dCS. It all started with Mike Story, our founder and a visionary who inspired so much of what we do at dCS. Mike then passed the baton on to my dad, who together with Andy and Chris stepped dCS back from contract design, pro audio, and broadcast, and really focused dCS on high-performance two-channel audio. I then took over dCS, and in my time I have always felt like one of my key responsibilities is to preserve what is special about dCS and our culture, while ensuring we continue to improve our technologies, develop new technology and products, and be agile in every area of the business. That focus on continuous improvement and trying to be the best should then reflect in our products, our partnerships, and the service we deliver to dCS owners.

Running a UK-based high-tech manufacturing business that develops its own software and hardware is extremely challenging, but we love what we do and are proud to design and manufacture in the UK. We have trebled in size since I joined dCS and now have amazing talent across the company. After what happened to my dad, one thing I've always tried to focus on is knowledge transfer and succession planning so that dCS continues to be agile and thrives long into the future.

We recognize that owning dCS is a serious investment for any music lover, and that is why we invest so much back into research and development, as we want to ensure our products offer amazing performance, reliability, and a life cycle that far exceeds what others in digital are capable of. We are on a journey of discovery when we develop products, so as we are able to improve and update them. We want to bring this to dCS owners and repay their investment in us.



JH: What prompted you to build the Varèse? What is unique about it?

DS: We are always looking to the future and asking ourselves where audio is going and how this impacts the way people listen to and enjoy music in the home. In terms of discovering and accessing high-resolution music and sharing music, this is a golden age for music lovers. So, with Varèse, we wanted to take 35 years of learning and know-how and use this to build a playback system that was measurably and experientially better than anything we had ever created before at the same time as making it future-proof.

I believe when you own dCS the primary experience should be auditory not visual as our technology merely delivers the sound; it is the music that creates the experience! It is easy to get ethereal in product design, it is also easy to get lazy. During the Varèse project, we were relentless in questioning everything we did. How would this move the dial forward? Is this dCS? Does what we are doing enhance the musical experience? Where can we improve performance, usability, reliability? With Varèse, everything we did came back to preserving the purity of the musical signal and allowing the artist to communicate with the listener.

To get to this place, Varèse didn't start as a "system." It was a series of research projects running in parallel with a common goal of advancing the state of the art and improving (measurably and experientially) on what we had developed before. The output from some of these research projects actually made their way into other products (Lina) and an upgrade to the Ring DAC (Apex), but what really led to the creation of Varèse system was the differential mono DAC architecture. The team has taken huge leaps forward in so many areas; mechanical and chassis design, hardware through the groundbreaking use of flex-rigid PCBs, an all-new interface (ACTUS) to progress from bandwidth-limited AES/EBU, and patented clocking technologies. All these technologies enabled the use of Mono DACs with no jitter compromise.

That for me is what true innovation is, not being scared to fail or change, thinking beyond the limits of what is considered possible, and being relentless in the pursuit of performance. tas