

# AUDIO FOR HD & 3D – UEFA CHAMPIONS LEAGUE FINAL

**Matt Bell looks at how Sky Sports OB audio workflows have evolved to cope with live championship football in high-definition 3D & 2D, with 5.1 surround sound**

**European satellite broadcaster BSkyB was one of the world's first to begin regular high-definition transmissions to a consistent technical standard; its HD Sky Sports channel launched in early 2006 after several years of behind-the-scenes preparation.**

Sky's control over its broadcast chain, from production to satellite distribution, meant that it could re-write the rules for its new HD workflow as required, but the lack of a technical precedent to follow meant that the company had to invest vast sums in the necessary production, post and transmission infrastructure, and work with manufacturers to develop much of the technology it required for HD broadcast. The transition also meant that Sky's OB facilities partners had to invest in HD-capable vehicles, most of which had to be built from the ground up.

After many trials and much discussion, Sky published a detailed technical specification for every element of its HD production and broadcast chain, ensuring that even when it was working with equipment provided by third parties (such as its OB partners'

trucks), the complement of equipment provided for its use would always be the same. The spec of the service was fixed at MPEG-4-compressed 1080i video, with 5.1 surround sound where possible, and stereo audio otherwise.

The HD service began with football and rugby matches (although cricket, golf and darts followed). To achieve the required audio standards, the agreed plan for football stadiums was to capture the overall ambience of the venue in 5.1, and then use further spot mics at pitch level to add close-up detail, such as the ball being kicked, and players' cheers. Mindful of the fact that many of their subscribers would still be listening in stereo, Sky's engineers designed the audio workflow so that folding down the 5.1 mixes to stereo would not cause phase problems. They avoided the use of multi-mic arrays, which they felt could not be guaranteed to produce phase-coherent audio in every possible broadcast situation, and instead worked with UK microphone manufacturer SoundField to develop a digital, 'point source' microphone system, the DSF-2. This microphone system outputs phase-

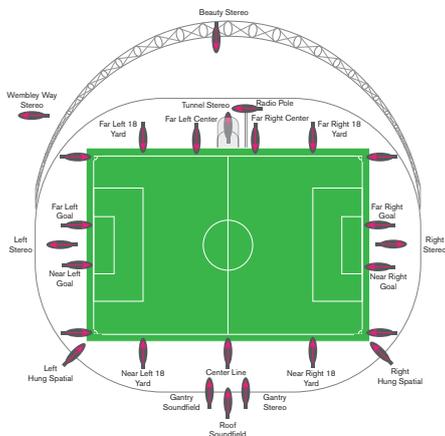
coherent 5.1 audio which can be collapsed to stereo (or even mono) without generating phase artefacts.

To the output from the DSF-2, Sky adds pitch-level detail from a group of Sennheiser 416s placed in custom coloured Rycote windshields around the pitch and over the tunnel through which players enter the stadium (usually 12 in total). A more directional Sennheiser 816 is attached to a swivelling camera on the half-way line, Left and Right fill mics are placed at either end of the stadium (usually Sennheiser MKH20s), and radio mics are attached to Steadicams used near or on the pitch itself. (Collectively, these pitch-side ambient mics are known at Sky as the Effects mics.) The outputs from all of these mics are fed back to OB vehicles equipped with Calrec mixing consoles. In the early years of Sky HD, Calrec Alpha desks were used, but the new Apollo consoles are now replacing these.

This standard set-up has been used mostly unchanged on the stadium-based events Sky has covered in high-definition since 2006, but it has varied for large-scale fixtures. To find out more, I spoke to two OB engineers from companies that have provided HD OB facilities for Sky Sports from the beginning: Neville Hooper of NEP Visions and David Rowley of Telegenic. At the time of our conversations, their most recent job for Sky was overseeing coverage of the UEFA Champions League final at Wembley Stadium, Hooper taking responsibility for the 2D coverage and Rowley the 3D. The task was in every sense larger than average, with Sky's HD coverage of the final being beamed to over 25 foreign broadcasters around the globe via the European Broadcast Union's satellites, in addition to Sky's own channels.

NEP Visions deployed its latest pair of HD vehicles, collectively known as Gemini, to handle the 2D coverage and the so-called





‘World Feed’ which was distributed via the EBU. “Gemini is two trailers which act as Sky’s match and presentation trucks,” explains Neville Hooper, Deputy Head of Sound at NEP Visions. “One truck has two audio production control rooms, each with a Calrec Apollo, and the other has the video control room, and the recording/slo-mo video playback area. The match was mixed on one of our Apollos, the opening ceremony, pre- and post-match interviews on the other.” The feeds from the game were distributed to the EBU, terrestrially and via satellite. The trucks were parked in the underground broadcasters’ compound at Wembley Stadium.

For the match itself, Gemini only produced pictures and audio from the Effects mics; NEP Visions had a separate truck providing Sky’s commentary, while the foreign broadcasters’ commentary was produced elsewhere in Wembley, in a separate Commentary Control Room (CCR). A TOC (Technical Operating Centre) by the stadium’s East Gate took feeds of Gemini’s video and Effects-only audio, and was responsible for ensuring that the foreign broadcasters, whose trucks were parked near the TOC, added the correct commentary from the CCR to their feed of Sky’s coverage. “The TOC gave all the foreign broadcasters one central point to refer to if they had any problems with our

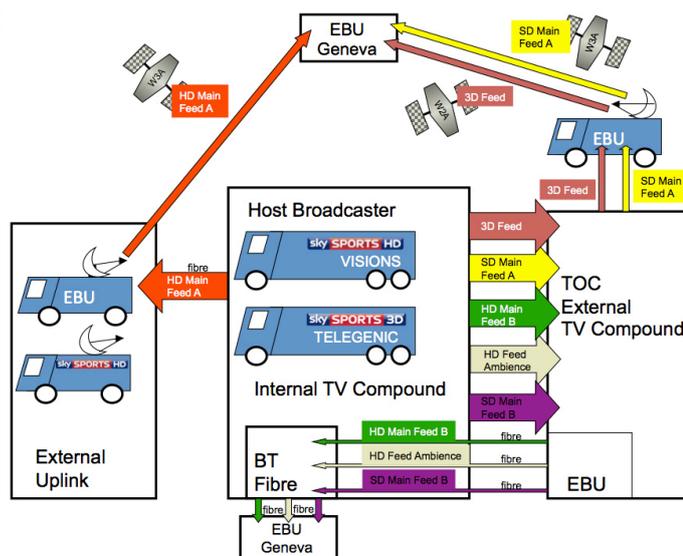
feeds,” explains Hooper. An exception was made for Telegenic’s trailer, which looked after the 3D coverage of the event; it was parked next to Gemini and took direct feeds from it.

The process of setting up the equipment and the feeds in between the various OB vehicles and the TOC took five days. “It wasn’t just a case of driving the trucks into the compound and putting the usual mics out,” comments Hooper. “For example, Sky have permanently installed SoundField DSF-2s at a lot of football stadiums in the UK, but not yet at Wembley — and we’d decided we wanted more than one for this game anyway. We had one very high up under the roof, and one on the standard TV gantry. We put up a pair of high-slung omnis about level with the 18-yard line, the ‘Spatial’ mics. There were also mono DPA shotgun mics, configured as stereo pairs, behind each goal, pointing up at the crowd, and 16 Sennheiser 416s around the pitch instead of the usual 12.”

“There were extra ‘beauty shot’ cameras, including one on a helicopter run by Aerial

Camera Systems,” continues Hooper. “Within the stadium, we associated the high beauty shots with the highest SoundField, so that the ambience for that shot was in instant 5.1. There were three radio cameras in the stadium with mics, and a radio-linked Sennheiser 416 on a boom pole going around with one of the Steadicams, to get added on-the-spot pictures and sound, for example during the coin toss at the start. And when Barcelona were throwing their Captain around at the end, the pole mic was right in there, which was great.

“We also had to lay all of the fibre-optic feeds round to the TOC and the CCR, test all the radio mics, and interface with Aerial Camera Systems. Just getting the comms set up to talk to all of those people is often the biggest part of the job. The audio feeds were sent to the TOC embedded in the video feeds, but we also sent two MADI streams as a backup, and analogue feeds via multicore, in case anything went down. Supplying the Telegenic truck next door was fairly straightforward — we used AES over MADI for the audio, again with analogue via multicore as backup.”



## 2D to 3D

Although the visual side of 3D broadcast requires separate stereoscopic cameras, the audio side is more straightforward. Sky's preferred audio format for 3D broadcast is 5.1 surround, as on its 2D coverage. The earliest 3D outside broadcasts on Sky in Spring 2010 were made using the 5.1 mix being transmitted with the 2D pictures, but as David Rowley, Telegenic's Head of Sound, explained, this soon changed. "In the beginning, we just took a clean Effects mix from the 2D truck. But different production values have to be applied for 3D broadcast. Viewers have to be given time to absorb the 3D content, so there's not as much fast cutting as there is in 2D. And that means you need a separate commentary team and a separate Effects mix to complement the picture. We usually take in every source separately over MADI from the 2D truck — the pitch mics, the SoundField mic, and any camera mics that we're taking feeds from — and our Sound Supervisor does a mix for 3D."

The scope of the Champions League broadcast necessitated some compromises. Neville Hooper: "With all the foreign broadcaster commitments at the final, we didn't have enough MADI streams available, so we sent the 3D truck a premixed feed of pitch-side mics — what we call the Ball Kick Group — as a premixed feed." "We still had a number of discrete feeds, including those from the SoundField mics, to add to our mix though" adds David Rowley.

"Fortunately," continues Hooper, "on Calrec's MADI I/O boxes, you can feed out of the optical and co-axial outputs at the same time, so we could double up on some of our feeds in the compound, one on copper and one on fibre, when we needed to send the same signal out to two different destinations."

In the near future, the hope is to streamline the tangle of MADI and analogue connections, as Rowley explains. "We've just started experimenting with Calrec stage boxes using Hydra 2, the audio networking protocol on the Apollo. The idea is to network the commentary positions to the main desk with remote Hydra stage boxes, using the built-in fibre connections that you're starting to find in the major stadiums." "We used two fibre-connected Hydra 2 boxes out in the stadium to bring in the pitch mics at this final," adds Neville Hooper. Rowley continues: "We're hoping this will be our standard way of working by next year — we already use the older Hydra 1 boxes with Calrec Alphas on our Rugby coverage. Our aim is to use less copper cabling than we do at the moment; it can be susceptible to hum and wiring faults, and the rigging time is much longer, because there has to be so much of it."

## Mixing

Telegenic and NEP Visions adhere to a standard console layout when working for Sky, with pitch and Effects mics routed to the fader channels on the Apollo's left, and group faders assigned to the right side. These carry submixes like the aforementioned Ball Kick Group, and these are usually routed to both the main output mix containing commentary, and the 'clean', Effects-only mix onto which other commentary can be layered. Commentary is always mixed exclusively to the Centre channel, although studio-based discussions featuring multiple commentators, such as the half-time analysis, are mixed across the front three channels to give a wider spread.

Generally speaking, mixing for football is very much a hands-on event for Sound Supervisors, as David Rowley explains. "They're forever trying to second-guess





the players. If the action goes to a corner shot, for example, there will be a corner mic mainly covering that, and also the goal mic and the 18-yard mic will be present in the mix at a lower level. What most Supervisors will do in that case is ride the goal fader if the ball heads that way from the corner, or ride the 18-yard mic if it gets kicked up the pitch instead. If you watch an experienced Football Supervisor at work, they're constantly fading up combinations of mics, and fading down others. Over time, they do

develop a feeling for where the ball is likely to go next."

Thanks to the care taken when originally specifying the mic'ing systems for Sky's HD coverage, stereo fold-down compatibility of the 5.1 mixes produced for the 2D and 3D broadcasts is excellent. Neville Hooper: "The Apollo desk automatically creates a Dolby Pro Logic-encoded LtRt mix at the same time as the 5.1 mix. We never have any serious problems at the downmix stage

now — we went through all of that pain in 2005!" The standard format for each of the eight-channel audio output feeds from the Calrec Apollo on a Sky transmission has the downmixed stereo LtRt mix for SD transmission on the first pair, containing Sky commentary and the stadium Effects mix, then a similar LtRt stereo mix on the second pair which lacks the commentary, to which international commentary can be added. The third and fourth pairs also feature 'with commentary' and 'clean' Effects-only mixes, but in Dolby E-encoded 5.1. For the Champions League final, this standard arrangement was again varied to accommodate extra foreign broadcasters and UEFA's own commentators.

### **A Model Broadcast**

As a testament to all of the careful preparation involved in its broadcast, the Champions League final was seen on TV by an estimated 300 million viewers worldwide, in addition to the 87,000 spectators packed into Wembley Stadium in person — and there were no on-air hitches. "It was a very long week, but the broadcast went off without any problems," comments a relieved Neville Hooper. "There was nothing to make viewers sit up and wonder what had gone wrong, anyway — and that's what we're there to achieve."

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