AMBISONICS REVISITED

BY JOHN BORWICK

SURROUND SOUND continues to make news, even though all the major record companies have turned their backs on it, and even BBC sound radio now gives it only a very occasional mention. The uniquely British contribution is that possibly definitive process (because it encompasses a whole ladder or 'hierarchy' of two and three dimensional recording and reproducing formats) known as "Ambisonics". It is this system which I have been putting to exhaustive tests recently, and which forms the subject of this report. But there has also been progress towards an in-car version (Troy) and the audio-video world is agog with what can be done with a (very simple, non-Ambisonics) surround processor to reproduce in the home that multi-directional effect now enjoyed in the better equipped cinemas when they show films with all-round Dolby soundtracks. I shall discuss these developments in a later article.

...e Ambisonics background

The first thing to say about the Ambisonics system is that it is fully developed technically. The mathematical and electronic specifications were worked out in detail about 15 years ago by Peter Fellgett of Reading University (see, for example, his articles in our January and February 1976 issues, pages 1266 and 1397) and Michael Gerzon of Oxford. They later worked together with one of the luminaries of the Nippon-Columbia multiplex quadraphony system, Duane Cooper of the University of Illinois, and today the Ambisonics technology is protected by more than 100 patents worldwide.

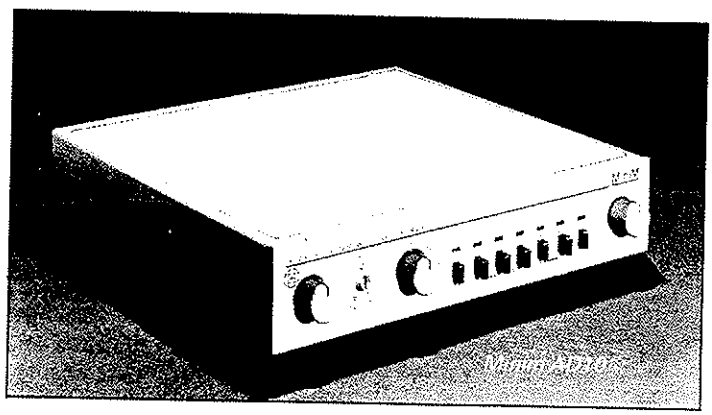
In this cruel commercial world, however, just having a thoroughly interesting technique for recording and reproducing the natural sound-field, with all the directional and environmental clues intact, does in no way guarantee its wider acceptance. The group of experts, headed ...se named above, did their bit by presenting papers to learned societies and setting up demonstrations at hi-fi shows. These invariably awakened keen interest amongst hobbyists but, when there was practically no possibility of following up the idea by buying suitably encoded discs and decoder units, this interest soon waned.

What was needed was a commitment to the system by recording and hi-fi companies, and this simply did not happen. Against any such commercial commitment was the still-fresh memory of the frustrating and expensive mistakes made by nearly everybody in promoting (simultaneously!) the three ill-fated quadraphonic systems SQ, QS and CD4. Any suggestion of taking on-board a new surround sound system—however superior in quality—would have an executive laughed out of the boardroom. Perhaps realising their own limitations as persuasive travelling salesmen, the Ambisonics team signed up the system as a project under the banner of the then NRDC (National Research Development Corporation). This produced some financial backing, indeed up to now about £500,000 has been invested in the project, but the hoped for commercial acceptance has not come about.

One encouraging side-effect has been the growing popularity amongst recording engineers of a special Soundfield microphone designed by the Ambisonics team and turned into an attractive product by the manufacturers Calrec. This consists of a cluster of four microphone capsules contained within a single casing and coupled to an extremely versatile control box. The Soundfield microphone can be used for straight Ambisonic recording in a number of formats or, most profitably, as a high quality stereo microphone in its own right. The special control circuitry then provides the engineer with facilities for 'steering' the unit's directional properties by remote control (even when copying the tape at a later date): no wonder it is popular. However, the engineer can at the same time commit to tape the full Ambisonics encoded signals to reproduce now, or at any future time, the complete soundfield effect for natural surround sound in the horizontal plane—or even a fully periphonic (with-height) 3D effect (see Fig. 2).

There is therefore a growing archive of Ambisonics encoded master tapes languishing in the record companies' shelves (having been processed for the immediate marketplace in the more acceptable stereo format). If Ambisonics ever does get the full go-ahead, these recordings could well provide the basis for a rapid build-up of available repertoire.

A few discs are already available in LP and CD form for the few enthusiasts who have invested in an Ambisonics decoder plus the necessary pair of rear-channel loudspeakers and amplifiers (see Fig. 1). The main source is Nimbus Records, all of whose recordings since the mid-1970s have been Ambisonics (UHJ) encoded. (It is a special feature of the Ambisonics system that such recordings are compatible with stereo or mono playback—unlike the now defunct quadraphonic systems which invariably sounded a little odd in stereo, and even more odd in mono.) Nimbus adopted the Soundfield microphone early on but now, as I found on a recent visit to their recording studio, they have put together an Ambisonics microphone arrangement of their own.



Ambisonics now

The NRDC has now been replaced as sponsors by the BTG (British Technology Group) and I can detect signs of a bolder bid for public and professional acceptance of the technique. For a start, BTG organized a one-day Ambisonics Seminar at the Russell Hotel, London on October 10th, 1985. This comprised a number of formal presentations explaining the differences between the professional B-format mastering and UHJ consumer versions, and the more elaborate loudspeaker arrangements for large auditorium or promotional applications. Workshop sessions involved the attendees in hands-on experience with (a) multi-track mixdown, using an equipment package now available to studios, (b) two-channel UHJ playback from commercially released discs and tapes, (c) Ambisonics soundtracks on video tape, and (d) the use of periphony for music and drama.

It remains to be seen to what extent all this missionary work will cause Ambisonics to spread throughout the recording and broadcasting fraternity—eventually persuading consumers to invest in a four-speaker array. I am making no forecasts, even though I have found this method of recording and listening to music a very satisfying exercise.

Proof of the pudding

As well as a shortage of recorded material, the spread of the Ambisonics technology has been hampered by the near non-existence of that other half of this chicken-and-egg situation, domestic Ambisonics decoders. There have been short-lived flurries of manufacturing activity on behalf of Boots and others, but the longest persisting company has been Minim Electronics Ltd., Lent Rise Road, Burnham, Slough SL1 7NY.

They currently market two decoders, the AD10 (£299·95) and a simpler AD7 (£129·95), and an AD8 decoder/amplifier (£179·95) which simplifies the equipment hook-up by wiring an AD7 and a 20 watts-per-channel amplifier into a single case.

I have been experimenting with the Minim AD10 and a selection of amplifiers and loudspeakers—all the way up to monster professional amplifiers and four B&W 801 loudspeakers. There are subtle improvements as one moves up the fidelity scale of carefully matched playback equipment, but the sense of being present in the acoustic environment in which the music is being performed is still remarkable with quite modest amplifiers and speakers.

The AD10 has a Layout control to compensate for a wide range of rectangular arrangements of the loudspeakers from length/width aspect ratios of 2:1 to 1:2. This allows for experiment in almost any shape of room, and of course a little cheating is permitted if you prefer more 'width' than other people, for example. There is also a Distance button which compensates for the extra spread of low frequencies (spherical waves) at distances of 3 metres or more. A Focus control

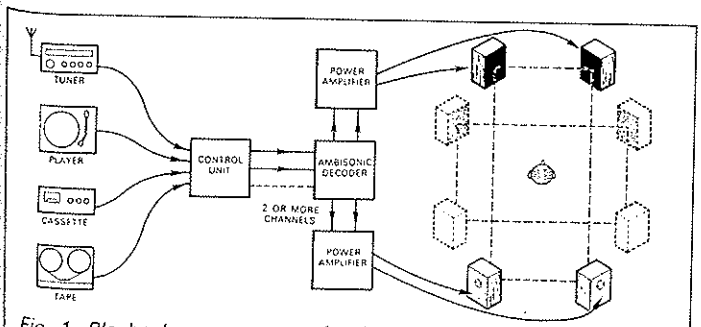


Fig. 1. Playback arrangements for Ambisonics encoded programme material

gives more detailed listening to the front sound stage, whilst a Position control has the effect of moving the listener forward and back in the imagined auditorium.

Of course with such a dearth of properly encoded recordings or broadcasts, the user will be obliged to do most of his listening to normal stereo material. There is therefore a Stereo Enhance control giving a range of playback effects from non-Ambisonics sources from a central mono image all the way to an all-round surround picture. Alternatively, the Stereo switch reverts to normal stereo reproduction via the front loudspeakers only. For setting up the gain in all four channels, there is a Set button which combines all input signals into a single mono sum sent equally to all four output sockets.

With this setting up reassurance so easily carried out, it was possible to check the system's performance in quick time. I had available to me a large proportion of the 100 commercially released recordings, and several Ambisonics tapes made using the Soundfield microphone. Pop recordings were of course impressive, and adaptable to variations in front/back balance to taste. These included the live jazz and folk music LPs made in the USA by IMF when they were associated with the Ambisonics project, and the audience participation and applause added further realism to the already lifelike theatre and club auditory settings.

One excellent classical album which I can strongly recommend is the justly famed "The Fenby Legend" in which Eric Fenby conducts the music of Delius (Unicorn-Kanchana DKP9008/9, 10/81) though only sides 2-4 are UHJ encoded. The Minim decoder could be adjusted so that orchestra and voices seemed to float most naturally as from a concert platform, with me sitting in a privileged seat in a moderately lively auditorium—a magical effect. This album would make a persuasive argument for anyone planning to move into Ambisonics. So too would almost any recent Nimbus LP or CD, with the Compact Disc version now a more likely acquisition following the recent Nimbus announcement that they have decided to cease LP production (and devote all their energies to their CD plant, building up its annual CD capacity to 25 million from mid-1986).

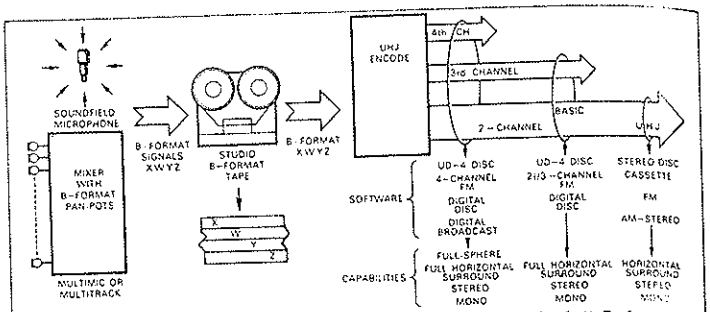
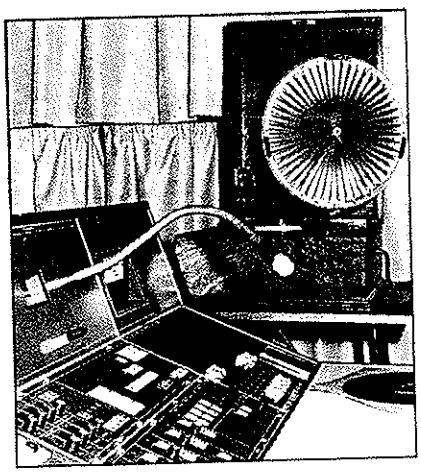


Fig. 2. Professional master tapes store the recording in full B-format for subsequent replay in a hierarchy of formats

I spent a long time relishing the spacial effect and added naturalness on several Nimbus discs. The one I returned to most often perhaps was Haydn Trumpet and Horn Concertos played respectively by John Wallace and Michael Thompson with the Philharmonia Orchestra directed by Christopher Warren-Green (Nimbus NIM5010, 10/84). I would urge any reader to ask for this to be played if they arrange an appointment at Minim Electronics, or can find a dealer demonstrating the decoders.

Don't blame me if you are carried away by the pleasing wrap-round effect and impression of 'being there'—and end up buying the disc, and the decoder and the necessary extra amplifiers and speakers. For you the Ambisonics era may have arrived—despite the fact that so much of the world is looking the other way. What they are looking at—Audio/Video with surround sound—I shall discuss soon.



The NSA digital console recording from a 1924 Lumière gramophone

NSA digital desk

The British Library National Sound Archive, 29 Exhibition Road, London SW7 2AS has installed the world's first specially-designed digital sound-processing desk. This was custom-built by Neve International Ltd., and represents only the third all-digital sound console from Neve, following on the heels of mixing consoles delivered to CTS Studios, Wembley and the BBC. The NSA desk is capable of computer-controlled filtering, suppression and boosting for the restoration of non-ideal recordings of any vintage. The facility is available for individuals and organizations, as well as forming a major installation for the Archive's own programme of sound recording and storage. The NSA, formerly the British Institute of Recorded Sound, is now part of the British Library and spends about £20,000 annually on preserving its holding of recordings of all kinds. Over one million items of recorded music, literature, wildlife and actuality sound are held on media ranging from wax cylinders to today's Compact Discs. A public listening service is available by appointment.

Meeting News

The British Section of the Audio Engineering Society is continuing with its regular series of evening lectures, held normally on the second Tuesday of each month at 7 pm, with tea at 6.30 pm. The venue is the IEE, Savoy Place, London WC2 and non-members are welcome. Forthcoming lectures are as follows:

April 8th, "The art of orchestral recording" by Brian Couzens (Chandos)
May 13th, A digital audio colloquium
June 10th, "Electronic sound effects" by S. Nevison
July 8th, "BBC digital control vehicle" by J. McErlean

The Institution of Electronic and Radio Engineers are holding a Colloquium (one-day conference) on "Audio companding and noise reduction techniques" at the Royal Institution, Albermarle Street, London W1 on April 23rd. It will include papers from Sony (on 8mm Video), Dolby Labs, DBX, Telefunken, Audio & Design, Electrosonic, BBC Research Department and the Home Office. The meeting will commence at 10 am and will include demonstrations. Further information and registration forms from The Conference Secretariat, IERE, 99 Gower Street, London WC1E 6AZ

Trade News

Automation Sciences Company have moved to 20 Little Gaddesden, Berkhamstead, Herts HP4 1PA.

Shackman Electrostatic Loudspeakers are now located at 106 Piccotts End, Hemel Hempstead, Herts HP1 3AU.

Mecom (Acoustics) Ltd., have changed their name to Heybrook Hi-Fi Ltd., and are still located at Knighton Hill, Wembury, Plymouth PL9 0ED.

TDK UK Ltd., Pembroke House, Wellesley Road, Croydon CR0 9XW have dropped the words "Tape Distributor" from their name, and have also announced the setting up of a TDK magnetic tape plant in Western Europe. This is located in a former Grundig factory in Rammelsbach, West Germany. TDK Corporation of Japan plan to invest DM25 million during 1986 and reach a production capacity of 3 million audio cassettes per month from January 1987.

Sondex Ltd., 4 West Street, Alderley Edge, Cheshire SK9 7EG are no longer using the brand name of Orpheus for their range of hi-fi amplifiers.

Quad Electroacoustics Ltd., Huntingdon PE18 7DB are removing the voltage selectors on all Quad models except the Quad 44 preamplifier. They are also introducing a new colour scheme for their products. The traditional Quad browns are to be replaced by a metallic grey and charcoal. The new Quad 306 power amplifier is to be available in the new grey only, but existing products will be available in both colour schemes for the time being.

Ventura Leisure Ltd., The Broadway, Old Amersham, Bucks have taken over the UK distributorship of the American Proton audio equipment.

RAK Electronics, Rosewood House, Bridge Road, Downham Market, Norfolk PE38 0AE undertake repair and restoration work on a wide range of valve-based audio equipment.

Presence Audio, Eastfield House, Plummers Plain, Horsham, West Sussex RH13 6NY have added new lines to their UK distributorship. These include Ensemble loudspeakers, Glanz cartridges, Interface accessories, Kiseki and Milltek cartridges, Nuance preamplifiers and Plenitude power amplifiers.