

FESTIVAL SOUND

Ben Duncan explores the technology used at this year's Glastonbury Festival

This year's 20th Anniversary Glastonbury Festival is the 12th to be held at Worthy Farm, which comprises a stone farm house and 440 acres of pasture land in a valley behind the village of Pilton, four miles from the twin towns of Glastonbury and Street in Somerset. The farmer Michael Eavis has substantial support from the established members of the local community in staging the Festival. Worthy Farm has been farmed by his ancestors for 400 years and the land quickly heals after the festival-goers have departed. This year's official attendance figures were 72,000, including festival workers and suppliers. Around 10,000 (or 1 in 7) were children getting in free, coupled to 60,000 adults who'd paid £39 a head for three days of camping and a chance to see some of the 1,000+ acts staged around the site. A substantial donation is made to CND, an arrangement that's gone on ever since the nuclear disarmament movement began to swell in the early '80s. Smaller donations are also made to local organisations, e.g. village halls and Scouts.

System Outfront

The PA system was supplied by Britannia Row Productions. As Europe's biggest PA rental company, they're privileged to stock two completely different and contrasting speaker systems - stocked in such abundance that they were able to supply the Festival while running eight other tours! Their US-made MSI system and their TMS-3 based Turbosound rig were covered in last year's report on the Pink Floyd tour (L+SI August '89). This year, Turbosound's new generation UHQ or 'flashlight' enclosures were being tested for the first time. Turbosound's TMS-3 is today the most used 'one-box' PA enclosure in the world, with more than twice as many in use than the nearest competing product. The TMS-3 was first used at Glastonbury shortly after it was launched, in 1982. TMS-3 arrays have been supplied, first by Turbosound Rentals, then Samuelsons, and more recently by Britannia Row, for every subsequent festival.

The PA's front-end comprised Brit Row's standard equipment, much of it state-of-the-art, BSS Audio's stage splitter units interfaced the FOH, monitoring, TV and radio feeds,



Busy sampling the sound at the front of the mix position are Trevor Dixon and Turbosound's Tony Andrews.

resulting in a total lack of buzzes and noise throughout the event. Outfront, the main console was a Ramsa S840 (reviewed in Feb '89 L+SI). I asked Turbosound's John Newsham, who was assisting with the mixing and engineering and who hadn't used the Ramsa before, about his experiences.

"All the engineers we were working with appreciated its clean sound. It's a very transparent desk, remarkably free from crosstalk. The only crosstalk we encountered was very minor, on the PFL buss. But I've yet to find any desk which doesn't have crosstalk on the PFL! Besides, it was no problem during the show. The desk was straightforward to use; everything falls to hand except the pan control. A couple of engineers confused it with the gain control, which is red; the pan pots on a lot of mixers are coloured red. The consequences of panning to the right while remaining in the middle would have been frightening - considering the large amount of microphone gain that's available. Besides, the pan position is transposed on this desk, at the top where the microphone gain control normally is! Also, each of the sends has an on-off switch. That's a nice feature. It means you can preset FX, then bring them in swiftly. The buttons rely on shadowing so you cannot tell whether they are in or out. Even an illum-

nated switch wouldn't have been clear in the bright sun. So people forgot about the switch and would suddenly begin to rack their brains after realising the effect hadn't come in on cue! There were loads of outputs. The matrix outputs were used to send a mono mix to the BBC Radio mobile, and a completely separate stereo mix to the BBC TV truck. Then we were routing tapes to the stage for bands who had intro tapes, or who wanted to hear a specific tape just before their set. There were plenty of spare outputs left; we used the 'Studio' outs for recordings on cassette and R-DAT."

Effects were mixed by an elderly Yamaha M512 sub-mixer. The FX rack contained an assortment of 'industry standard' processors, namely Yamaha SPX 90 and 900 and Rev-7; dbx 160x compressors; AMS and Lexicon 224X reverbs; and Roland SDE-3000 slap echo. BSS DPR-402 compressor/de-esser/limiters were normally assigned to bass guitar and vocal channels with extras assigned as necessary. The snare, tom and kick-drum mics were gated with Drawmer 201s. A further three DPRs and 201s were on standby ready to be patched to vocals or wherever the need arose.

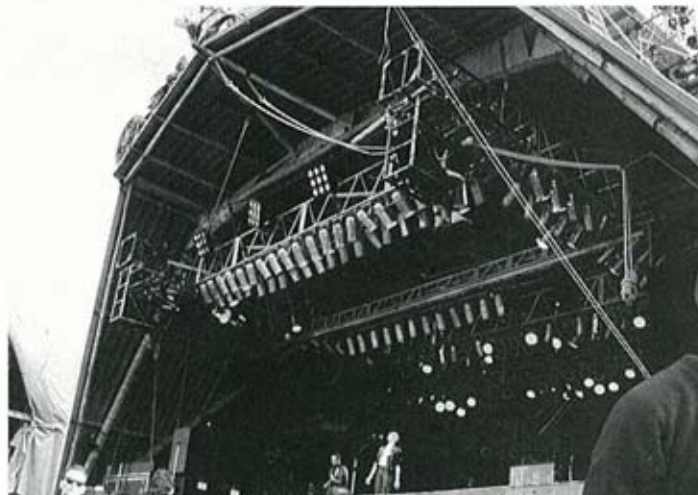
Amplification

Twin crossovers, one feeding each stage wing, were BSS Audio's 'industry standard' FDS-360. Using the 'breakout' facility, a buffered full-range signal was derived after the low and high-end protection filters, and routed to BSS Audio's new TCS-804 dual time corrector which permits nested delays in stereo. The four (2 in stereo) time delayed outputs were then re-introduced via the FDS-360s breakout, to feed the HF + Mid-High and Low-Mid filter chains, which were delayed both with regard to each other and the sub-bass feed, which being the one that's lagging most, wasn't delayed at all.

Amplification in each stage wing comprised just nine of BSS Audio's EPC-780, an advanced, powerful and very compact touring power amplifier launched last year. Each of the EPC-780s two channels has 2 ohm capability without compromising sonic quality, enabling four boxes to be driven per channel in a given frequency range. In spite



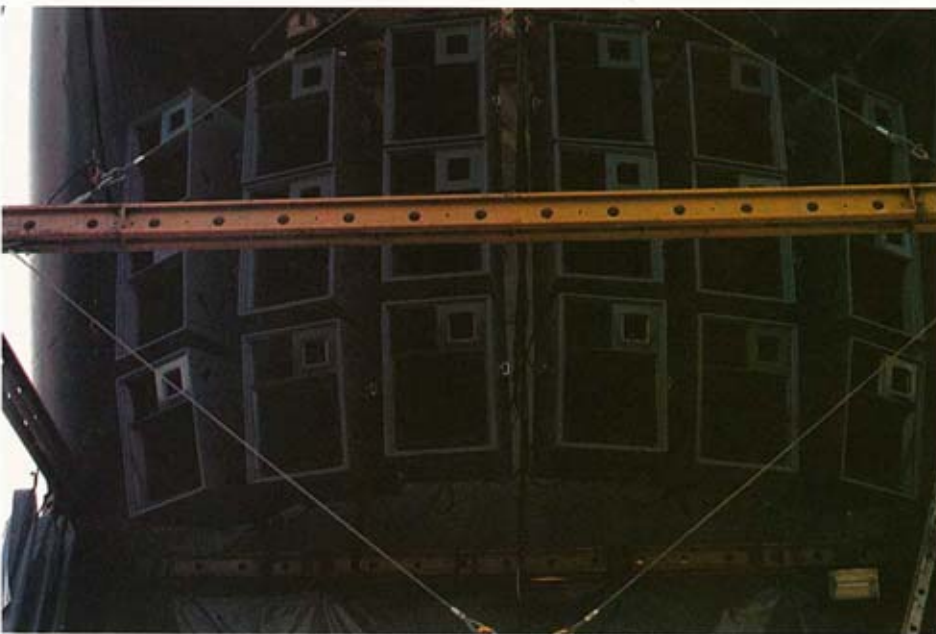
The view encapsulates a fraction of the festival site. Looking down into the valley, the main pyramidal main stage is visible to the right of the hedgerow situated halfway up the left side. Immediately to the right is the red tarpaulin covering the mix position. Glastonbury Tor, a local and sacred landmark capped by a derelict church, can be seen poking up on the horizon immediately above.



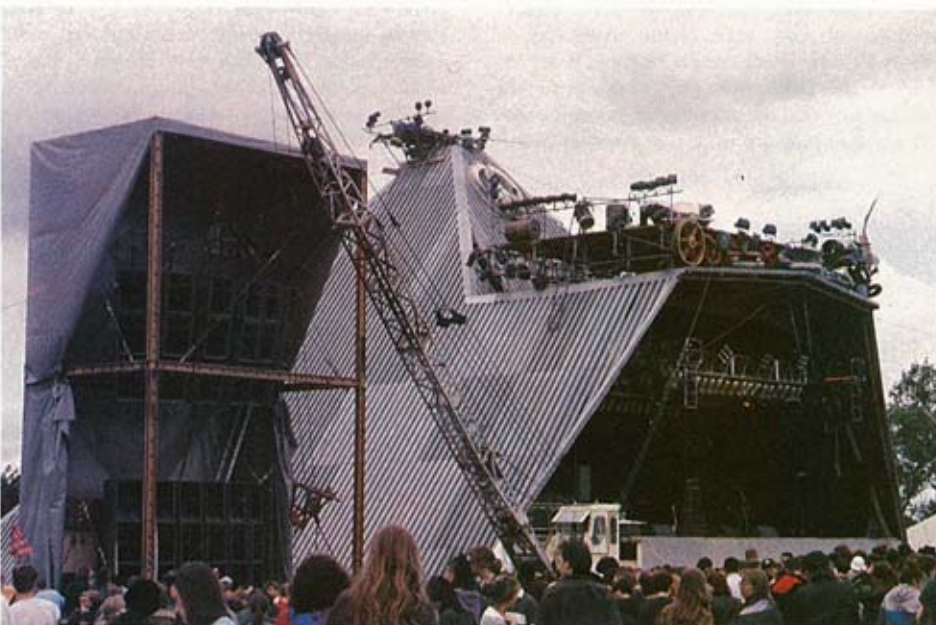
Front of stage. The monitor console can be seen stage right.



Standing over the Ramsa console while the set is being changed, Steve Ludlum of Britannia Row hesitates over a button, John Newsham of Turbosound thinks deeply while Trevor Dixon from Mendip Council relaxes from making notes.



Turbosound's new UHQ enclosure 'High-Packs' were flown in a semi-spherical array.



The pyramidal stage with one of the PA wings on the left. A curved barrier kept the crowd back from the stage. The top of the pyramid is rigged for *Archaos*, a daring French circus troupe. The badly parked crane was part of their act, which took place at night.

of the way that the SPL in the auditorium limited, peak levels were still reaching 108dB_CSPL, so it was amazing to see that the drive was at least 20dB below full output on every single amplifier's peak-indicating bar meter. BSS Audio's AR-204 line balancing units were appended to each of the crossover outputs, so the multicore returns to the stage wings were fully balanced. The residual noise level at the speakers was so low that amidst the 65dB-ish ambient background noise of 20,000 campers, half a dozen generators and the backstage traffic, it wasn't possible to know whether all the drivers were working when they were checked by Turbosound's Toby Hunt on the opening morning, at least without driving the system with pink noise!

Spherical Rigging

The UHQ array comprised two kinds of box. The 'high pack' contained three long-throw devices: a single Turbo-loaded low-mid horn, a smaller Turbo-loaded Mid-HF horn, and an HF 'waveguide' horn. Sub-bass was provided by an enclosure, which is similar to the established TSW-121, except it's slightly smaller to match the high-pack and can be flown if needed. At the festival, 18 of the sub-bass cabinets were arrayed six wide by three high on the tower's lower tier, about 3'/1m above the soil.

The high-packs were flown in the semi-spherical 'point source' array that's featured in Turbosound's indoor installations over the past six years. Outdoor hemispheric flying was employed for the first time ever in 1988 at the Roskilde Festival in Denmark, with TMS-3s, and subsequently it featured at last year's Glastonbury Festival. John Newsham recounts that the engineers were impressed at the complete flexibility of adjustment: "You can get it high and point it down — which obviously helps with all the outdoor acoustic problems of wind, temperature layers and spill". At this year's Festival, the high-packs were arrayed in three tiers of six. The upper tier was angled down some 10°, while the two subsequent tiers were each angled down slightly more.

The BSS Audio TCS-804 was used to align the speakers. The HF + High Mid were delayed a few hundred μ s (millionths of a second) to the Low-Mid. This grouping was then delayed by a few tens of milliseconds to synchronise with the sub-bass enclosures. The delays for the HF/Hi- mid to Low mid were perfected in Turbosound's R&D department, as they're invariant and independent of how enclosures are arrayed. As the distance to the sub-bass enclosures was an unknown quantity until the PA had been rigged, the master delay to the 'high-pack' was fine tuned on the site.

Acoustic Factors

The main stage is set in a valley five miles from Glastonbury Tor, a notable landmark. In common with every other part of the British Isles that's close to the Atlantic seaboard, Somerset has some of the most volatile weather in Europe. Midsummer is no exception, and virtually every year has seen tumultuous downpours or sullen haze dramatically alternating with hot sunshine. When it's hazy, gusty breezes frequently build up and sweep down the valley as the day wears on, mixing air of different temperatures and breaking up the music's coherence.

Whether you believe in pyramid 'energies' or not, there's no disputing that the silvery, pyramidal stage at Glastonbury has some

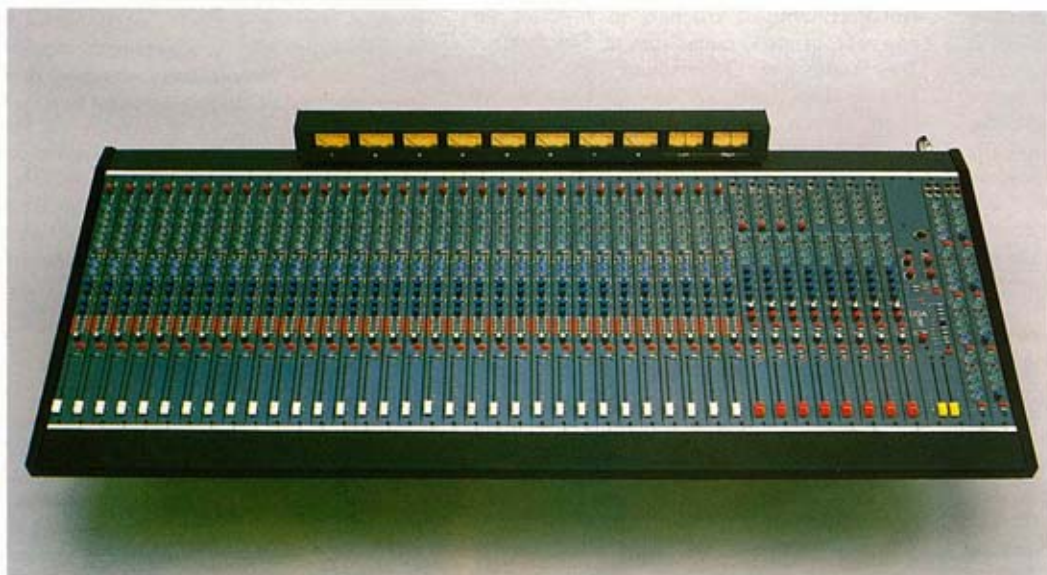
Any console with this much flexibility deserves a closer look

Q

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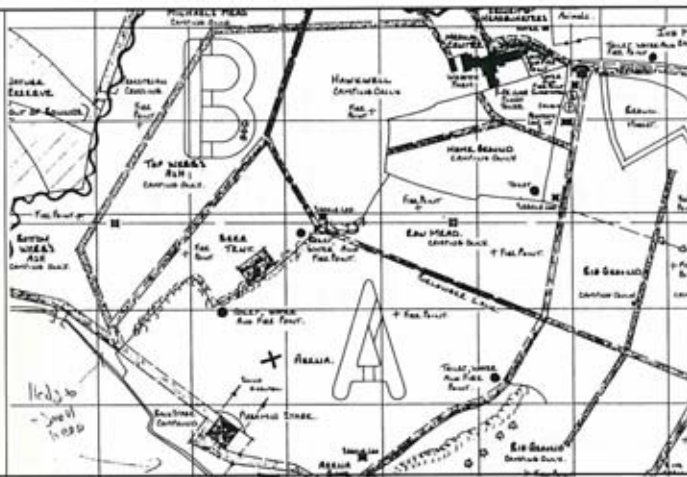
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1990 GLASTONBURY FESTIVAL

Layout of Area:
The Cross indicates
the mix position



interesting and valuable acoustic properties, as well as providing a platform for amazing laser shows. Because the metal cladding isn't covered inside, the mid/high frequency reverberant field is especially strong. Second, because there are no parallel sides, and because the cladding's surface is heavily castellated, the reverberation is highly diffuse. Third, because reflecting surfaces are always more than 15'/5m away from the performers, direct sound is unimpaired. The nett result is that a rich, yet detailed ambient soundfield is built into the mix; it's rather like miking up in a 'live end/dead end' studio control room. The stage doesn't rotate. This is probably wise, considering it's used to store hundreds of festival fixtures like chairs and mats (and as play-area by the Eavis family children!) ten months of the year. Instead, successive bands' drumkits and keyboards are prepared on rolling risers which can be swiftly manoeuvred into position before 'plugging-up'.

At last year's festival, Mendip council applied a restriction on the SPL coming from the main stage for the first time. The 'noise' suffered by the village of Pilton and surrounding countryside was monitored at Benleigh House, 800 yards (700m) from the main stage. It belongs to Michael Eavis' (the farmer's) brother and is conveniently sited at the top of the valley, just inside the village of Pilton and almost on axis to the main stage. A maximum LEQ of 60dB was set at this position, integrated over 15 minutes. The 'LEQ' suffix indicates that the level is integrated (i.e. successively averaged) over a period, so occasional and/or short-term peak SPLs can be 10 or 15dB higher. The effective limit at the mix position was determined at 96dBLEQ with a 100dB ceiling allowed for short periods. In the event, the SPL restriction was broken 17 times during the three day event. A lot of the breaches were regarded as insignificant by the council, while all the serious breaches occurred during one band's set. John Newsham recounts "It wasn't bad for 36 hours of music. The limit wasn't broken accidentally, but because one of the bands' engineers wouldn't comply; he just wouldn't back the faders off". It all contributed to the £14,000 fine levied by the Council on the festival organisers in 1989 for a variety of breaches of their licensing conditions.

This year 'active monitoring' was employed, so the sound engineers had prior warning that they were approaching the 60dB limit at Benleigh House. The SPL limit was set at 93dBLEQ at the mixing console, over an integration period of one minute. This was just an advisory limit for the purposes of meeting the statutory 60dB limit at Benleigh. I

asked John Newsham how the tricky problem of bands' engineers not complying was tackled. "Using the UHQ system was like driving an Audi Quattro in a 30mph limit. So a DPR-402 compressor/limiter/de-esser was connected across the mixer's main L+R insert points, and finely tuned to give a little overall compression and peak limiting. It assisted in keeping within the SPL limits set by the council as well as avoiding the political embarrassment of reaching in front of an engineer to take command of the faders." The series of Turbosound PA systems employed in successive festivals have always been entirely horn loaded - hence highly directional even at bass frequencies. Which means the music escaping the site has been principally confined to within 30° on axis to the main stage.

While bands were playing, SPLs at Benleigh House were automatically logged with a Metrosound DB604 precision SPL analyser. At the mix position, both Britannia Row's engineers and the Council's environmental health officers were equipped with handheld Bruel & Kjaer model 2221 meters which compute and store LEQ readings. This was arranged intentionally, so the sound engineers could see what was going on for themselves with their own equipment, while having a common basis of comparison, so there'd be no disagreements. Regular comparisons also revealed early on, that the batteries in Britannia Row's meter were nearly flat! As weather conditions (notably winds coupled with temperature inversions) could cause the SPL at the far site to deviate independently of the LEQ at the mix position, the two monitoring 'stations' were actively linked by radio phones so adjustments could be made, with Trevor Dixon, the 'man from the council' working alongside to advise the sound engineers. Up at Benleigh House, at the top of the site, sound escaping from the main stage was concentrated towards the low frequencies, so the 'A' weighted reading (which progressively rejects bass frequencies) was presumably reacting as much to the predominant bass as well as to the low-mid content. The monitoring at this point had to be carried out with discretion because of its proximity to site maintenance traffic, notably JCB excavators, farm tractors and HGVs, not to mention the police helicopters' landing pad! To be fair, the council officers made notes and discarded the affected 15 minute segments whenever the recorded SPL was clearly originating from sources unconnected with the main stage.

Sound Assessment

The UHQ system had a smoothness of cover-

age that I had never previously experienced. Quality was uniform throughout the crowd. At 30° off-axis to the last horn on the tower, the SPL fell off extremely rapidly, dropping nearly -10dB with one pace, but without tonal aberration. At the 1983 festival, an Ambiosonic decoder was installed to provide enhanced stereo. This year, and in spite of the gusty winds, the stereo image approached a top-flight domestic hi-fi system. Standing in the middle, 50 yards (45m) from the stage, it was undoubtedly bigger and stronger than the image produced hitherto by any ordinary PA system, and appears to be a product of the UHQ's tightly controlled dispersion and lack of mutual interaction between the individual sources, particularly in the mid and high frequencies. The enhanced fidelity of the electronics chain, notably the Ramsa console and BSS processing and amplification must also have contributed.

The Aftermath

I asked John Newsham to sum up the occasion. Were the SPL limits broken? "The council guys were pleased at our co-operation. We broke the levels on a couple of occasions, but only briefly. We generally had far fewer complaints than ever before - even though we were running louder at the mix position than last year. On occasions, we had to drop a few dB. At other times, especially when the air temperatures changed or the wind dropped or shifted direction to face the stage, we were allowed to increase the levels with the council's consent. The highest LEQ was 101dB during The Cure's set. As long as the noise limit isn't too stringent, it actually has beneficial effects on the sound. It means an engineer can't just push up all the faders to get out of trouble. It keeps the 'dynamics base' of the music happening, preserving the dynamic range of the system."

How was the new speaker system? "The UHQ boxes are much more like the 'Festival System'[*]. Like any other one-box system, the TMS-3s clarity suffered in the windy conditions we get every year at Worthy Farm, when a fairly high number are arrayed to get high SPL. This year I was hearing some difficult instruments - like piano - with unrivalled clarity for the first time. And bass guitar had uniform realism all the way up the scale. I could even hear the round-wound strings!"

What about the winds? "Although they were stronger than average, I was surprised if affected the sound as much as it did. On the other hand, the sonic effect was different. The 'break-up' had none of the wind 'phasing' or 'flanging' the sound, it seemed the complete image was shifting and jumping - possibly because the cabinets were swinging in the breeze. The minimum number of components helped."

Tony Andrews adds "The UHQ system was intended to maximise the soude level in the crowd while controlling the spill. It's purpose made for this kind of situation. Because we've been successful, our R&D department have been given the chance to break radical new ground. The 'Flashlight' is the synthesis of all the work over the past eight years. We've pushed up the compression drive to 8kHz, out of the critical mid-band. The 6 1/2" driver alone has taken us 18 months to develop and refine." The last word goes to engineer Chris Lindop, who equipped immediately after mixing The Cure's set "Where can I get one?"

*An early Turbosound system used at the Glastonbury Festival from 1978 up to 1982.

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