



## John Stadius

The man behind the technology at Soundtracs and DiGiCo talks fixed point, floating point, one-box solutions and central heating control.

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**A** GRADUATE OF Surrey University, John Stadius joined SoundOut Labs — later to become Soundtracs — after leaving in 1978. He was promoted to technical director in 1980 and has been designing the company's consoles ever since.

Stadius is one of the genuine few with experience in designing analogue, digitally controlled analogue, and all-digital desks for the studio and live market sectors. Best known now for the DiGiCo range of live sound consoles that grew out from the Soundtracs range of digital studio desks, his contribution has been crucial to the manufacturer's development and has reflected the changes the firm has undergone. The Virtua and then the DPC-II signalled Soundtracs' metamorphosis from an all-analogue to an all-digital company and the firm is celebrating a decade of digital this year. Further back his analogue contribution had seen high levels of digitally controlled dynamics control on Soundtracs desks and sophisticated automation — all at a price that set new standards for the day.

When not designing desks he says he's fishing, cooking or fishing...

### What's special about Soundtracs products?

All our digital consoles have a common design theme from the DSP engine (with minor tweaks) to a surface interface that would be familiar to any user of our consoles from post to theatre. Our simple and quick touchscreen technology interface has been our key selling point since the launch of the DPC-II in 1998.

I have always adhered to the design philosophy of 'keep it simple' and I have been that way from the early analogue days. I always tried to keep my circuits as simple as possible without compromising performance. This has many advantages including a cleaner signal path, lower power requirements and better reliability.

The same goes for today. Our current DSP engine design is way more efficient than many others out there. Using very efficient coding we probably achieve more channels/buses per processor than any other manufacturer.

### What's tougher: designing your first digital product or the second one?

It has to be the first one which was — apart from all those reject ideas — the Virtua. Although not using the touchscreen technology of all our other products that followed, a lot of the basic principles were derived here, such as multi screens and the automation.

It is always good to have a rough idea of where you are going. Designing a product for the first time will take you up many a blind alley and our R&D lab is full of product ideas that went nowhere.

### How has user acceptance of digital worksurfaces manifested itself in your designs?

I think the evidence speaks for itself. If you compare our DPC with our latest D1 the familiarity between them is immediately obvious. Because our surface concept is so simple and easy to use it has remained virtually unchanged for the past eight or so years. Of course, under the surface things have changed and improved manufacturing techniques have made the product simpler to build.

I find most sound engineers to be very conservative when it comes to major operational changes. They never seem to have time to cope with a steep learning curve. Priority number one is to get the job done. I have a number of wacky and not so wacky ideas waiting in the wings and to launch them all at one time would give any operator sleepless nights. We have looked at being more adventurous, such as replacing the faders with touch surfaces, but the take up was very low. The analogue console surface has remained basically the same for a number of decades now and all engineers are very familiar with them.

### What technological advances have made the biggest difference to Soundtracs digital products?

A few years ago I would have said the floating point DSP (SHARC). Without it — I don't do fixed point

unless it's I-O — we probably would not have been into digital until much later. Now I would have to say it's the large scale FPGA. FPGA stands for Field Programmable Gate Array; basically it's a large integrated circuit with a huge number of uncommitted logic cells (some have over 125,000). With it you can design your own specific DSPs, microprocessors or almost any logic circuit you like. Currently we use them in a number of applications such as filters, MADI, and optical communication.

FPGAs are slowly but surely taking over. With repetitive tasks such as audio processing it is better to fix it in hardware than to throw multiple large DSPs at it. Don't get me wrong, there will always be a place for DSPs — reverberation effects being one of them.

High speed comms using fibre optics between consoles, I-O and other consoles have provided huge benefits. It's simple, impervious to external electrical noise, truly redundant, robust and idiot-proof.

### You're one of a select group of designers with experience of analogue and digital desk design, what do you miss about analogue desk design?

I really miss the bus noise, limited headroom and crosstalk problems, their size, power consumption, using VCAs for gain control, huge wiring looms..... No, in fact I don't really miss it at all. Digital is so much more flexible. You can put a control on a surface without considering the implications of getting signals too and from it. Did I hear someone mention digital controlled analogue? I tried that with the assignable dynamics system in our later analogue desks. It worked very well but I would never design a whole console that way. Digital is so much more elegant.

Analogue is still here today. We poor humans are still unfortunately analogue by design so there is still the front and back end to the console. I am still messing about with new mic preamp ideas and remote analogue gain control.

The only thing I miss about analogue is the bread boarding of circuit ideas, not something you can easily do with high-speed digital.

### What were the key stages in transferring Soundtracs technology to DiGiCo live consoles?

Our DSP core was fortunately flexible enough to be adapted to the live environment. Not bad considering it was conceived ten years ago now. Of course, there have been a number of updates but the basic design structure remains the same.



Our worksurface philosophy also transferred to the live domain very well, requiring only a few additional features such as snapshots, matrix and output processing channels.

MADI was not the ideal medium for transferring large numbers of channels over 100 meters (front of house to stage) and I was not going to put the whole concept at risk by using CAT5 type cables. I cannot believe some manufacturers today are expecting users to rely on flimsy computer network cables for the main front of house snake. That is why we went to optical. Rather than reinventing the wheel we approached Optocore in Germany as they in my opinion had the best solution. It is capable of carrying 512 channels in a redundant loop. In conjunction with 'battle field' Kevlar lined cables and expander beam connectors we now have the perfect solution.

There's also serviceability. I would be a fool if I said our products never go wrong. We live in the real world and the touring environment is a very harsh place for any piece of equipment. Taking this into account we re-engineered our live consoles to be very easily serviceable such that we can now swap a complete engine core in less than two minutes.

#### **How significant are the differences in expectation between studio and live engineers?**

Live engineers live in the fast lane and the theatre engineers appear to travel that bit faster. There is no going back for a retake in live, they have to get it right first time. Having said that both studio and live engineers want a console that is responsive and easy to use. Neither wants to stop and read the manual. I hate products where you have to constantly refer to a manual every time you want to use it. My central heating control box at home springs to mind. It's my old philosophy again, keep it simple.

#### **From your standpoint, what differentiates the different brands of competing digital desk in the market?**

They all, more or less, do a similar job but it's how they present themselves, i.e. the man-machine interface, that mainly differentiates the different brands.

Currently nearly all digital consoles have a surface that is to a greater or lesser extent assignable. It's the degree of assignability that differentiates the different products. Many products provide the controls for just a single channel accessed by a channel select key. While keeping the costs down it does not let a user control more than one channel at a time. The DiGiCo/Soundtracs approach is to



provide visual indication of what is happening on all faders on the console, i.e. EQ, Dynamics, gain, pan, etc, and have dedicated controls for each block of eight channels. This I believe is a good compromise.

I mentioned briefly floating point verses fixed before. DiGiCo/Soundtracs consoles have always been based around floating point processors. Early DSPs were fixed point and like analogue systems they had a fixed dynamic range. Some console manufacturers still employ them. Normally 24 bits gives a dynamic range of up to 144dB. This sounds like a lot but when you are bringing in signals around line level you only have about 22dB of headroom — same as analogue. Signals arriving at any digital console (from A-D converters, AES-EBU or MADI) are by their nature fixed point. It's when you come to mix them that you start to run in to headroom problems. A floating point system enables you to increase this headroom by a fantastic amount, 1000s of dBs. Now we have a system that is almost impossible to clip. Of course, when we return to the real world we have to convert back to fixed point but as long as we don't clip the output by driving it too hard users can be happy in knowing that the integrity of the original signal is preserved.

On the issue of the number of bits it is often assumed that 32-bit floating point is good enough. This is not the case. When it comes to low frequency signals we found we had to up the process to 40 bits to again preserve the integrity of the signal. If you listen carefully to a low filter on a 32-bit floating point product you will hear what I call a slight gritty sound.

One other aspect I feel differentiates digital mixers is how manufacturers build them. Some are presented as a collection of boxes, worksurface, power supplies, racks of DSPs, I-O boxes, etc. Others provide a simple one-box solution.

We have always been a one-box solution (apart from the I-O racks). Having separate worksurface, DSP and power supplies is not the way to go about designing a live desk. Engineers want to turn up, open the box, turn on and mix. For the studio engineer this is not so much of an issue.

Having the I-O built into the product can also be a problem. The ideal solution is to do the conversion as close to the source as possible. Analogue signals, especially from sources such as microphones, are very sensitive to interference and degrade rapidly over long cable runs. Having all our I-O in remote racks again minimises this issue. The other advantage is the elimination of the expensive and very bulky multicore snake. Our 150-metre fibre optic drum capable of handling 512 channels weighs only 6kg.

### What products are you most proud of and what would you most like to build?

From a cosmetic point of view I loved the DS3. The DSP engine and power supply were held in a single leg with the very thin profile worksurface on top. It was a challenging engineering project.

As for one product I would like to build... most products these days have too many functions for too few controls. Digital cameras, MP3 players, mobile phones and my central heating control unit spring to mind. I always have to keep referring back to the manual. Is it me or am I getting old? So, I will start with a simple central heating control box. ■

