

In the world of Electric Phoenix, a contemporary vocal quartet plus electronics, small is beautiful. We are apostles of minimalist technology, which we define as (a) affordable and, (b) transportable. There are only five of us, including the engineer, and on the road we're all roadies. But it's not just our backs we have to worry about. Travelling by air as we do to concert halls and college campuses all over Europe and America, we must weigh and measure every new piece of equipment even before we price it; a few flights with a bulky item can cost as much as the original purchase. For instance, the deciding factor between Soundcraft 200 and 200B mixers (both 16/4/2) was the fact that a 200 (without its power supply) would fit in a flight case small enough for an American airline not to count it as two pieces of luggage!

The weight problem is compounded by travelling with a complete surround sound system including amps and speakers. We have learnt that when you arrive a few hours before a concert in an unfamiliar venue you'd better not spend your time cursing the house PA or chasing hum loops in a hastily cobbled interface: better by far if all you need is a wall socket. The quad principle was with us from the beginning 10 years ago but the rationale and the hardware have steadily evolved. One of our first commissions went to the great Belgian composer Henri Pousseur who asked for complex, precise spatial distribution by assigning each of four microphones to two faders, one pannable between the front speakers and the other the rear. Imagine the logistics of rotating all four voices around a hall! Joysticks were subsequently investigated and found to be expensive, cumbersome and unreliable; levels in different positions could vary by several decibels.

The big breakthrough came a couple of years ago with the Ambisonic Pan Rotate system from Audio+Design/Calrec, a spin-off from Soundfield microphone technology. Designed as a studio production tool, this provides continuous 360° peripheral panning for each of eight separate inputs, plus through-the-centre diameter control by a second row of pots. The peripheral controls are so sensitive that with practice they can be played with eight fingers like a sort of rotary keyboard; there is also a master control that allows a complex sound field to be rotated around its epicentre.

Ambisonic purists had always maintained that the system, which relies on phase as well as amplitude, would not function properly in a large hall. Image integrity would disintegrate, they claimed, with more than about 20 feet between the speakers. But the concept was so attractive that we decided to try it anyway. One option was a system with extra speakers 'plugging the holes' between the corners but we rejected the idea as too cumbersome for our resources—it had to work, if at all, with four speakers.

My first chance to experiment came with a Glyndebourne Opera production of Oliver Knussen's *Where the Wild Things Are* ('Glyndebourne Panned', *Studio Sound*, February 1986). The monsters' amplified, reverberated voices went whizzing about the opera house in a very satisfying fashion. Subsequent experience has shown that, even when it is not possible to distance the rear speakers sufficiently from the audience, spatial effects work much more satisfactorily than with conventional quad, which is entirely dependent on relative amplitude. Even outside the rectangle of speakers one perceives a sonic hologram of considerable detail and

LIVE SURROUND SOUND

Electric Phoenix is a contemporary electro-acoustic and vocal quartet frequently performing around the world using surround sound. John Whiting is their engineer and here he discusses some of the practicalities of equipment selection

complexity.

Possession of the Pan Rotate unit led us immediately to the solution of another problem. Much of our repertoire includes pre-recorded tapes, sometimes 4-channel, with a click track for the singers. Five separate tracks require an 8-track deck, which is wasteful overkill. But

another Ambisonic by-product came to the rescue. UHJ encoding reduces Ambisonics to stereo in a format from which it can be retrieved by a small decoder (custom-built for us by Roger Furness of Minim Electronics), thus permitting the production of 701 digital Ambisonic masters with the click on the audio track of a Beta VCR. Using



a Beta hi-fi keeps the click clean and hiss-free.

For a while we toured with digital performance tapes but there were serious drawbacks: the system, with up to 18 cassettes, was bulky and heavy; it is impossible to cue the VCRs for instant, glitch-free starts, particularly if the tape starts and stops frequently in a single piece; over a long period, 701/Beta technology is not reliably robust, and in the rough-and-tumble of live performance drop-outs became a growing problem.

The solution of the moment is a custom-built, double-speed Neal 340 4-track cassette recorder with external dbx (the UHJ-encoded programme goes on tracks 1 and 2 and the click on track 4). It is equipped with foil-sensing double contacts located between the playback head and the capstan, which automatically stop the tape at the beginning of each successive cue. A foot pedal on stage, its signal transmitted down a mic line, connects to the remote socket and permits one of the singers to start the tape for perfect sync. Thus the engineer need only change tapes between compositions and give his full attention to balance, panning and treatment.

Another problem was dealt with by yet another of our back-up crew of specialists. The Neal's massive flywheel is driven by a heavy-duty AC motor, which derives its speed and stability from 50 cycle mains. In America, of course, the norm is 60 cycles; and so Mike Solomons of London Sound designed and installed a crystal-controlled 50 cycle power source that is independent of mains variation. All this may be rendered obsolete by R-DAT or solid state but so far none of the available hardware meets all our requirements.

Since we are essentially an electro-acoustic ensemble who commission our repertoire from some of the world's greatest composers (the likes of Luciano Berio and John Cage) we have to think very carefully about our technical parameters. If we were rigid in our restrictions it would stifle creativity but if we were to give composers *carte blanche* to use any equipment they liked, we would be travelling with a whole showroom of state-of-the-art signal processors. In practice our purchases tend to be both composer-accelerated and budget-braked, which so far hasn't stripped our transmission.

For instance, Henri Pousseur requested that we have individual vocal synthesisers constructed for the four singers that they could control themselves, allowing much more flexibility than central control by a single operator. Designed and built by Ian Macintosh of Anchor Assemblies, they included a ring modulator, a resonating bandpass filter, and a simple digital delay, patchable to treat each other in any order. These are now virtually museum pieces of analogue technology but they are still in service, providing vocal sounds as yet not available from compact, affordable digital technology.

A recent godsend has been the Yamaha SPX-90, of which we have two, remotely footpedal-controlled by the singers. They are particularly useful because their cheapness and versatility have made them common all over the world. Thus a composer in any country is likely to have one available for experiment and can specify treatments with precisely noted settings and know that he will get exactly what he wants. We have found that, like so many of the newer generation of signal processors, they are capable of interesting and unrecognisable effects never discovered by those who don't bother to alter the presets.

But still our biggest problem wasn't solved. Even with all this distributing and processing hardware; when we went into a hall we were

at the mercy of its acoustics. Dry, unresponsive spaces are particularly cruel to singers; it's no accident that western vocal music evolved side-by-side with western architecture. Artificial reverb was a possibility but stereo reverb inside an Ambisonic system sounded unconvincingly flat and one-dimensional, and the Quantec Room Simulator was so far beyond our means that we didn't even want to tempt ourselves with a demonstration.

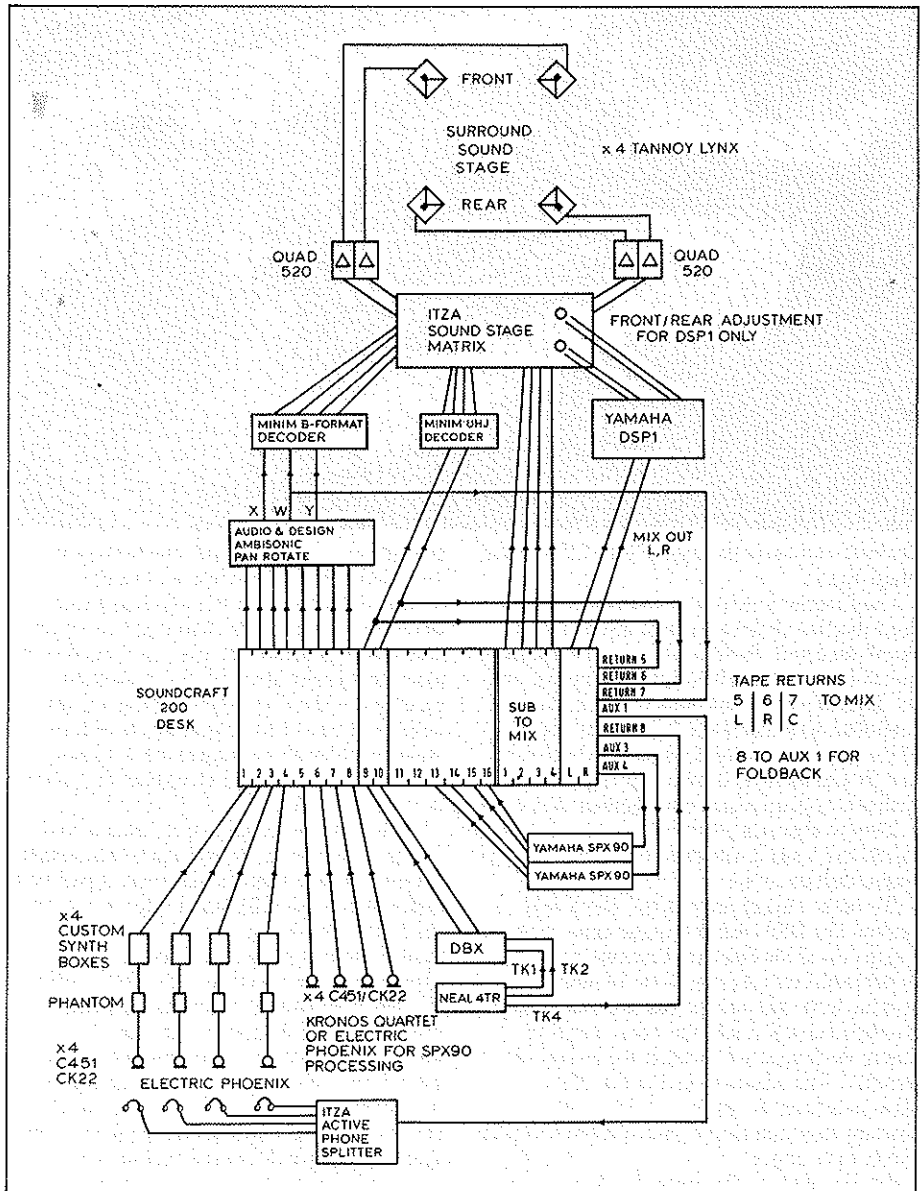
Then I heard the Yamaha DSP-1 Digital Soundfield Processor. After spending half-an-hour with it in Yamaha's R&D studio I went straight next door to their showrooms and had one within 24 hours. It was a gamble whether or not it would work in a large space like a concert hall, but I knew I wanted it anyway for my own Ambisonic listening area. Anything else would be a welcome bonus.

At this point Electric Phoenix had to make a quick decision. We were about to set out on another five-week tour of the US and this time we had decided to expand our repertoire to include brief examples of the great vocal traditions of the past, from the middle ages onward, some of them supplemented by overdubbed pre-recorded tape. With these older works, written to be performed in churches or banqueting halls, it was now

essential that, in addition to everything else, we carry a 'portable cathedral'. The DSP-1 had better be the answer.

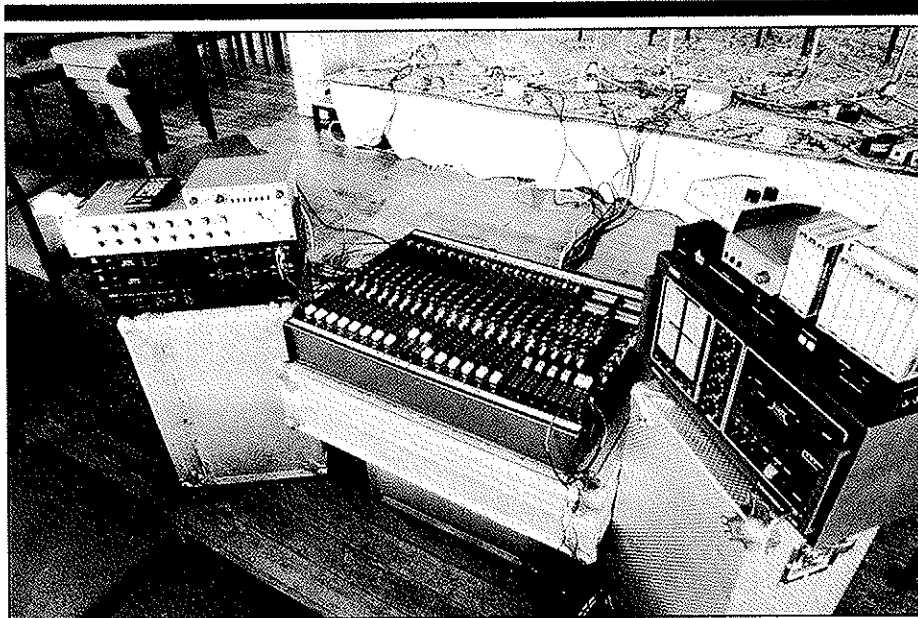
But wait, we're now talking about eight channels (Pan Rotate) feeding four outputs through a decoder, another two channels (UHJ tape) feeding four outputs through another decoder, a further four to six channels (SPX-90s) feeding yet another four outputs, and finally the DSP-1, which must be flexibly fed-by everything else, going to a final four outputs. And all four of these four-output groups must be superimposed symmetrically to feed four channels of PA. At a quick estimate, a 28/26/4 mixer ought to do the trick. What price Minimalism?

The final solution is shown in Fig 1. It became obvious that we needed a mini-mixer, which would superimpose four sets of groups at unity gain (except the DSP-1 output, which should be adjustable for optimum S/N ratio). The job was entrusted to Mike Skeet, who produced a gerbil's coffin with four 5-pin XLR and DIN inputs (one with stereo front and rear pots) and one 5-pin XLR output. The two Ambisonic decoders and the DSP-1 were retrofitted with 5-pin DINs (no room for XLRs) so that interconnection is by stock cables; mixer-out and amp-in required 4/1 octopus cables. The box is powered by a ± 15 V 'Time



Electric Phoenix touring surround sound projection

LIVE SURROUND SOUND



Machine' and bears the cryptic label 'ITZA Sound Stage Matrix'.

It had become evident that the Soundcraft 200 must function as three separate mixers plus a reverb send unit. So Mike altered the break jacks on the first 10 channels to post-fade (tip out, ring in). This allows the first eight channels, fader-controlled, to go discretely to the eight channels of the Pan Rotate system. Similarly, channels 9 and 10 feed the UHJ decoder, leaving the last six channels in conventional configuration. Aux 3 and 4 sends on channels 1 to 10 were made pre-fade to match aux 1 and 2; otherwise they would no longer function at all.

The really elegant touch is the reverb send facility. The DSP-1 has a genuine stereo input, so I make use of the Soundcraft's panpotted multitrack return sockets, formerly superfluous, to bring back split signals from the Pan Rotate and tape outputs to feed the stereo mixdown faders; the groups are similarly fed by the sub switches. This allows me to feed the DSP-1 selectively from the mixdown faders, with constant easy gain ride on reverb levels via input rather than output.

The final piece in the jigsaw puzzle is the click track to the singers, which now comes into the mixer on a tape return socket and is fed out

through aux 1 to a multicore line to stage and into another Mike Skeet box, a powered headphone splitter with four separately gain-controlled outputs. (It can also feed four separate click tracks to the four outputs, as is required by one *bravura* piece of unimaginable rhythmic complexity.) Since the signal is going via aux 1, foldback of tape or live signal can be added if required, although the singers are so used to performing with classical ensembles, that foldback is rarely called for.

The bottom line, as always, is, 'Does it work?' The short answer is, 'Beyond our wildest dreams.' We were already familiar with every aspect of the system except the ITZA sound stage matrix and the DSP-1. The former was so efficient and trouble-free that we quickly forgot it and concentrated our attention on the DSP-1, which was like a sensational companion at a party. From one end of America to the other, local musicians and technicians commented on how their dreary, all-purpose halls were transformed into environments of sonic luxuriance. In one of our frequent joint concerts with the Kronos String Quartet, they asked for amplification in a normally acoustic part of their programme just to take advantage of the improved ambience. One of the most remarkable results was a brand-new

2000-seat, virtually anechoic chamber in Illinois—a real sound-sucker, which our four Tannoy *Lynx* speakers and two Quad 520 amps (minimalism, remember?) transformed into Münster Cathedral. And at MIT, one of America's high-tech Meccas, the campus mag's critic said it all:

'For the Phoenix concert, loudspeakers were placed on the walkway above, and a special Ambisonic sound projection system insured that the listener got the full intended effect wherever seated. The result was far better than is achieved by the Media Lab's usual set-up, and investment in a permanent set-up of this sort would be a good investment for The Cube.'

Within this context, the DSP-1's success is especially remarkable in that it was obviously intended for the rich domestic market, complete with Dolby *Surround* decoder for videos and remote control for self-induced paraplegics. Some of the more promising Concert Hall settings consist only of early reflections and there are a number of environments not useful for our purposes, from Disco to Stadium to Warehouse Loft. The only settings we used were Chamber, Church, and Münster but they were quite enough.

There is also a range of remarkable surround sound special effects, analogous to, but more sophisticated than, those of the SPX-90, and of full CD quality and bandwidth. These are obviously aimed beyond the barriers of the domestic market within which the unit was officially conceived and launched. We are perhaps witnessing another manifestation of the *F-1* syndrome, in which the clever lads in the hi-fi section show the old pros a thing or two. The unit certainly deserves a serious write-up as a production tool.

I've one ironic footnote to this happy ending. The word 'Soundfield' (which Yamaha carefully splits in two) is part of a concept and a technology pioneered almost 20 years ago by funds from the National Research Development Corporation, culminating in Ambisonics and the *Soundfield* microphone. In those far-off days governments of all parties considered it their responsibility to encourage and support primary research but never, alas, to promote its products. Other countries see fit to support their native technologies with legal sanctions even when they are inferior whereas in Britain, Ambisonics has remained the plaything of a few aficionados. Even Nimbus, who have always recorded everything Ambisonically with the tenacity of the British bulldog, now tell you so only on the disc, in small print, as if it were a government health warning. (The *Soundfield* is admittedly a respected tool of some recordists, but principally as a clever fabricator of coincident pairs.)

Private companies under contract—Calrec (now part of AMS) later joined by Audio+Design—did their best to launch Ambisonics in the wake of the quad debacle with its rival standards, each worse than all the others. But now, perhaps, the market is finally ready for 'surround sound'. Everyone who has heard Ambisonics recognises that it produces a more complex and precise sound stage than the various 'Brand Xs', quite apart from its infinite 3-dimensional capabilities. But there's no really important money behind it, so when the time comes, the great buying public, with one stereo speaker on top of the liquor cabinet and the other behind the sofa, will never know what they missed.

In the meantime, Electric Phoenix travels around the world, bypassing the marketing infrastructure by taking surround sound technology straight to thousands in the concert hall. It's a great life if you don't get a hernia. □