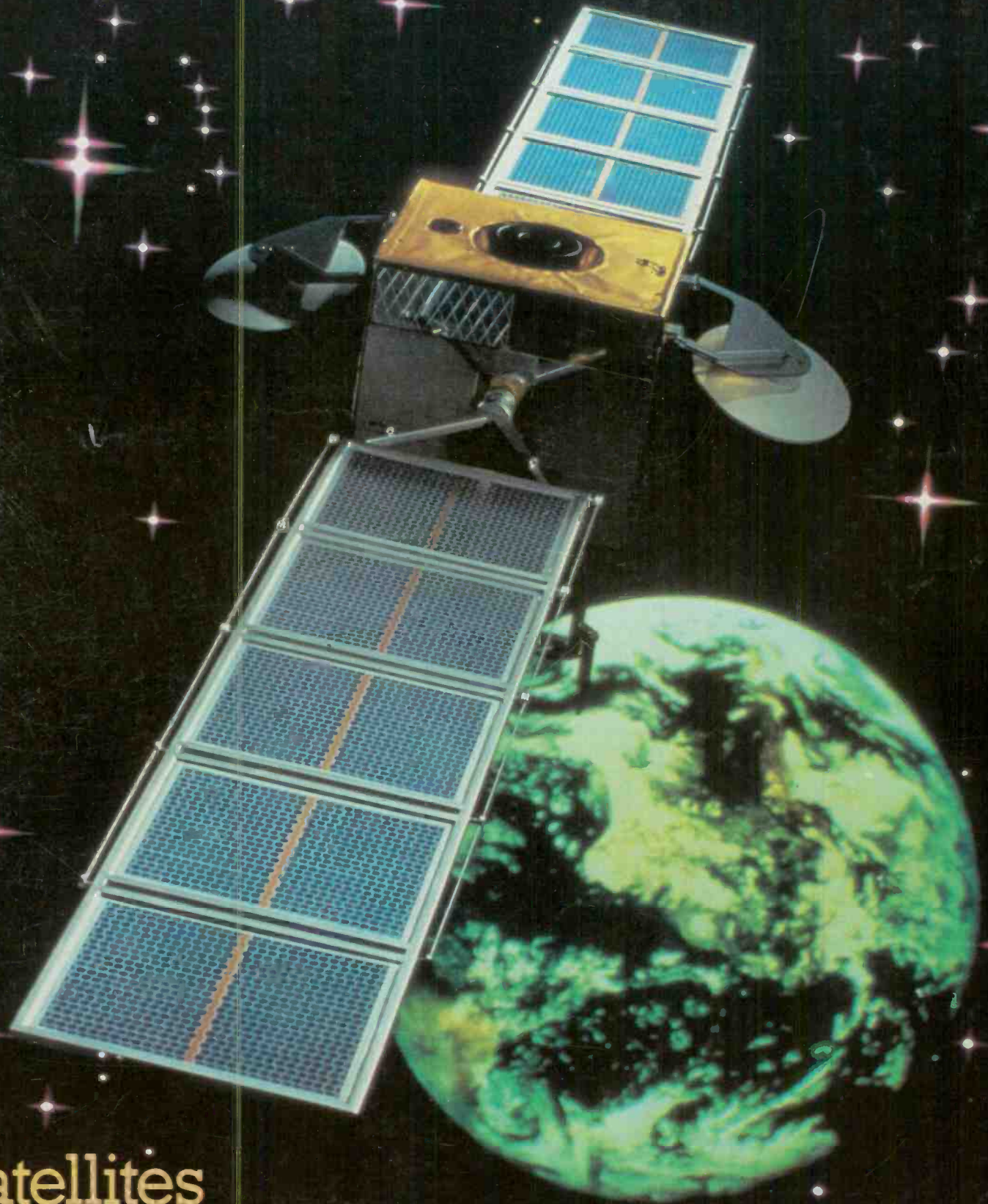


SEPTEMBER/OCTOBER 1984 £1

BROADCAST SOUND

A-LINK HOUSE PUBLICATION



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IBC preview
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Soundcraft

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SEPTEMBER/OCTOBER
VOLUME 3 NUMBER 5
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EDITORIAL

Editor designate
RICHARD LAMONT
Production editor
ANN HORAN
Production assistant
LINDA FIELDHOUSE
Consultant
HUGH FORD
Secretary
CARRIE LOVE

ADVERTISING

Sales manager
MARTIN MILES
Sales
COLETTE RAMSAY
Secretary
MANDY PAUL
Production manager
JACKY THOMPSON

Commercial manager
PHIL GUY

Editorial and Advertising

Offices:

LINK HOUSE
DINGWALL AVENUE
CROYDON CR9 2TA
GREAT BRITAIN

Phone: 01-686 2599
International: +441 686 2599
Telex: 947709

Telegrams: Aviculture
Croydon

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Japan and Far East agent:
Media Sales Japan Inc
Tamuracho Bldg 3314
Shimbashi Minato-Ku
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Cover

Unisat 1, the UK's proposed Direct Broadcasting Satellite, will be built by United Satellites, a consortium of British Telecom, British Aerospace and GEC-Marconi. Programme services will come from a joint BBC, ITV and 'third force' operator.

Photo illustration: British Telecom

BROADCAST SOUND

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EDITORIAL

Better mousetraps

The conventional wisdom in commercial radio is that advertisers just want ratings: provided the demographic profile is OK, the main thing is the number of listeners.

In the last issue of *Broadcast Sound*, Tim Lyons of Radio West described how their programme for computer buffs, *Datarama*, attracts advertising for computer products. Hardly surprising. In this issue, Michael Bartlett describes how he's made drama the salesman's friend – by delivering a *national* vehicle for advertising.

The implications of these two things are clear: minority, specialist programmes attract minority, specialist ads. It is no way to make money at breakfast time but it seems to work in the evening. Second, advertisers want a national medium.

The time has come for ILR to think big. With a stereo distribution network using satellite subcarriers, and a re-shuffle of the programme schedules, ILR could operate as a national medium for a few hours each day, carrying... computer programmes and drama, among other things. The costs seem manageable, especially if local cable companies can provide the satellite downlinks. Revenue would surely increase substantially, and ILR as a medium would gain a vastly improved image. That would really be one in the eye for the pirates.

Richard Lamont



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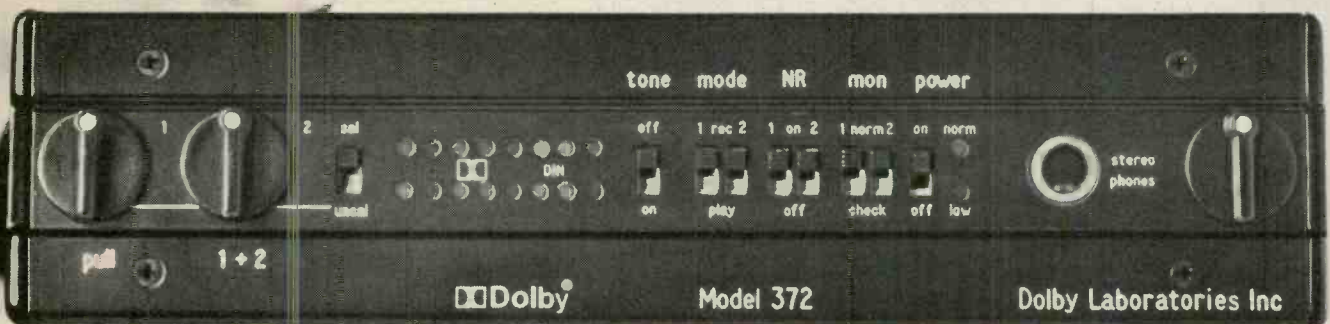
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All in all the 601 Superdynamic Limiter and the D60 Feedforward Limiter Delay Line meet all the requirements of critical transient control.

Be ready for tomorrow's challenges by making the right equipment decisions today. Contact Audio+Design for all the details.

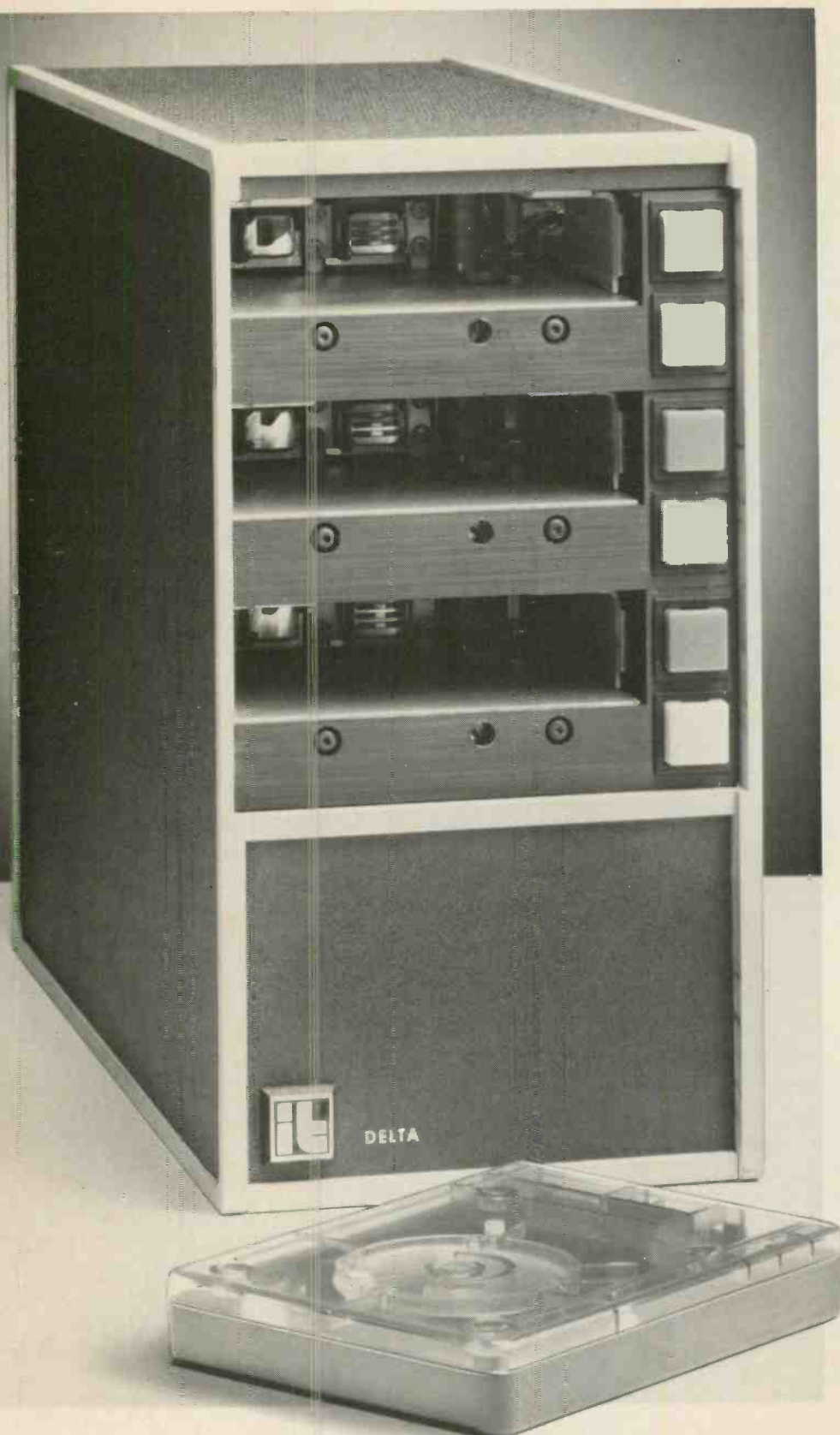
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speed controller, and exceptional shock absorption. The built-in EQ amplifiers have balanced studio outputs as well as integral muting for run-up.

Almost all international standard 47 k-ohm magnetic cartridges are compatible with the EMT 938. Compact and light in weight, the unit can be surface mounted or recessed in a table-top.

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BBC stereo TV success

The BBC says it is confident that digital transmission is the best way of adding stereo to its existing TV networks.

After a series of tests at the Wenvoe and Crystal Palace transmitters, engineers carried out a compatibility trial with the Crystal Palace BBC 2 transmitter after close down. They broadcast a digital stereo recording of a recent *Sight and Sound* concert featuring Thin Lizzy, synchronised to an analogue videotape. The picture was recorded on 1 in C-format, and the sound (from a Sony PCM F1) on a U-matic. The two machines were synchronised by timecode on their analogue audio tracks. The 44.1 kHz F1 signal was converted to 32 kHz sampling by a Studer bit-rate converter, and a BBC-designed digital processor altered the pre-emphasis for transmission. This all-digital process produced a 700 kbit/s bitstream which was fed on a

microwave link from Television Centre to Crystal Palace, where it was subsequently qpsk-modulated on a carrier located 6.55 MHz above the vision carrier, at a power level of -20 dB with respect to peak sync.

The BBC began negotiations to establish a UK standard with the IBA and the Home Office at an early stage, in order to avoid another Extended-PAL v MAC battle.

The BBC plans to make more transmissions during normal programme hours, subject to Home Office approval. In the long term, however, the expense of providing stereo transmitters is likely to mean that it will take many years to provide stereo throughout the UK. Apart from a handful of key stations, it seems that stereo may only be installed when transmitters are replaced because of old age — but such replacement is already beginning to happen.

Channel 4 radio mic fears

Channel 4 is worried that it may be unable to make some programmes unless independent producers can obtain new frequency allocations for their radio microphones.

At the moment, independent producers usually rent their radio mics from equipment hire companies. However, these operate on spare frequencies inside Band III (174 to 225 MHz) which will almost certainly be allocated to mobile radio when 405-line TV closes down in January 1985. Because of the difficulty in obtaining licences, many companies have been forced into DIY frequency allocation in contravention of the Wireless Telegraphy Acts.

A joint study group of the Department of Trade and Industry's Radio Regulatory Division (RRD), the BBC and the IBA has proposed that there should be six blocks of frequencies for radio mics in Band III, each 700 kHz wide, providing 18 channels. The study group also wants a 4 MHz allocation in Band I (41 to 68 MHz), providing a further 19 radio mic channels.

Unfortunately, because of the snail-like pace of Whitehall, the study group calculated the demand for radio mic channels long ago, when the only broadcasters were the BBC, ITV and ILR. Channel 4 and cable TV were not operating, so the study took no account of the needs of independent producers. The

proposed 37 channels are for the exclusive use of the BBC, ITV and ILR.

The Independent Programme Producers' Association (IPPA) is calling on hire companies to form a group to press the RRD for a radio mic allocation. Non-broadcast users of radio mics, such as theatres, clubs and PA companies, are also seeking an increased allocation — at the moment they are limited to very low power in the band 173.6 to 175 MHz.

European cable radio

The Audio Broadcasting Company, formed in April, aims to provide European cable networks with stereo audio services starting in early 1985.

Although programming formats are still being developed, it seems that the first three networks will be a 'Top 40' service, an AOR service and an up-market channel carrying such things as classical and jazz music including a large proportion of compact disc material, news and business — described by managing director Barbara Lodge as "a sort of LBC with music". The networks will be financed by advertising, conforming to IBA rules. Other sources of finance are being considered, but much depends on changes in European cable and satellite laws.

The company is looking for London studios — as yet it has not decided whether to rely totally on

facilities houses or to build its own studios.

The networks will be distributed via subcarriers on the European Communications Satellite. Cable companies will feed the signal to subscribers as an FM signal, to plug into the aerial socket of an ordinary stereo tuner.

UK ILR news

● Piccadilly Radio (Manchester) has announced that managing director Colin Walters has taken on the role of editor of the station's output, following the departure of programme controller Tony Ingham. Simon Cole has been promoted to head of programmes, Mike Shaft to music controller and Mike Briscoe to head of news and current affairs.

● A fund has been set up following the electrocution of Severn Sound engineer Tony Cooper and assistant Nigel Lane, which happened when their radio car's link aerial touched a 6.6 kV overhead power line. The address is: Severn Sound Engineers' Benefit Fund, William and Glyn's Bank, Westgate Street, Gloucester.

● Swansea Sound has held on to its franchise, subject to agreement with the IBA on "operating points", for up to eight years starting in September 1985. Swansea Sound was challenged for the contract by one other bidder, Radio Gwyr Cyfyngedig (Radio Gower Ltd).

● Viking Radio is now on the air in Humberstone, on 1161 kHz and 102.7 MHz.

● More than £2 million was raised by ILR charity appeals during the year ending March 1984 — up £300,000 on the previous year. Half of the total came from Piccadilly's charity marathon.

● Piccadilly Radio presenter Timmy Mallett managed to play *Two Tribes* by Frankie Goes to Hollywood five times in one show on the day it was released.

NAB says line tariff regulation must stay

The National Association of Broadcasters is asking the Federal Communications Commission to continue to regulate tariffs for special broadcast lines and services provided by common carriers. It says that to deregulate in this area "would denigrate the Commission's statutory role of ensuring that rates and service offerings are just, fair and reasonable".

NAB says it would be wrong to

deregulate in the absence of a competitive market: the FCC's assumption that all markets are competitive is wrong because many relevant local markets are not. In some circumstances, says NAB, broadcasters have no alternative to these services, and would be at the mercy of monopolies.

NAB argues that the lack of competition and scarcity of supply would cause delays and even the loss of some programming, and force broadcasters into using more radio links, which would be impractical because of frequency congestion.

Events

September 16 to 19
Radio Convention and Programming Conference, Los Angeles, USA.

September 21 to 25
International Broadcasting Convention, Brighton, UK.

September 25 to 27
AES Convention, Melbourne, Australia.

September 30 to October 4
Institution of Radio and Electronics Engineers Exhibition, Melbourne, Australia.

October 8 to 11
AES 77th Convention, New York, USA.

October 23 to 25
Inter BEE 84, Tokyo, Japan.

November 11 to 14
Gulf World Film, TV and Radio Exhibition and Conference, Dubai.

November 29
Sound Broadcasting Equipment Show, Birmingham, UK.

1985
March 5 to 8
AES Convention, Hamburg, West Germany.

People

Bill Denny has been appointed controller, operations and engineering, BBC Radio, following the retirement of Duncan MacEwan ... Christopher Pettit is now managing director of Eddystone Radio: he succeeds Bill Cooke who becomes Eddystone's chairman ... Robin Doughty moves from Harman (UK) to HH Electronic to become their new sales manager ... John Guaspari moves to the newly created position of manager, corporate marketing programmes at GenRad Ltd ... Joan Davies becomes head of BBC World Service's Popular Music Unit: she succeeds Humphrey Walwyn who recently became head of BBC Records ... Henry Pattinson will start work as BASF UK's external affairs manager on October 1.



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Holland AEG Telefunken 20-5105 473 • Italy Audio Equipment 039-836 767 • Belgium Inelco 02-2160160

Neve 5455 console

Neve has announced a four-group version of the 542 audio console, designated the 5455. It is available with 12 or 16 input channels and has stereo and mono outputs as well as four group outputs. Two auxiliary outputs with pre/post fader selection on each input channel, and two direct inputs to the output buses, provide for reverberation or foldback. Other facilities include panpots and a three-band equaliser on each input. Full length conductive plastic faders are used.

Neve has also introduced two new video post-production interfaces for the 542 series. They link a 542 console to a video editor, giving complete audio control.

The VCA control system is designed for systems where a DC control voltage is available, as with the Sony editor. The VCA can be set to operate over a wide range of control voltages allowing the system to be used with most video editors. Two control inputs to each VCA are provided, as is a separate 'mute'



control input. Cross-fades between selected audio channels are achieved by applying a standard linear ramp voltage. Carryovers and perspective transitions are achieved similarly.

The faders on the console may also be used for manual cross-fades or dissolves, or to compensate for errors in playback level from the tape machine.

For editing systems requiring individual audio sources, such as CMX, a direct output interface is available. A post-fader audio output

from each channel at line level, buffered and transformer isolated, terminates on a multi-pin connector for connection to the video editor. Neve Electronics International Ltd, High Street, Melbourn, Royston, Herts SG8 6AU, UK. Tel: 0763 60776. Telex: 81381.

USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744 6230. Telex: 969638. USA: Rupert Neve Inc, 7533 Sunset Boulevard, Hollywood, CA 90046. Tel: (213) 874-8124. Telex: 194942.

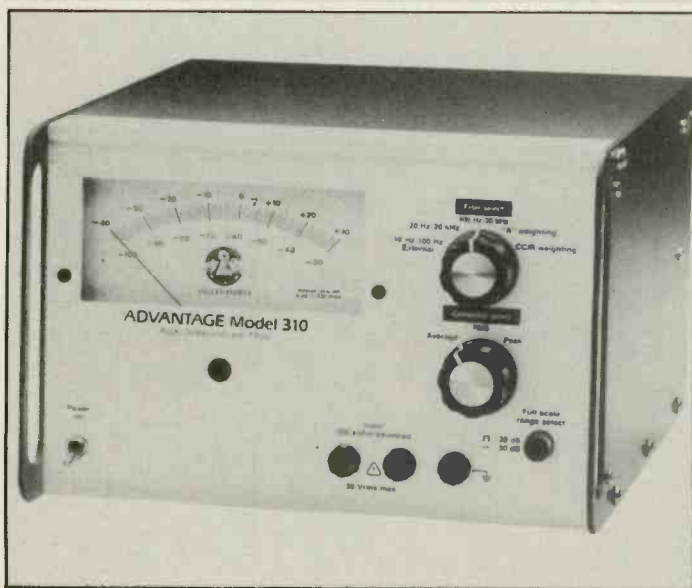
AM antenna tuners

Television Technology Corporation's Wilkinson Radio Division is reintroducing its complete range of tuning units for AM transmitting antennas.

Radio Division sales manager Bill Harland says that the ATUs range in capacity "... from one to 50 kW. Each is enclosed in a weatherproof housing and is equipped with an RF ammeter, a meter disconnect switch, a meter jack and a static drain choke. Complete documentation will be provided. The meter jack is of special interest to daytimers as the meter scale may need to be readily changed to meet FCC standards for reduced power PSSA operations."

Optional items include a Delta RF ammeter, a tower lighting choke and a make-before-break meter jack.

Wilkinson Radio Division, Television Technology Corporation, 2360 Industrial Lane, Broomfield Lane, CO 80020, USA. Tel: (303) 465-4141.



Advantage noise and level meter

Advantage Model 310 audio noise and level meter provides a low cost measurement device which is nevertheless capable of very high resolution. The unit offers isolated, balanced, 'Trans-Amptm' differential inputs to eliminate noise, RF and hum pickup; a 10 Hz to 100 kHz wideband filter; 20 Hz to 20 kHz and 400 Hz to 20 kHz multiple-pole (18 dB/octave) filters; A- and CCIR-

weighting filters; average, RMS and peak detector responses; dual-scale analogue meter; full-scale range selection; detector output; preamp output/return.

Valley People Inc, PO Box 40306, 2820 Erica Place, Nashville, TN 37204, USA. Tel: (615) 383-4737.

UK: Scenic Sounds Equipment Ltd, Unit 2 Comtech, William Road, London NW1. Tel: 01-387 1262.

Furman Sound stereo reverb

The Furman Sound Inc RV-2 stereo reverberation system consists of two complete systems each with a 16 in triple-spring reverb tank, limiter circuitry, and controls for input level, equalisation and 'wet' and 'dry' output level. Also included are an earth lift switch, a power-on indicator and an LED which indicates if the limiter is above threshold.

A unique feature is a stereo/mono switch. When in stereo, the unit generates stereo reverberation from a

mono source. Alternatively, the two channels can be used independently (eg with two separate instruments, or right and left of a stereo pair) or they can be patched in series, to deliver an extremely dense mono reverberation.

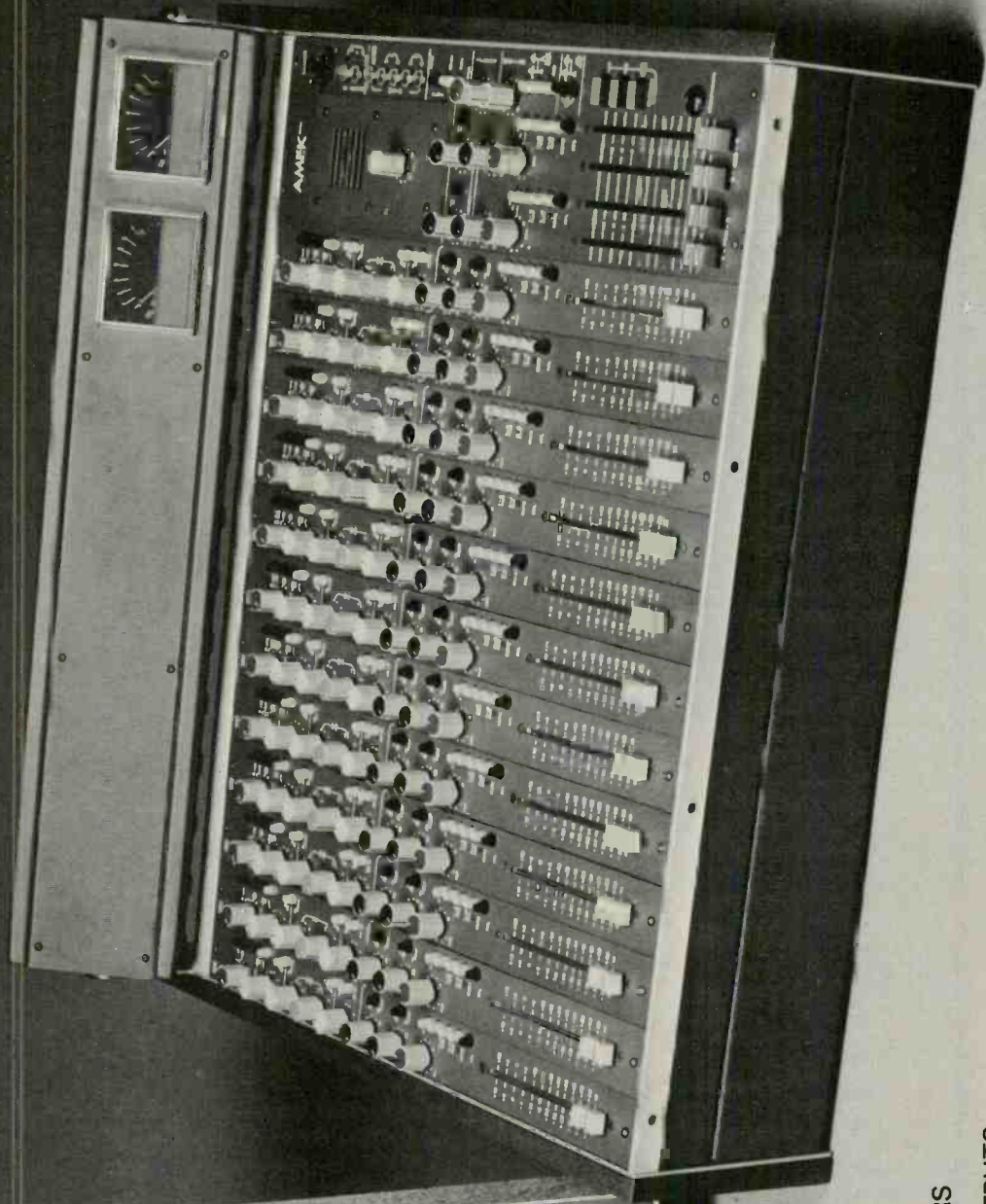
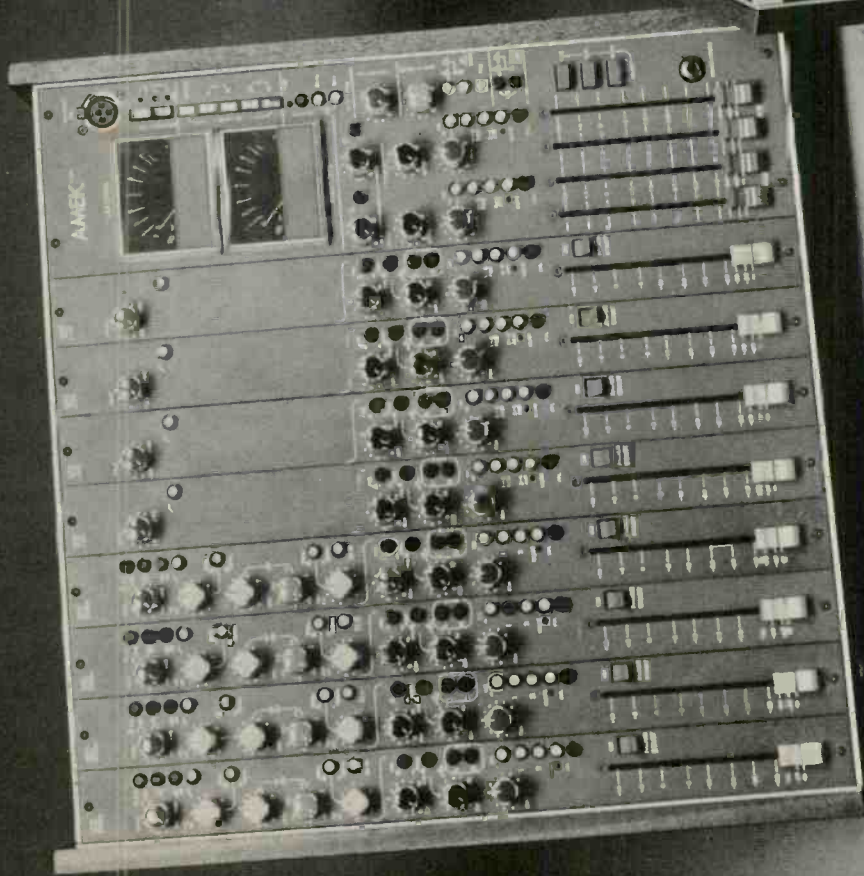
Standard units are equipped with 1/4 in jack inputs and outputs. Additional balanced inputs and outputs are available as an option.

Furman Sound Inc, 30 Rich Street, Greenbrae, CA 94904, USA. Tel: (415) 927-1225.



AMEK BCO1

THE FLEXIBLE OB MIXER

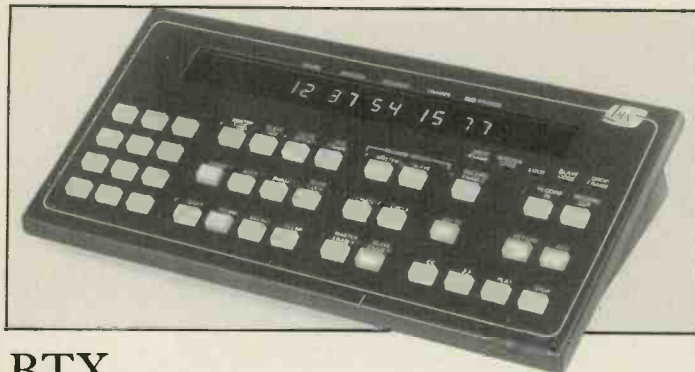


- INTERCHANGEABLE MONO AND STEREO INPUT CHANNELS
- 8 & 12 INPUT CHASSIS (8 INPUT RACK MOUNTING)
- CHOICE OF VU OR PPM METERS
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- COMPREHENSIVE MONITORING AND TALKBACK FACILITIES
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STUDIO CITY, CA 91604
U.S.A.
TEL: (213) 508 9788

NEW PRODUCTS



BTX The System

The System is a universal multi-transport interface/controller that directly controls and synchronises a master and slave in any combination of multi-track audio, video or film transport configurations. According to Michael Sipsey, vice president of marketing, *The System* represents a price/performance breakthrough by providing advanced capabilities for transport autolocation, control and synchronisation applications at low cost.

BTX has also announced a *Digital Control System* (DCS) which is a packaged version of *The System* available in three models: a digital

multitrack system (model 7001 DCS) which includes two interfaces for Mitsubishi X-80 and X-800 transports, or the Sony PCM3324 and the 3M M81, or any VTR used for digital audio playback.

BTX launched several other new products at NAB '84, including extensions to the *Shadow* and *Softouch* systems.

The BTX Corporation, 75 Wiggins Avenue, Bedford, MA 01730, USA. Tel: (617) 275-1420. Telex: 95-1887.

UK: Scenic Sounds Equipment Ltd, Unit 2 Comtech, William Road, London NW1. Tel: 01-387 1262.

Inovonics TVU display

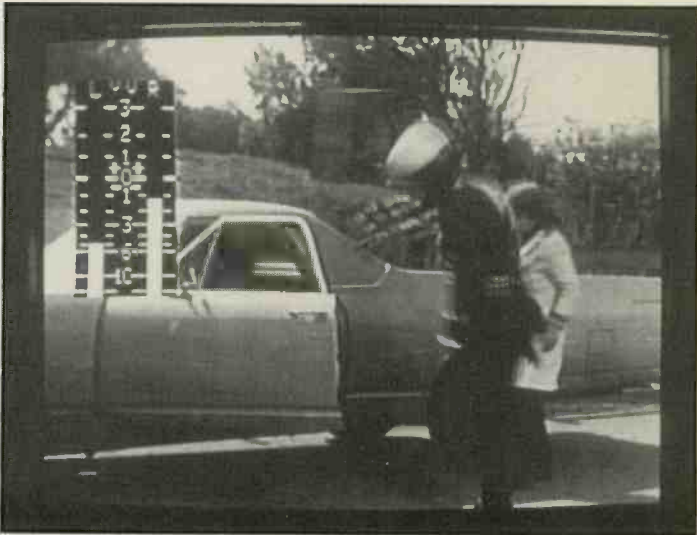
The Inovonics *TVU* inserts an audio level bargraph display onto a picture monitor. Connected in the monitor's video line, the *TVU* produces a black box in the picture with a pair of vertical bars for stereo. The device can work as either a PPM or a VU meter (with peak flasher), conforming to appropriate standards. The inserted box can be positioned anywhere in the picture, reduced to a

single channel, or bypassed.

The *TVU* is self-contained and can be mounted on the side of the picture monitor, or rack mounted (1 U).

With 8-bit A/D conversion, the *TVU* has 0.25 dB resolution around 0 VU. It has separate balanced and unbalanced inputs.

Inovonics Inc, 503-B Vandell Way, Campbell, CA 95008, USA. Tel: (408) 374-8300.



Eela Audio radio desk

The *S 150* is Eela Audio's new stereo on-air console. Available in two main frame sizes, it can have up to eight (CH 15) or 14 (CH 21) input channel modules. Larger frames can be made on request.

The main frame has a standard wiring arrangement, using ribbon cable and gold-plated IDT

connectors. Any input module can be inserted anywhere in the console without modification. The central script space contains the mixing and line amplifiers, master controls and some monitoring and talkback facilities.

The meter bridge is equipped with two VU or peak meters and a control

room monitor circuit as standard. There is space for optional *EA 700* modules, based on eurocards, including a studio monitor circuit, guest monitors, telephone hybrids, selectors, extra meters and a console speaker. Cartridge machines can also be fitted into this space.

Three types of input module are

available: dual microphone, stereo line and telephone. Connections to the outside world are balanced, floating and (in most cases) on XLRs on the back of the module. The modules are fully screened to reduce crosstalk and RF breakthrough.

There is a choice of two types of fader: an ALPS carbon track type or a P&G unit. All inputs use VCAs as the main level control: this allows easy implementation of a compressor/limiter in the microphone channels, and gives excellent stereo tracking in the line channels.

The master section, housed in the central script area, contains all the output amplifiers and their controls. All external outputs are low impedance, transformer balanced, on XLR connectors. Outputs available are: stereo left and right, mono, four send outputs and PFL. DC control signals and unbalanced audio signals are available inside the meter bridge for use with the optional facilities modules.

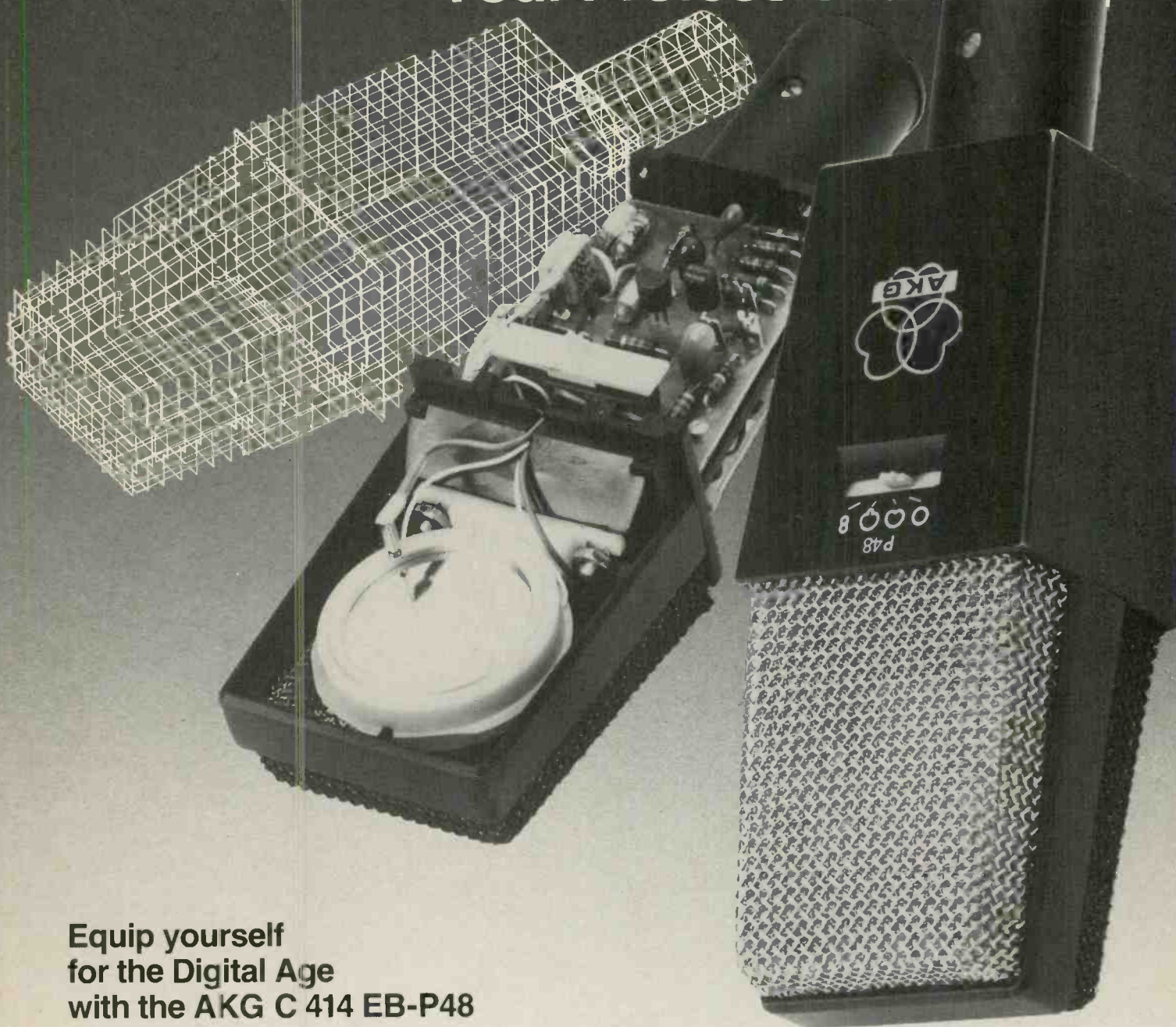
Eela Audio, Hondsruglaan 83a, 5628 DB Eindhoven, Holland. Tel: 040-424455. Telex: 59281 BOLLE NL.

UK: Audio & Design Calrec Ltd, Unit 3, Horseshoe Park, Pangbourne, Reading, Berks RG8 7JW. Tel: 0734 861088. Telex: 848722 ADRUK G.

AKG

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Equip yourself for the Digital Age with the AKG C 414 EB-P48

The C 414 EB-P48 is the latest development in a long line of famous AKG large diaphragm microphones, all employing the acclaimed CK 12 one inch dual diaphragm capsule. The electronics of the new C 414EB-P48 are a completely new departure, and the key to the digital-level performance of the microphone.

The C 414EB-P48 features:

- Large, one-inch dual-diaphragm system
- Four different polar patterns selectable on the microphone
- Pre-attenuation (0, -10, -20 dB) and bass attenuation selectable on the microphone
- Exceptionally wide dynamic range
- Low inherent noise
- For 48-volt phantom powering only, with less than 1 mA power consumption



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IBC '84

The tenth International Broadcasting Convention—IBC '84—takes place from Friday, September 21 to Tuesday, September 25 at the Metropole Conference and Exhibition Centre, Brighton, UK. The convention promises to be the largest IBC yet, with around 140 companies showing their products in over 11,000 square metres of exhibition space. In addition, there will be many OB vehicles and mobile units on show, including satellite earth stations, along the esplanade in front of the Metropole Centre.

Technical sessions start on the Saturday morning under the heading *Evolving Technology—Its Application and Costs*; the economics of broadcasting is a theme running throughout the convention.

Technical sessions

Some 90 papers will be presented in 14 sessions from Saturday to Tuesday. Sunday morning has been declared 'paperless' for the benefit of churchgoers, by popular request after IBC '82. Some of the papers likely to be of special interest to audio and radio engineers are:

Sunday 1400 hrs: Session 3B: AM radio transmitters: *Quantized amplitude modulation* by S A McFarland, Harris Broadcast Transmission Systems; *Further developments and applications of pulse step modulation* by Dr W Schminke, Brown, Boveri & Company; *Trends in high power broadcasting transmitters* by R H Bradbrook and J D Watson, Marconi Communications Systems; *Design of high power transmitters operating in the long wave sound broadcast band* by J A Brisbane and K W Boon, Marconi Communication Systems.

Monday 1000 hrs: Session 4B: satellite broadcasting: *Audio coding methods to extend the DBS sound coverage* by W B Harding, Independent Broadcasting Authority.

Monday 1400 hrs: Session 5B: receiving systems: *Characteristics of the EBU radio-data system 'RDS'* by D Kopitz, European Broadcasting Union; *Broadcasting of sound radio programmes by satellite direct to portable and vehicle receivers* by J Chaplin, H-H Fromm and C Rosetti, European Space Agency.

Tuesday 1000 hrs: Session 7A: new services: *A proposal for multichannel sound in television broadcast* by B V Sesterikov, Radio Televizija Beograd, Yugoslavia; *Experimental digital stereo sound with terrestrial television* by Dr S R Ely, British Broadcasting Corporation; *A proposed digital multiplex sound system for teletext* by S L Yu, H L Liu and G L Li, Tianjin University, China; *US multichannel television sound technical standards* by E M Tingley, Electronic Industries Association; *DBS sound data broadcasting—new service possibilities* by R I Collins and E J Wilson, Independent Broadcasting Authority. **Session 7B: signal distribution and links:** *A two-channel sound in syncs transmission system* by J E Holder and N M Spenceley, British Broadcasting

Corporation, and C S Clemenston, Pye TVT. **Tuesday 1400 hrs: Session 8A: sound signal origination:** *Linking together a digital audio studio* by B E Waggoner, Grass Valley Group; *Design of an expandable 'low-cost' digital audio mixer* by P Skritek, E Parth, R Polleros and J Rabitz, Technische Universität Wien, Austria; *Considerations of digital audio and video distribution in a broadcasting studio* by Dr J R Emmett, Thames Television; *Digital audio editing* by G W McNally and P S Gaskell, British Broadcasting Corporation; *Digital audio in broadcasting—the opportunities and challenges* by Dr N K Taylor, Independent Television Companies Association; *Digital sound mixing in the analogue studio* by Dr M H Jones, D J Langford and D A Tilsley, Neve Electronics International. **Session 8B: Measurement Technology:** *A measurement method for stationary and dynamic non-linear distortions in audio systems* by P Skritek, Technische Universität Wien, Austria; *The quality control of monitoring loudspeakers for use in broadcasting* by M E Whatton and W T Shelton, British Broadcasting Corporation.

Exhibition

Because of the record number of exhibitors, this preview concentrates on audio and audio-related products, although other equipment has been included as far as space permits. More comprehensive details of video exhibits are available in our sister magazine *Professional Video*, which will be available along with copies of *Broadcast Sound* and *Studio Sound* at our stand at the exhibition.

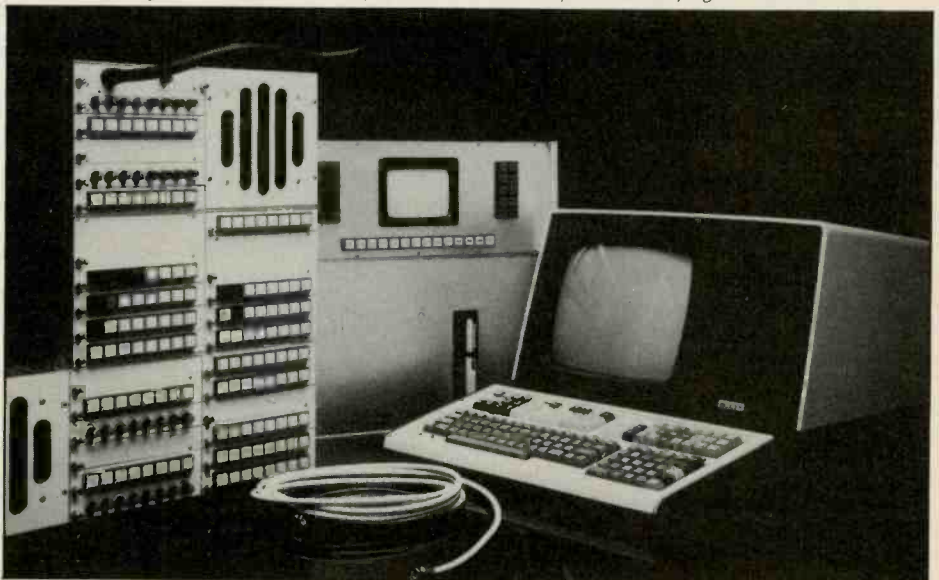
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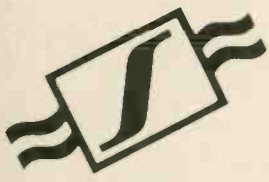
Acquis Ltd: Convergence Corporation editing and post-production equipment, VRL computerised video rostrum system, operating with the Acquis *AniVid* animation/single VTR controller. **Acron Video:** 401P and 402P sync pulse generators, 510P SC/H phase meter, 410A auto SPG changeover unit, 505P and 502P broadcast-grade 8-field SPGs. **Advanced Music Systems:** range of digital delay, effects and

B

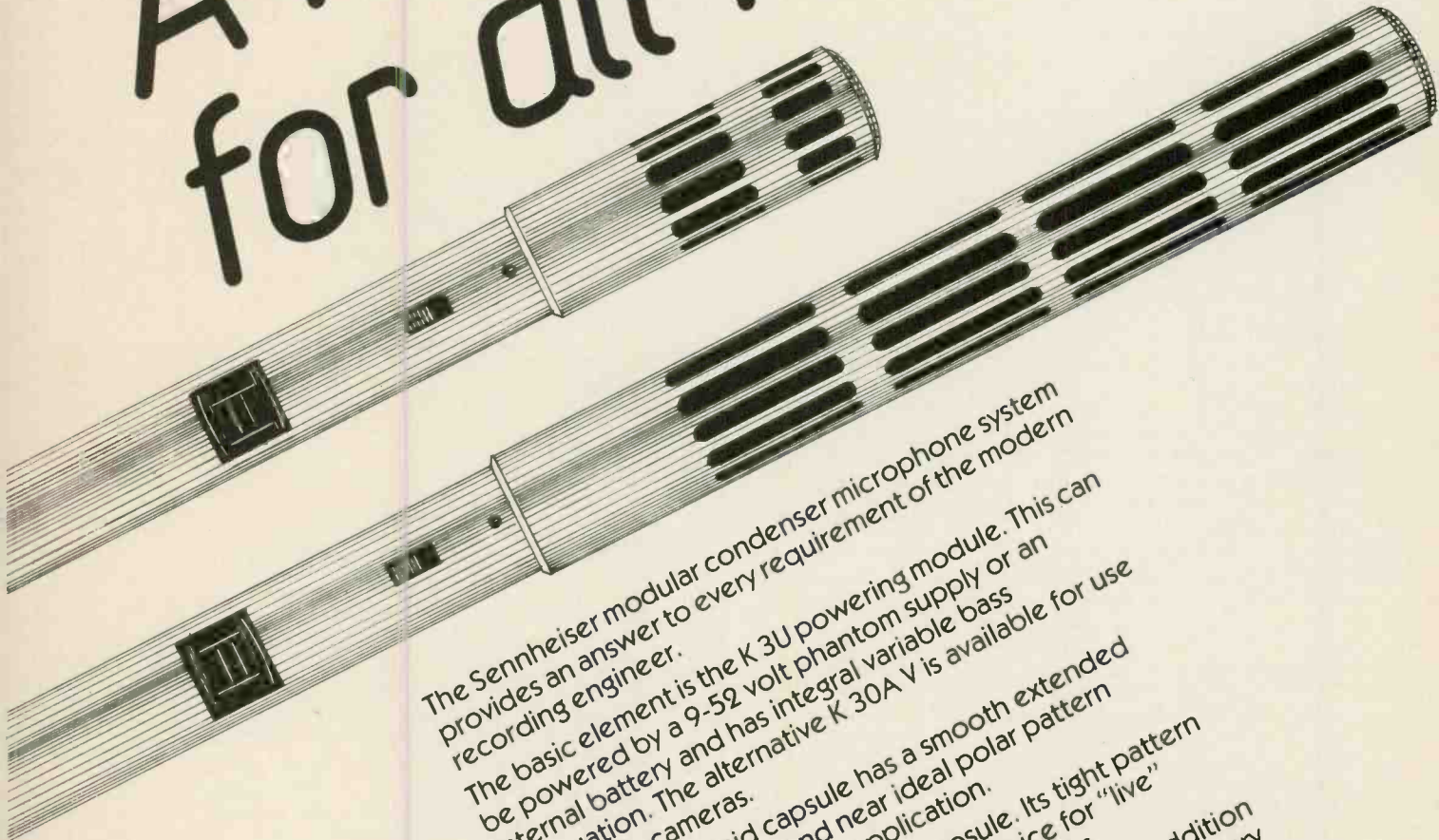
BAL Passive Components: new range of video filters, manufactured under licence from British Telecom, also video DIL delay lines equalised to 10 MHz, DL505 rack-mounted delay card system, and a display of printed circuit design from Andrew Parsons Designs. **FWO Bauch:** demonstration of dubbing area based on Studer 900 console and A810 timecode machines, linked

New Access digital communications system from Audix, capable of carrying 60 channels





A mic for all reasons



The Sennheiser modular condenser microphone system provides an answer to every requirement of the modern recording engineer. The basic element is the K 3U powering module. This can be powered by a 9-52 volt phantom supply or an internal battery and has integral variable bass attenuation. The alternative K 30A V is available for use with video cameras.

The ME 40 cardioid capsule has a smooth extended frequency response and near ideal polar pattern making it suitable for any application. The ME 80 is a super-cardioid capsule. Its tight pattern and high output make it the right choice for "live" situations, interview work and p.a. systems. The system has recently been extended by the addition of two new products. The MKE 212 acoustic boundary microphone gives a clean, balanced, natural sound that adds a new dimension to sound recording.

The MKE 2 is a subminiature tie-clip microphone. Using the same capsule as the MKE 212 it provides a clear, crisp sound from a package only 5mm. (dia.) x 10mm. For full details of Sennheiser products and our guide "How to choose, use and abuse microphones" please contact us on 0753 888447

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Hayden Laboratories Ltd, Hayden House, Chiltern Hill,
Chalfont St. Peter, Bucks SL9 9UG

CONVENTION PREVIEW

via new Studer *TL54000* synchroniser. The new *A820* ¼ in machine and a new 1 in layback machine will also be on display. **BBC:** continuous demonstration of stereo TV sound in a specially constructed studio, showing transmission techniques, stereo sound-in-syncs and subjective effects. New digital techniques on display are digital audio editing, 68 Mbit/s PAL transmission equipment, a digital PAL decoder designed primarily for PAL to MAC transcoding and a digital Test Card F generator. Other items on show are a UHF re-broadcast receiver, a new television waveform monitor which displays red, green, blue and luminance signals simultaneously on a large CRT, the Electronic News System used by *Breakfast Time*, a demonstration of high definition TV, a 'flate-plate' antenna for 12 GHz DBS reception, and a new generation of monitor loudspeakers. **Boston Insulated Wire (UK):** wide range of audio/video cabling for television cameras, multicore and triaxial, with connector assemblies. **Brabury:** new items include a portable ENG inject unit, a subcarrier sound modulator/demodulator, Misa range of jackfields and audio power amplifiers. Also colour picture monitors, grade 2/14 in and 20 in, also monitor with sound. Video and audio jackfields, script lights, cable reels, routing switches, DAs, modular audio storage system, talkback, SPG and changeover units, portable video presentation unit with 14 in display.

C

Canda Television Equipment: new items: Christie *Max-Erase* video tape degausser, CTE follow focus matte box for ⅓ in portable cameras. Also full range of Angenieux TV lenses for 1 in, 1¼ in, ⅔ in and ½ in cameras and Christie ni-cad batteries and Reflex chargers. **Canford Audio:** large range of cables, connectors and countless other items such as BICC Citec faders, Illsonic acoustic tiles, assignable TV talkback systems, Lundahl audio transformers, Littlite gooseneck worklights, London Acoustical Developments turntables, Omnimount brackets and Niverco cassette duplicators. New products on display include Neutrik goosenecks, pro-converted Fostex powered speakers, Sonifex *Micro-HS* cart machines and the Lynden Micros *Phone-Vote* system. Canford also manufactures studio furnishings, fittings and custom console woodwork. **Connolly Systems Ltd:** *Cats* and *Captain* broadcast automation and management systems used by Channel 4, and the *PMC-5000A* Programmable Machine Controller. **Michael Cox Electronics:** new *T16* video mixer, *Type 660* component colour corrector and *CVP100* framestore standards converter.

D

Digivision: five new products: *DPG-112* master sync pulse generator, *DCO-118* automatic pulse changeover unit, *DCE-166* PAL encoder, grade 1 monochrome picture monitor and broadcast standard dual 9 in colour monitor assembly. **Dolby:** first UK showing for *Adaptive Delta Modulation* digital transmission system and noise reduction for C-format VTRs including the new *380* unit for Ampex *VPR-3* and *VPR-80* machines. Also the complete range of noise reduction equipment, including *SP24* multitrack package, *372* 2-channel portable and *362* 2-channel rack-mounted unit. **Philip Drake**

Electronics: new *6000 series* Intercom system, *Comprehensive* re-assignable studio talkback and intercom system. Also an integrated audio system based on a new studio talkback matrix using *600 series* cards in a 6 U rack package. This matrix links together standard Drake products including the *Mini Mobile*, *Callbox*, PPM and LS unit, *7000 series* modules, studio floor facilities boxes and *4000 series* jackfields.

E

Electronic Visuals: *EV4061* colour signal monitor, a combined waveform monitor and vectorscope. Also other new waveform and vector monitors, and picture monitors. **EEV:** *K3372BCD* 55 kW external cavity klystron, with beam control, water or vapour cooled.



Film-Tech's Compact 3 ENG mini-mixer

F

Film-Tech Electronics Ltd: portable audio mixers including original *Compact 4-1*, also *3 ENG* and *4-1 EFP* models. Accessories include a nicad charger, a discharger, a battery checker, a Nagra-powered headphone amplifier, audio and video cable checkers and an electronic, silent slate. New items include the *Compact 8-2* Production battery operated stereo mixer with 3-band EQ, two aux sends, PPMs and headphone monitoring. The *Cassette Start Unit* is a new accessory for the film recordist who has to provide a feed for the PA's cassette recorder but forgets to start and stop it. The unit starts the cassette via its remote sockets when the Nagra is put into record. The *RA 12* replay amplifier is a battery powered unit with a 12 in speaker to provide good quality, high level music replay on location. **For-A Company:** new items: *VTW-700* character generator, *FA-400PS* TBC, component mixer, *FVW-930* video writer, *FA-450P* high performance TBC, *DEC-100* decoder. Also *FA-400P*, *FA-410P*, *FA-430P*, *VTW-400*, *ENC-100*, *VTW-210* and *TSG-5000*. **Fuji Optical:** new *Fujinon* ⅓ in format f/1.6 A44x9.5ESM lens with 2x extender, A17x9ERM and A14x9ERM ⅓ in format lenses, S14x6.6ERM ½ in format ENG lens. Also other new and established ENG, EFP and studio lenses. **Future Film Developments:** representative samples from the catalogue. This catalogue is available free of charge from the stand and details over 2,000 items, including new patching systems.

I

IBA: the stand will show the principles of the C-MAC/packet transmission system for DBS, including future enhancements for compatible improved definition pictures. Also other examples of IBA technology and engineering publications. **Industrial Acoustics Company:** a complete

studio and control room suite to demonstrate IAC modular studio system, and *Moduline* acoustic panel system. **Interimage:** Interactive video imaging system. **ITCA:** video and audio equipment including a digital audio sampling rate converter, for 44.1 kHz to 48 kHz, and an audio transmission line identification and measurement system with voice-synthesised announcements. Also ITCA publications. **IVCC:** first showing of *Zeno*, described as "the affordable zoom machine". Also *Gemini* range of TBC/field stores.

K

KVP: engineered cases for electronic equipment. New items: packs for new compact component recorders, and 'add-on' packs for portable timecode generators and sound mixers. *Kangaroo Video Pack*, *Semi Tough Camera Case*, *Super Tough Camera Case*, *Nagra Pack*, & *Gripper Strap*. The *Wide Eye I* and *II* wide angle lens attachments and *Teletest* charts are also being shown.

L

Link Electronics: *Link 130* and *Link-NEC 100* colour cameras, *Grass Valley* equipment, talkback systems, distribution amplifiers, test generators, noise meters, ITS generators. New products: *ISC* editing system, *Grass Valley 100* production switcher and an isolated point jackfield.

M

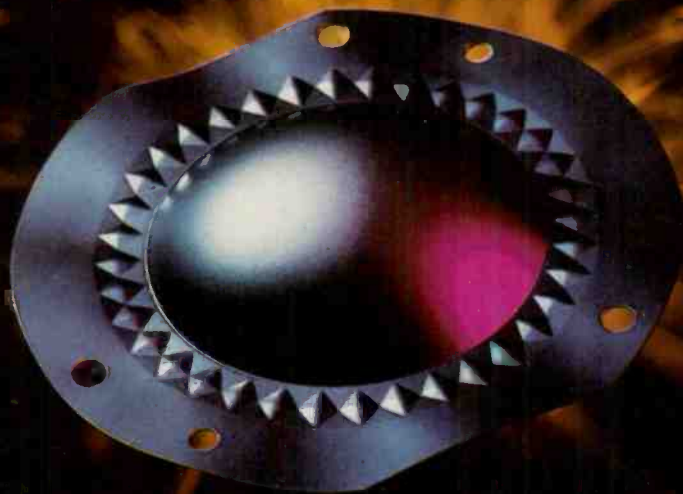
Melford Electronics: new *DU5-16C* grade 1 16 in colour monitor, *DU6* range of general purpose colour monitors. Also *DUI*, *DU3* and *DU5-20C* picture monitors, *500/600 series* video/audio switching equipment. **Microwave Communications:** new items: *Super 2MR* 2 GHz receiver, *Super 2MX* 2 GHz transmitter, airborne microwave ENG antennas. Also *MLV-I* transportable SHF link (7 GHz), *MA-23CC* and *MA23VFM* shortrange video links (23 GHz), *MA-13CP* ultra lightweight video link (13 GHz) and *MA-2MX* high power lightweight video transmitter (2 GHz). **R E Miller:** camera plates, fluid heads, a column-lift accessory, tripods, dollies and accessories.

N

Nagra Kudelski: *T-Audio TC* timecode tape recorder for post-production. Also *IV-S* portable timecode machine. **Neilson-Hordell:** *NH214* video animation rostrum coupled to Sony *BVH 2500* 1 in VTR, displayed on the Sony broadcast stand. **Neve:** full working demonstration of *Necam 96* automation system, *S1 series* multi-track console, *S42* range of TV audio editing consoles (see *New Products* p. 12). The *Neve Digital Caravan* will be on the seafront, housing examples of digital audio technology.

O

Optical and Textile (Optex): new items: *Telcom* video insertion unit, *Cam-rail* portable tracking system, *Adapta* optics, heavy duty ENG field trolley, *SQN* mini stereo mixer, top-up *BP90* car battery charger. Also *Sachtler* tripods, *Tiffen* special effects filters, *Periscope* optics, fibre optic endoprobes, carrying cases, cameramen's protective jackets, battery testers and dischargers. **Otari:** *MTR90* multitrack tape machine; latest version of *MTR12* with centre track timecode



JBL's unique titanium diaphragm and "Diamond Surround" bring new purity and consistency to high frequency response.

IT TOOK JBL SCIENCE, A NITROGEN EXPLOSION, AND PURE TITANIUM TO GIVE YOU PERFECTED HIGH FREQUENCY SOUND.

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JBL scientists decided to fight back. They exploded nitrogen into a remarkable metal, pure titanium, encircling their unique diaphragm with a vibration-absorbing "Diamond Surround," so revolutionary it warranted its own patent.

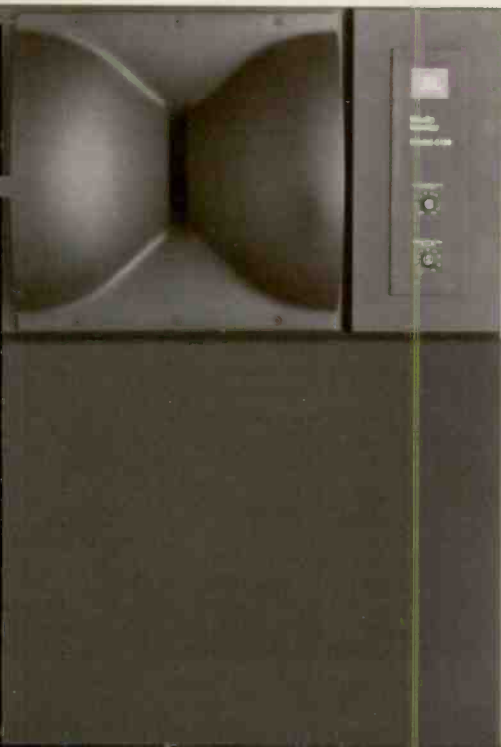
The result? A diaphragm that delivers and sustains a power and purity to high frequency response never before approached in the industry.

Perfecting titanium technology is just one of innumerable ways in which JBL science is re-shaping the quality of sound. From driving your studio monitors in a demanding final production mix, to critically evaluating in detail actual on-air signal quality, JBL audio systems are focused on the most exacting demands of the broadcast professional. To find out which system is designed to meet your specific requirements, contact your authorized JBL professional products dealer today.

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CONVENTION PREVIEW

(also available as a retrofit); *MTR20/BTR20* ½-track ¼ in mastering machines with centre track timecode; *BTR5* broadcast mastering machine, also with timecode.

P

PAG: *Speedcharge 6000* computer-controlled charger, *Sequencer 6000*, *PAG 10/90*, *PAG Solo*, battery packs, battery belts, *Paglights*. **Polar Video:** first showing for PAL versions of *Newsmatte-2*, *Ultimate-5* (probably not shown fully operational) and *Picture Manipulator*. Also *Polar Blanking Generator*, Fortel TBCs, Quanta character generators, Polar safe area generators, Liftroy VT clock and a demo tape of the Polar Video in-house special effects facility. **Pro-Bel:** new range of vision cards for large routing switchers, updated 68000-based control system, demonstration of ATE for large routing switchers. Also routing switchers, small vision and audio mixer, *CapGen Series 2* with coder/keyer.

Q

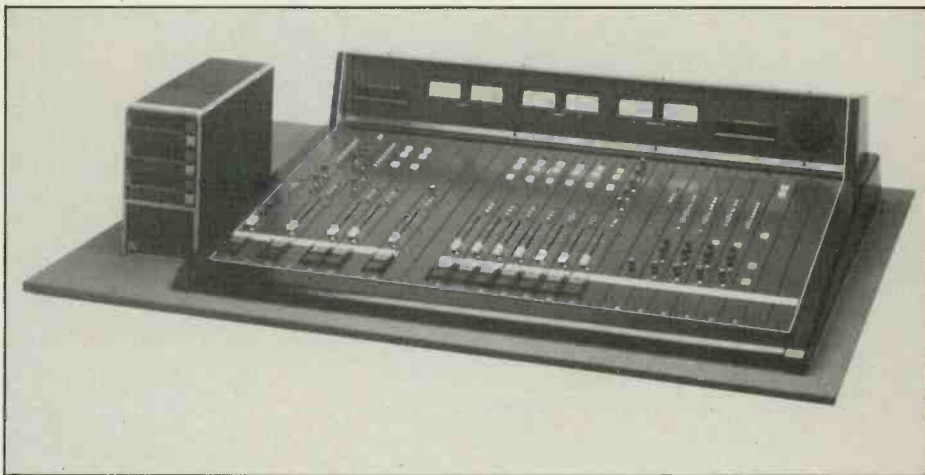
Quantel: range of digital video systems, enhancements and options. New products include *Mirage Macro*, *Encore*, *Henry* and the Floating Viewpoint Control Panel. **Questech:** new *610P* video effects framestore and *2101P* PAL frame synchroniser. Also *6001P* frame synchroniser, *2009* PAL comb filter decoder.

R

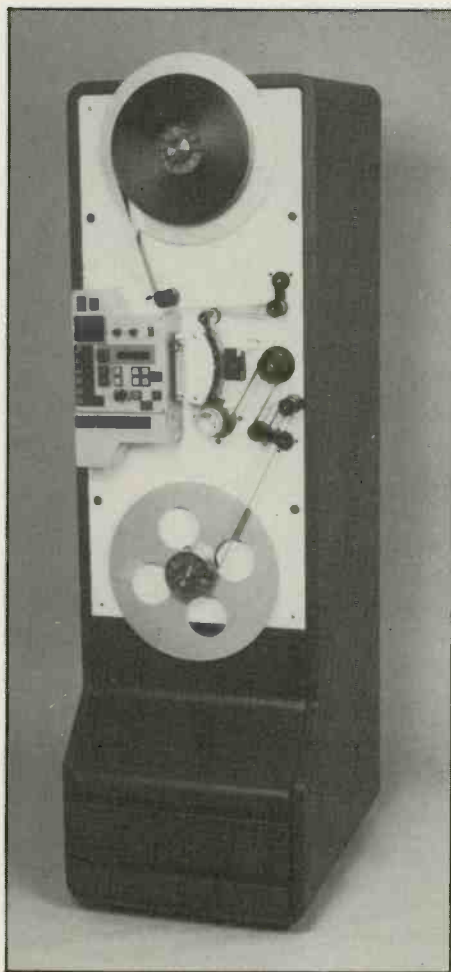
Rank Cintel: new products—shot change detector for *Mk III/Amigo* telecine, *Mk III* film-to-tape telecine, *Digiscan III* frame store. Also *ADS 1* low cost telecine, the *Slide File*, the *gic* synchroniser and the *FeRRIT* sepmag sound follower. **Rank Strand:** new Quartzcolor and Strand lighting products, from studio to hand-held battery lamps. **RE Instruments:** *RE800* 140 Mbit PCM system, *RE601* optical time domain reflectometer, *RE201* audio analyser, *ELM1* PCM equipment including generator, monitor, decoder.

S

SATT Electronics: new *SAM 31* 3-channel ENG/EFP/OB audio mixer. Also *SAM 82* and *SAM 42*. **Scenic Sounds Equipment:** new Amber *5500* automated audio test set, *btX The System* and *PAL Cypher*, Lexicon *1300* PAL-compatible automatic audio/video delay unit. Also large range of Lexicon, *btX*, Amber, Orban and *dbx* equipment. **Screen Electronics:** new developments in *Ibis* teletext products. **Shrinton Company:** new equipment: *690* longitudinal and vertical interval timecode reader/generator, *650* longitudinal reader/generator, *Empress 2000* PAL post-production mixer, *270* audio-follow-video mixer, *12X* routing switchers, *MG1* intermatrix converter, *200* series audio, video and pulse DAs. Also *390* post-production vision mixer, *646* timecode reader and character generator, *647* timecode generator, *372RP* OB/EFP vision mixer, *374P* dual mix/effects vision mixer. **Solid State Logic:** *SL 6000 E Series* Stereo Video System, including the recently introduced *SL 688 V* stereo mix matrix for dual-language soundtracks and easier clean feeds. SSL has also added a *Master Synchroniser Controller* to handle up to five machines, and a *Programmable Equaliser*, consisting of a panel which mounts in the console and an external electronics package. It



The SAC-2, Soundcraft's new radio presentation desk



Rank Cintel FeRRIT sepmag sound follower

provides two channels of 3-band parametric EQ, and stereo panning, which can be programmed to change in reference to timecode. **Sony Broadcast:** a self-contained professional audio area will display several new products, such as the *WRT-87 1* W UHF radio microphone transmitter, which contains an audio mixer and two receivers. One receiver is for 'off-air' cue programme, the second for VHF talkback. The *WRR-87* is a

companion diversity receiver. The *TCC-566* is a new portable audio recorder with a dedicated timecode track. Digital recorders on display are the 24-track *PCM-3324*, with the new *RM-3310* remote controller, and the new *PCM-3102* 2-track recorder. Also shown is the prototype *CDK-7000* compact disc storage and player unit, which can hold 120 discs, and the *AVS-500/AVP-500* audio/video synchronisation system. Other equipment on display, not of an audio nature, includes Betacam equipment, cameras, 1 in C format VTRs, High band U-matic equipment, edit controllers, TBCs, monitors, timecode generators/readers and complete systems (on the esplanade) including a 3-camera OB unit for Hungary, a mobile editing unit for Thames TV and a demonstration vehicle for high definition TV. **Soundcraft:** new *SAC2* modular console for small radio stations or independent facilities, *TV24* in-line console for TV broadcasting and post-production. Also *Series 20* 2-track mastering ATR.

T

TBA Lighting: Clear-com intercom systems, including a new 8-channel *Studio Master Station* with IFB, the *CP-300* 2-channel beltpack and the new portable *CS210* 2-channel master station. **Thomson-CSF:** new *TH 563* 50 kW tetrode and cavity, *TH 3694* 450 W TWT for 18 GHz DBS uplinks. Also full range of UHF tetrodes and cavities, radio tetrodes up to 1.2 MW CW, klystrons and TWTs for DBS, image pickup tubes and devices including CCDs.

V

VG Electronics: new items: *Newfor*, *TT54 Mk II*, *1065* intelligent editing terminal, *1058* teletext processor. Also *Zone Plate Generator*, *1033* calibrated distortion unit, *1054* video level corrector. **W Vinten:** new *Microswift 200* remote control system, *Mk III* remote control system, *Hawk* pneumatic pedestal. Also *Merlin*, *Teal*, *Avocet ENG/EFP*, *Cormorant EFP*, *Portaped*, *Tritack*, *Dolphin*, *Fulmar* and *Raven*.

W

Ware Macgregor Partnership: architectural photographs, models and drawings of buildings commissioned by radio and television organisations. □

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MUSIC BOX

Richard Dean

July 12 saw the start of Music Box, a pop music video service for European cable networks. Because it is in many respects similar to America's highly successful MTV, Music Box is widely seen as a testing ground for the commercial viability of cable television in Europe.

In the heady days when people thought UK cable TV was going to make money, Thorn-EMI Screen Entertainment, the Virgin Group and Yorkshire Television were all involved in separate plans to run pop music cable stations. In April this year, they joined forces to form The Music Channel Ltd.

Before the July launch they were already broadcasting via Sky Channel for four hours a day. This will continue until the end of the year, but with the daily hours cut to three. Similarly until August 1, the new channel comprised just four hours of programming rotated into a 12-hour format. The rotations now span 16 hours, with original material steadily increasing to six hours in an 18-hour format by autumn. Ambitious projections of a 2,500,000 audience and 24-hour operation are being made for early next year.

From the start, Thorn-EMI's own Swindon Cable plus 20 Rediffusion networks in the UK, and cable systems in Holland, Sweden and a hotel in Paris were receiving the service, which is

distributed by transponder 12 on the ECS1 satellite — the same downlink frequency as Sky Channel but with opposite polarisation. Contracts to receive the service have also been confirmed with networks in Austria, Finland, France and Switzerland among others, with further announcements to follow. Music Box hopes to carry four minutes of advertising per hour, and is free to basic-tier subscribers.

Recently Music Box moved production from Trilion's Dean Street, London, studios and has now set up separate post-production and transmission facilities at Thorn-EMI Video Facilities (TEVF) in Metropolis House, Tottenham Court Road, where a conference room has also been converted for links. A separate two-camera production studio in Shaftesbury Avenue should be finished by the time this appears in print.

The Metropolis House premises were set up in those giddy days when JVC's Video High Density (VHD) video disc was all set to become a consumer product. Since then TEVF has picked up facilities work from outside, as well as mastering films for Thorn-EMI's REW duplication plant, and editing interactive training and jukebox programmes for VHD in its current industrial guise.

Music Box's dedicated post-production suite at the Tottenham Court Road tower block houses four Betacam players and two 1 in C format recorders, with another two available as back-up among the complement of 11 installed in the adjacent general technical area.

"This is our first venture into Betacam," says manager Dudley Elston, "and so far we've been extremely pleased with the results. I'd say the format has a very bright future." The suite includes a Grass Valley 1600 vision mixer, and all the Betacam production tapes are transferred to 1 in for transmission.

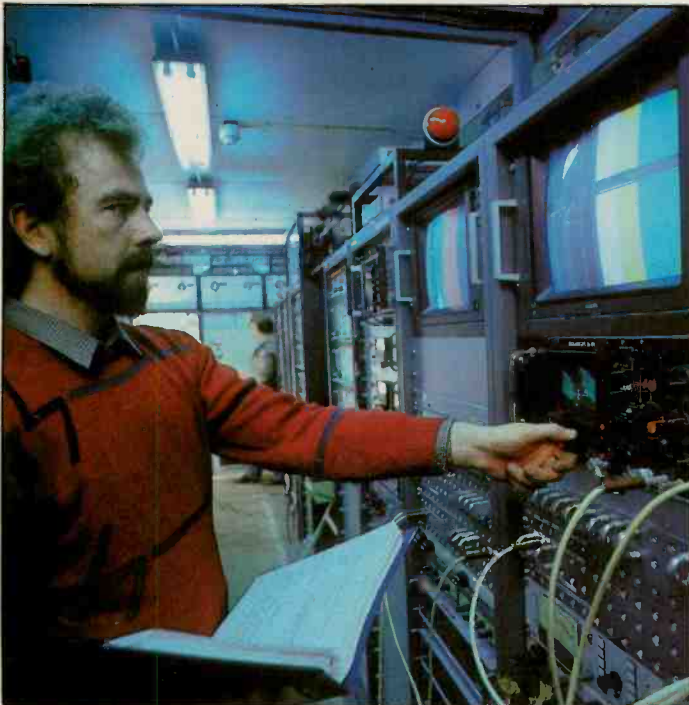
Any fancy editing work is booked into one of the more sophisticated suites, which has access to Quantel effects, *Aston 3* character generation *et al*, and this together with the transmission service is booked to Music Box under the normal in-house discount arrangement.

Sound

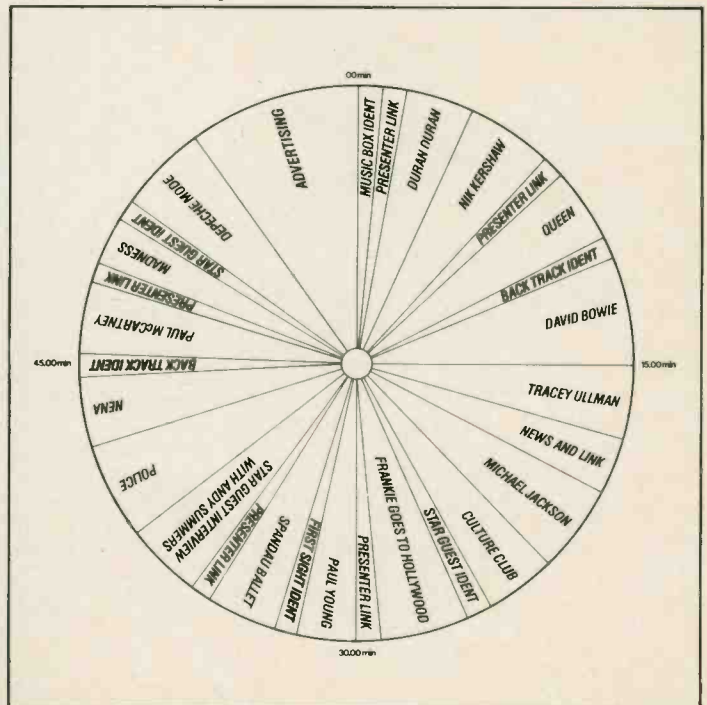
And so to the most interesting part of the equation, to my ears at least. The Music Channel is broadcasting in stereo, via the Wegener system widely used in American cable networks, including MTV — with which Thorn-EMI has a co-operation agreement.

Video travels from Metropolis House via British Telecom coaxial cable to the London Telecom Tower, and then via a microwave link to the 'Teleport' earth station in the London Docklands. Eventually this microwave link will be replaced by another coaxial circuit. Audio also goes via the Tower, on a stereo pair of 15 kHz balanced 'music lines' to the Teleport. Audio and video are then multiplexed by the Wegener 1600 machinery, which can handle up to eight audio channels in addition to the basic mono TV sound channel, each on its own subcarrier. The subcarriers, which are between 5.5 and 10 MHz,

Video equipment at the London Teleport (photo: British Telecom)



Typical Music Box programme clock





use 50 kHz peak deviation and have adaptive pre-emphasis to maximise the signal-to-noise ratio. In Music Box's case, the subcarriers are on 7.02 and 7.20 MHz.

No scrambling is used on Music Box. Although Eutelsat, which owns the ECS satellite, insists on scrambling to prevent unauthorised reception, this rule has been waived until January 1985 because of the shortage of suitable hardware. It is still unclear what will happen in January.

Viewers will receive mono sound via cable in the normal way, but some cable operators will provide the stereo audio as a VHF-FM signal which can be fed into a stereo radio receiver.

Programming

Music Box's programming is based on a non-stop sequence of promotional video clips. The programme clock shows how they are linked; advertising is in a four minute block leading up to the hour.

As well as this diet of videos, there are some self-contained programmes, based on — you've guessed it — videos. *First sight* is a programme of new releases, which goes out on Fridays. *Back Track* is a weekly oldies slot. There are no fewer than three chart shows: *Music Box Video Chart* is compiled from viewers' votes, *Chart Attack* is the British Top 40, and *Euro Charts* is a weekly programme reflecting UK, French, Dutch and German charts.

There is a little information content: interviews, music industry news, a gig guide on Thursdays. There is a competition called *Quiz*

Box, and concerts and specials go under the collective title *One Night Stand*.

Advertising

Because Music Box appeals to an audience of 15-25 year olds and is a European service, the market for advertising is severely limited. The European aspect in particular means that alcohol and pharmaceuticals are banned, in addition to the UK's shared ban on smoking products. Holland has also refused advertising on Sundays, which The Music Channel will have to comply with right across Europe at least until local opt-out facilities have been established. Even this would be expensive for just one day a week.

The launch of Music Box follows a statement from Thorn-EMI management that its cable plans and commitments were under review, hinting that European expansion may take a higher priority than for the UK alone. The statement refers to the blow dealt by the government in phasing out capital allowances, and takes the unusual step of quoting press speculation that three of the 11 interim franchise holders may not proceed, that BT has stopped work in Aberdeen (which is not true) and the limited response to movie channel TEN (The Entertainment Network) as some of

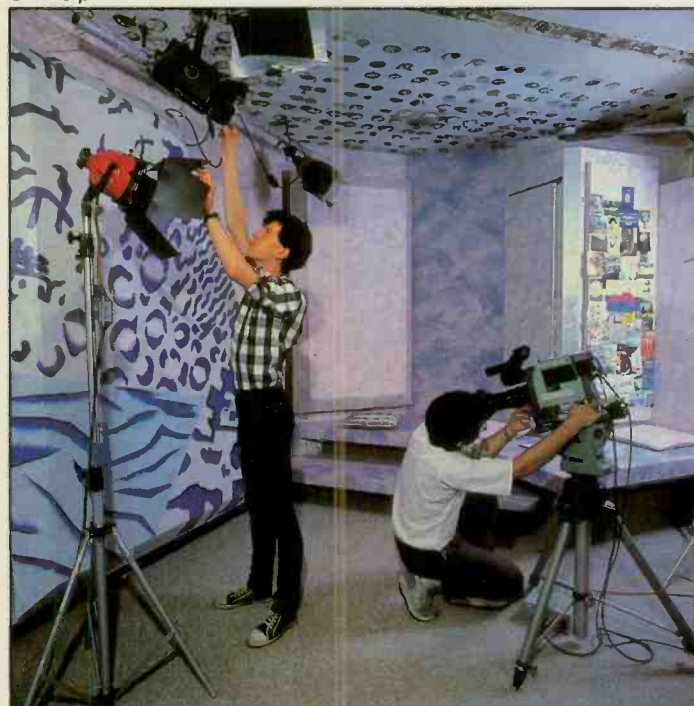
the reasons for reappraisal.

Thorn-EMI's movie channel partnership with Home Box Office, Showtime/The Movie Channel, Columbia Pictures, 20th Century-Fox and Goldcrest — 'Premiere' — has been put back two months to a September 1 launch date "because 30 per cent of the population is away in the Summer", while its TEN competitor is rumoured to have attracted only 11,000 subscribers since launching at the end of March.

Another channel in the Thorn-EMI cable empire, Jack in the Box, will be launched at the same time under the new title of The Children's Channel. "We felt the old title was rather old-fashioned for a service aimed at a pre-school to early teenage market," said a Thorn-EMI spokesperson.

Will it all work, or are people happy enough with off-air TV and the odd video rental? This is the question nobody can answer but Thorn-EMI is certainly giving it a good bash for better or worse. One heartening thing for broadcast engineers is the reasonably high technical standard adopted by Thorn-EMI. Perhaps those stories about a line of old U-Matics held together with rubber bands aren't true for this new cable TV lot after all. □

Studio presentation area



Uplink aerial working to ECS1 (photo: British Telecom)



COMPACT DISC AND THE BROADCASTER

Allen Mornington-West

There are some 80 radio broadcasting stations in the UK, including Independent Local Radio (ILR) and BBC stations. There are also hundreds of hospital stations whose operational budget and resources are very much lower than those of an average ILR station. Radio broadcast stations may be singled out from most other users of recorded music because they have to pay a lot for 'needle time'. Television, by comparison, does not rely heavily on copyright music from discs.

A typical ILR station may hold up to 100,000 vinyl discs in its library, mostly light and popular music, chosen from a potential worldwide catalogue of millions. Thus the penetration which compact discs could make, certainly into British ILR, is in part likely to depend on suitable programme material, or software, being made available.

Naturally, where the same catalogue item is available on both vinyl and CD, there will need to be some economic incentive favouring the CD product. So far, ILR stations have used CD mainly for classical music. However, not many ILR stations can justify the purchase of even domestic players and fewer still would contemplate the considerable cost of stocking a CD library with popular titles. However, ILR chief engineers and others are thinking about using CD, and this article is mainly an amalgamation of their views. It may, therefore, have a rather English outlook. There is an EBU working party which is also considering CD, and I have considered some of their points.

Regarding the use of CD in the current broadcast environment, three major considerations come to mind. These are:

- Operational. The controls and displays for handling CD; whether there is a need for dynamic range manipulation in order to match the transmission channel characteristics.
- Subcode data. Data can be specified which could be coded into subcode tracks. This would assist the automation of copyright accounting.
- Servicing and testing. Most broadcast stations will wish to carry out their own servicing and will require service manuals and a suitable test disc.

Operational

The broadcast studio has developed from the original concept of an engineer controlling signal levels and playing tapes or discs for a presenter whose only task was to speak. These days the presenter cues his records, tapes and cartridge machines and controls their levels as well as the

level of his microphone and that of a guest or interviewee. This way of working is known as 'self-op'. The presenter rarely has an engineering background, so the number of controls is kept to a minimum; disc equipment, especially, is arranged to start as soon as its associated channel fader leaves its end stop. Vinyl discs will probably be a major programme source for the next 10 years at least, and the playing equipment, which must be within easy reach of the presenter, takes up quite some space. With conventional vinyl records, the presenter can see which turntable is rolling, which track is playing and approximately how much is left on that track. With CD these direct visual cues will be absent.

Ideally, the broadcast CD machine should occupy a front panel area about the size of a single cart machine, into which the disc could be posted. Table 1 summarises some of the desirable features of a broadcast CD player.

The retractable trays and cover flaps of some domestic machines are potential problem areas, as they might not be robust enough for studio use. The most requested operational feature is that it must be possible to set the starting point on the disc anywhere within a particular track, and that the delay between the fader being opened and the music starting should be as short as 250 ms. The

suggested information to be displayed is:

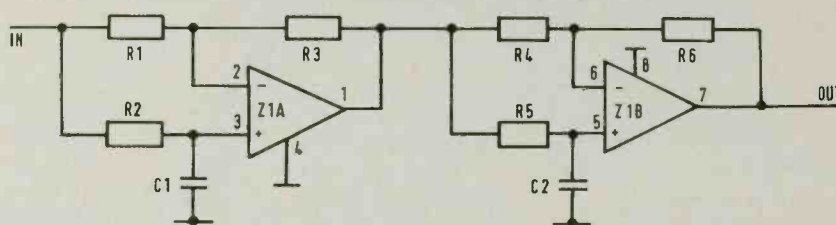
- current track number
- length of time it has been playing since the fader was opened
- length of time left till it ends
- light to indicate excessive digital error rate

In order to find a musical item it should be possible to go to any required track number within say, two seconds, and to have perhaps two higher playing speeds at which the disc can be scanned so that the cue spot can be judged.

Ideally, outputs should be balanced and arranged so that the maximum level on the discs (referred to as 0 dB by manufacturers) produces +8 dBu, although this is far from urgent as most broadcast mixing desks can be arranged to suit. Slightly more of a problem is mono compatibility which arises due to the D/A conversion technique used in some players. Some players use the same D/A converter alternately for left and right signals.

The output of the right channel is thus delayed by a half sample period (11.34 μs). Many early reviewers have noted that this delay gives rise to an apparent phase error of 59° at 15 kHz, but, possibly not noting the origin, may have failed to correct the auditory consequence by moving their left hand speaker 3.8 mm further away to compensate... at normal atmospheric temp-

FIG. 1
CIRCUIT DIAGRAM OF TIME DELAY EQUALISER



R1 THRU R6 = 5k6
C1 & C2 = 500pF
Z1 = NE5532

TABLE 1	
Desirable features of a CD player	
Small size, perhaps half width of a 2 U rack.	
Front loading.	
Mechanically robust.	
Controls and displays separated from player.	
Remote fader actuated start of an already cued item.	
Ability to cue a disc and leave it in pause.	
Time delay from un-pause to music signals at output < 200 ms.	
Direct access to track numbers, access time < 2 s.	
Ability to scan backwards and forwards.	
Left and right outputs corrected for time coincidence.	

Outputs at line level (0 dB from the disc = 8 dBu) optionally balanced.

Displays to show:

- Music Number (TNO).
 - Time to the end of this music number.
 - Time for which this item has been playing over air.
 - Indication that the error rate is excessive.
- Metering is not required as the broadcast mixing desk's meters are used. Monitoring is also achieved on headphones via the mixing desk. Cost should be reasonable; compare with cost of a quality turntable mounting, arm, pickup and preamplifier assembly.

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erature, pressure, humidity and composition! For broadcasters, the left/right time delay causes a mono summing error of some 1.25 dB at 15 kHz. This delay can be equalised out by the use of a simple time delay equaliser as shown in Fig 1.

The final operational aspect is the matching of the dynamic range of the CD programme to that of the transmission channel. The definition of equipment dynamic range used here is the ratio between the maximum output and the noise measured with a CCIR 468 filter and quasi-peak meter. For suitably placed VHF receivers with properly aligned aerials the dynamic range we commonly encounter is as best in the range of 60 dB and the frequency response is ± 1 dB 40 Hz to 15 kHz. By comparison, CD offers a dynamic range of 85 dB and a vinyl disc approximately 65 dB.

Perhaps surprisingly there has been no demand to modify the dynamic range of CD output, or of vinyl output, when broadcast over the VHF band. Typical listener reaction has been to notice the clarity and relative absence of background noise, despite the apparent limitations of the transmission path. Car receivers may need some dynamic range reduction.

A number of stations have found that some domestic players adapt quite well to the demands of broadcasting,

Subcode data

Most recorded music played over the air has to be paid for through copyright and similar fees. As I understand it this procedure has been adopted more or less worldwide, although the system is a little more lax in the United States. Broadly, in the UK, copyright fees are collected by Phonographic Performance Ltd (PPL), the Performing

Rights Society (PRS) and the Mechanical Copyright Protection Society (MCPS) and redistributed to the music publisher, composer, performer and record company in proportions which are derived from the information that the station returns. The onus is thus on the broadcast station to provide accurate returns. This task is usually given to the presenter as he is usually the only person who knows the precise details. It would be a great help to the radio station in the future, if information regarding copyright and royalties were encoded in the subcode track so that on replay they could be fed to the station's accounts computer directly. By this means a station could provide an accurate return with less manual intervention. If compact disc is the medium of the future then eventually there will be very few vinyl records in existence, and the use of subcode data might become more relevant. It is necessary to convince compact disc producers and those who format the subcode tracks to make space for it, and it might be timely to consider what might need to happen to it if compact discs are used to form a compiled programme on, say, digital tape. It will be sensible to marry up the available data from the disc so that it can fit a recognisable slot in the labelling codes. This was discussed in a recent paper *Labels and their formatting in digital audio recording and transmission* by R Lagadec and G W McNally (AES preprint 2003). This might be encoded along with album notes for dissemination using the proposed EBU Radio scheme.

Naturally, when such a digital tape is played out over the air the requisite data could be fed to the accounts computer.

The subcode channels not yet allocated could provide the presenter with all the comments about the recording and artiste usually available on vinyl album sleeves. The vexing problem for the

broadcaster is where to place his subcode data. A cursory examination of the structure of P and Q subcode data channels shows that the table of contents data contains much of the data concerning track names and disc title, but that the P track contains channel and contents flags and a time code starting from the beginning of the disc. The Q channel has three modes—one counts the time from commencement of the current music number, another carries the time since the last index point within a music number and the third carries the international standard recording code (ISRC).

The ISRC carries country, owner, year and serial number data and it is true that a large look-up table, which could be on line (at some cost) to a distant central computer, could decode this into the usually required data. The USA, however (with 32% of the world disc market) appears to be uninterested in it and the UK (with some 6% of the world market) has also taken no action in its implementation. If at all possible, a few more modes of Q subcode should be set aside to store in a repetitive manner the copyright related information. A timing uncertainty of less than 1 s one is desirable, and a brief survey of the capacity in the Q channel code suggests that a timing error of around $\frac{1}{2}$ s could be met, which would also provide at least 128 ASCII characters for automated accounting use.

It might be possible to arrange the positioning of the ASCII characters in order not to affect the timing accuracy of the Q subcode tracks, for example, by distributing them with suitable stop/start and link codes, over several frames. A cursory glance at a typical PPL form (Table 2) indicates that a minimum of 128 characters is needed. Even so, the contents of most fields will require abbreviation. Any change to CD formatting is bound to cause problems in the uniformity of the product, but this might be a small price to pay if the need is justifiable, and it is probably better done before the sheer number of discs released creates difficulties.

Maintenance and testing

Most broadcast stations, certainly within the UK independent sector, will wish to carry out their own maintenance and servicing. This is not just a matter of engineering pride but a matter of necessity in order that equipment down time is minimised. Independent Local Radio chief engineers have shown themselves to be highly adaptable in handling equipment which is becoming increasingly complex.

A satisfactory and properly documented service manual, with perhaps an auxiliary troubleshooting manual, is a prime requirement. It would seem, from a study of manuals already available, that most fault finding down to chip level requires only simple equipment, such as an oscilloscope and a digital multimeter, of a kind which is readily found in the engineering room at an ILR station. From a station's standpoint, replacement parts should be readily available.

A test compact disc is ideal for checking out a player. Philips, Sony and others have produced test discs whose primary intended function was to check the analogue performance of a CD player. The broadcast engineer can, however, see the potential of a test disc with a format and contents to match his needs more closely. A fundamental use of such a test disc is to establish that the

TABLE 2
Example of a single entry on a PRS/PPL return form

PRS/PPL Return form Radio Station Address
Day
Month
Year
Programme start time
Presenter

Title	Artist	Composer	Publisher	Label	Record number	Needle time	Category (if not needle time)	Duration M S
<i>Hello Dolly</i>	Darts	Manfield	Carlin M	Magnet	Mag 110	Y		03 21

See note (a)

PPL PRS	PPL	PRS	PRS	PRS	PPL	PPL	See note (b) See note (c)	See note (d)
MCPS						See note (b)		

See note (e)

16	16	16	16	16	16	16		16
----	----	----	----	----	----	----	--	----

Notes on Table 2

- Some of the complexities of the UK copyright fee collection.
- Three fee collection authorities exist: PPL, PRS, MCPS. This form has parts needed by them.
 - If this is needle time (music published by certain companies not registered with PPL, certain types of music eg, library music, are not counted as needle time) then the record label will be one of (currently) 2,000 registered with PPL, and PPL need to know.
 - If this is not needle time (see (b) above and also a pre-recorded live session, concert or import or secondary recording) then if session music PPL and PRS need to know:
if concert PPL and PRS need to know
if library MCPS needs to know
if pre-recorded programme then PPL, PRS and MCPS need to know
if imported disc (musical item not intended for release in this country) PPL needs to know.
 - Timing (in the UK at least) is that period for which music (not introductory speech or applause) is audible. A suggestion for the criterion of audibility is that the music registers greater than PPM 1 (-12 dBu).
 - This line shows the suggested number of ASCII characters which could be used to code the data in each field. For completeness, space should also be allocated for a 14 byte ISRC code. This makes the minimum required storage $7 \times 16 + 14 = 126$ bytes.

equipment is working reliably rather than simply to the peak of its performance ability. What makes the prospect of a customised pressing acceptable is the relatively low cost of manufacture and the long service life of a compact disc. An initial estimate of production costs indicates that a useful disc could be made available for less than £15. By comparison, a set of four vinyl discs has a relatively short service life and is likely to cost over £100.

What would be on a CD test disc? The signals recorded can be broken down into various types:

● Tones which follow the lines of the Independent Broadcasting Authority's Code of Practice; these include:

- Line up tone to peak level (+8 dBu, PPM 6)
- Frequency response
- Noise—or silence!
- Distortion—as THD measured by assessing individual harmonics
- Crosstalk
- Differential delay (it has been called phase difference!)

● Additional tones which check some aspects in more detail:

Tones based on Intermodulation Distortion (IMD). This is probably a more useful distortion parameter to measure as it can be argued that IMD figures yield a more accurate indica-

tion of the impairment of the audio signal than is given by simple THD readings.

Tones which indicate correct group delay performance.

● Signals which check the operation of compact disc player functions:

Pre-emphasis: by replaying tones of specific frequency and level.

Error code correction: by attempting to replay a signal which has been defaced to simulate pressing defects and to simulate fingerprints.

Accessibility of all potential track numbers (TNO) up to the maximum of 99.

● Signals which allow the broadcaster to treat a working disc and player combination as a quality signal generator and to provide:

Tones to briefly check or align PPMs.

A wow and flutter test tone.

● An optical read-out section which would be used in realignment of a machine.

Naturally there would be appropriate signals on the P and Q subcode channels. Other subcode tracks might even carry the instructions for use!

A detailed schedule, incorporating durations, has been worked out and in the scheme presented here, the total recorded time is 65 minutes—less than the maximum possible of 75 and less than the best currently feasible as a production proposition, but more than the length of most current

offerings in compact disc format. If there was a specialised test disc it follows that there would be a justifiable need for a compact disc analyser to aid in quality checking of the test disc. Ownership of such expensive equipment is likely to be centralised, being shared among needy users.

Looking to the future reveals a potential use for the recordable compact disc. This product could replace the cartridge tape machine for jingles, commercials and even pre-recorded programmes. It is already envisaged that accounting information, which perhaps may be encoded in the Q subcode, might be used to assist the station to invoice for money as well as part with it! □

After graduating from Durham University in 1969, Allen Mornington-West designed the original range of Naim audio power amplifiers but resigned as a director of that company in 1974 to continue in freelance design work within the audio industry. In 1982 he joined the IBA's Quality Control Section supervising the section's special design requirements. Since 1978 he has regularly lectured on behalf of the Association of Professional Recording Studios at many of their courses and was Secretary of the Association's initiative to co-ordinate digital audio standards. He is a member of the Audio Engineering Society.

Acknowledgements

The author is grateful to many colleagues within the IBA and in other broadcasting organisations for all their thoughts, inspiration and guidance and to the Director of Engineering of the IBA for permission to publish this article.

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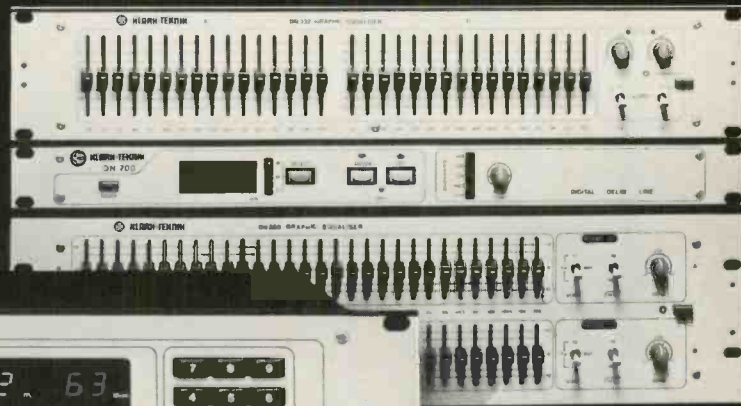
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This month Norman McLeod is on holiday: John Hill stands in

The Day After...

Engineers who go on training courses at Evesham, Worcestershire are well aware of the large nuclear bolt-hole underneath the BBC Engineering Training Centre. This, along with the long wave transmitter at Droitwich, is the nerve centre for ensuring that we'll still be able to hear Simon Bates play *Our tune* on The Day After.

The Wartime Broadcasting Service (yes, Ted Turner isn't the only one with a WTBS), better known in the Beeb as 'deferred facilities' or 'deferred services' is a fascinating thing. As well as Evesham and Droitwich for national broadcasting, for many years regional government emergency bunkers have been provided with studios and emergency transmitters. Some of these transmitters were heavily protected against hydrogen bomb blast by installing them in wooden caravans near prime targets. All of this cost a few tens of thousands of pounds a year to maintain. Until recently.

Readers of Peter Laurie's *Beneath the City Streets*, a paranoid subversive's guide to secret government installations, will have been surprised to see that in 1982/83 the budget for WTBS shot up to £5 million. Clearly some revamping has been going on. All information gratefully received, disgruntled BBC staff please take note.

... after the break.

Not to be outdone, the IBA is just as keen to bring us the joyous tidings that the missiles are on their way. After all, World War III is no time to let the JICRAR slip by being second with the news.

Never ones to be caught napping, patriotic officials at the IBA have hatched a top secret wheeze to plumb ILR into WTBS in the nick of time. ILR stations have been issued with plain brown paper envelopes containing their orders for the day, which they mustn't open before or they'll be frogmarched off to the local jug under the Official Secrets Act. The cue to open the orders will come by telex.

I am happy to report that one engineer, like James Watt, discovered that kettles have uses other than merely heating water. Having steamed the envelope open, he discovered that ILR's heroic wartime role is to rebroadcast the BBC long wave signal.

More spookery

The other day I visited our illustrious editor to talk about this page of gems. By now he is probably wishing I hadn't bothered. Anyway, when I arrived he was sitting at his desk sifting through a heap of cards. Apparently you lot fill them in to get free copies of the magazine. This generosity only extends to people in the industry; anyone else has to cough up.

This doesn't stop the occasional blighter trying to pull a fast one. Step forward Mr E. He sent in a card, claiming to work for a telecommunications outfit called the 'Government Communications Bureau'. My moles tell me that this is not another GCHQ, but a well-worn cover for the British Secret Intelligence Service, MI6. Now why on earth would they be interested in broadcasting?

Back after the break

Norman McLeod is on his summer hols at the moment, but his pen marches on. After years of obstruction and 'jam tomorrow' from the government about community radio, Norman has finally done it. He's gone pirate with Kitchen Table Radio, the trendiest station in Brighton—all one watt of it. Meanwhile, back at the good ol' Department of Trade and Industry, an official who shall remain nameless is hopefully still smarting from this attack:

Dear Jim, Let me just sound off on my typewriter while I'm still seething about our telephone conversation this morning. Then I can go on to tackle something more pleasant and agreeable, like weeding the garden, which is long overdue!

Before I start, please try to understand that there is no personal animosity taking place here. I am writing in sorrow, not anger. But I am about to give you a tremendous bollocking. This is because you are my contact with a vast Government machine which is making an absolute fool of itself. I don't blame you personally for any of its idiocies.

I would ask you to take a moderately sensitive radio receiver and tune it around the broadcast parts of the radio spectrum. There is Radio Jackie, to take just one example, broadcasting day and night with a 100 W transmitter. They are making private gain out of a public resource which they have illegally appropriated. And what is the DTI doing about it? As far as I can tell, nothing.

The reason why it is not doing anything is because Jackie is not causing anyone any bother. Petrol stations have not been bursting into flames, aircraft landing systems have not been malfunctioning and the United Kingdom has not been hauled before the International Telecommunications Union to give account of itself.

In fact, the presence of Radio Jackie is proof—if proof were needed—of what I have been trying to get across to you this morning. That is, that a low-power medium wave transmitter is a pretty harmless device. Powers up to about 100 W can be run on almost any locally-clear frequency and

nothing untoward happens.

So please stop wasting my time and yours trying to blind me with science or technical bullshit. I've had enough patronising rubbish from your colleagues in Laboratory Department to last me a lifetime.

Let us turn now to my own requirements. I am interested in trade and industry, too. In particular, I am interested in special event broadcasting, and I am interested in community radio. This is a life's work, not some flavour-of-the-month craze, but for the last four or five years I and other people in the community radio movement have been very patient while we have been fobbed off with one excuse after another by people like you.

My patience is very nearly exhausted. I see pirate radio stations getting away with daylight robbery, and yet when I ask nicely for a low power licence to run an experimental station I get a load of nonsense back.

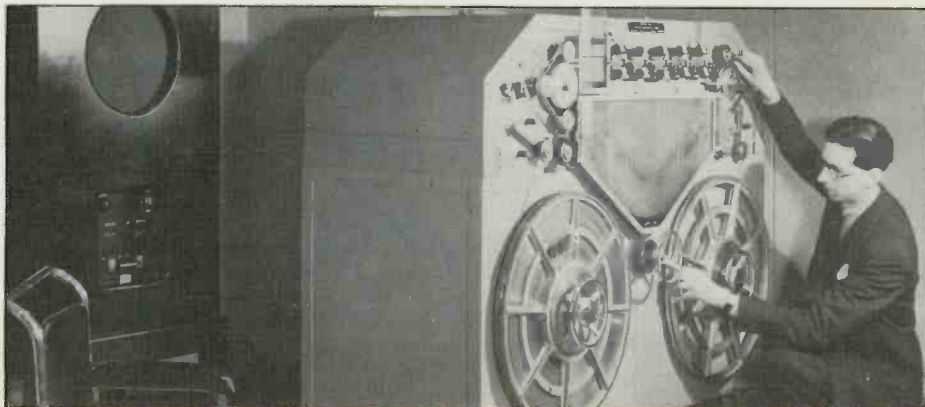
I'm not going to stand for this. It would be cheaper and less bother for me to go right ahead tomorrow and be prosecuted if need be. I am going to give you one last opportunity to act decently and then I am going to go pirate and challenge the Government, openly and in public, to close me down.

You have fourteen days to provide me with an experimental licence allowing me to make test broadcasts of a type which I consider to be appropriate on a frequency of your choice. I would prefer 1605 kHz because I have already got the rig for that frequency. But I will accept any alternative in the band 1500 to 1610 kHz.

I do not require to radiate more than one watt of effective radiated monopole power. I will take all reasonable precautions to ensure that no harm is caused to wireless telegraphy or any other facilities, and I will provide you with a telephone number which will permit you to request that the station close down at once, provided you can produce factual evidence that it is causing interference. In short, I will bend over backwards to be reasonable. But if that piece of paper has not passed through by letterbox by Tuesday, 31 July I am going on the air and you can all get stuffed.

Best Wishes, Norman McLeod

A BBC engineer at the Evesham bunker resurrects a Marconi-Stille steel-tape machine, the only tape recorder able to withstand a direct hit from an SS20



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NAB '84, LAS VEGAS

Paul D Lehrman

The 1984 convention of the National Association of Broadcasters, held in Las Vegas from April 28 to May 3, was quite an affair. Besides enough equipment on display to outfit several TV and radio networks, and seminars on everything from the effects of cyclones and tornadoes on antenna towers to how to be a great salesman without having a heart attack, there were multimedia shows, marching bands, picket lines, pontificating legislators, live fire-extinguishing demonstrations, a satellite-dish farm, and a couple of near fights...

The convention officially began on April 29, but opened a day earlier to accommodate several seminars for engineers. These covered AM and FM transmitter and antenna systems, television production engineering, multichannel TV sound, and audio production techniques for radio. Unfortunately, the two most interesting to us audio fans—the last two—were held simultaneously.

Radio production

The first half of the all-day radio production seminar covered the improvement of talk show sound—specifically through altering room acoustics and getting the most out of telephone lines—as well as stereo recording and production, and digital audio technology in broadcasting. The afternoon session discussed audio processing, and how to read tape machine specifications, and for a finale, the BBC's Duncan MacEwan did a detailed presentation on his network's outside broadcast facilities.

Dealing with phone lines is something Skip Pizzi, an engineer with National Public Radio, has a lot of experience with, in that phoned-in interviews and field reports are essential components of the network's extensive news coverage. Equalisation is very important to improve intelligibility, he said, and suggested a 6 dB cut in the 300-400 Hz band, with some compression to keep apparent levels up. He also expounded on the use of dynamic filters—'filter gates'—to minimise noise, and discussed various techniques for using non-real-time feeds to improve frequency response.

Dick Jamieson, a Minneapolis design consultant, attempted to explain some of the reasons why telephone-line studio-to-transmitter links (STLs) never work the way they're supposed to.

"The telephone companies say the signal-to-noise is 65 dB," he said, "but they're measuring it below the clipping point, which is +18 dB relative to 0 dBm. You can't hit the line with anything above 0 dBm because the line amps and equalisers can't take it."

He also talked about the need for proper acoustic room treatment and good construction techniques, even for small stations.

The discussion of digital audio started out with

the same old digital *v* analogue arguments, but soon settled into practical ways for radio stations to get into digital. Everyone agreed that it will be a while before stations can replace their good old Ampex 440s with digital tape recorders, but Skip Pizzi said that several NPR stations are using Sony PCM-F1s along with Betamax VCRs for delayed broadcasts of satellite-fed network programmes, as well as for remote classical music recording. Others are using the F1s in conjunction with spare video microwave channels for their STLs and for live feeds from remote units.

The general tenor of the discussion was not that digital necessarily *sounds* better over the air, but rather that it has distinct advantages in terms of reliability and copyability. Pizzi pointed out one other advantage—time accuracy.

"When you're doing re-feeds of a one-hour programme over several time zones, no analogue machine will line it up to within one second," he said, "whereas a digital machine will."

Rick Plushner of Sony made the well-received comment that radio has been instrumental in bringing digital audio to consumers' attention by playing CDs over the air, and identifying them as such.

On the subject of stereo production, Pizzi did a fairly detailed presentation on microphone techniques. He said that NPR does not do its news programmes in stereo because the sonic advantages would be minor compared to the drawbacks—the national feeds would take up twice as much valuable satellite space. On the other hand, some member stations process the mono feeds through stereo synthesisers. He mentioned a new unit, which he admitted he hadn't heard yet, made by Studio Technologies, which uses a time-delay separation technique for stereo synthesis instead of the usual frequency-splitting method.

He stressed the need for good mono compatibility and the importance of consistent monitoring of the mono signal with both speakers and an oscilloscope. He suggested the installation of a switch on each console input labelled 'Left, Stereo, Right, Mono' so that any phase problems on a programme source could be instantly compensated for. He also cautioned producers and editors to use steeper splicing angles on stereo tapes, especially at slow tape speeds, to prevent image shifting. Perhaps most importantly, he warned producers to allow 50% more production time for stereo.

Multichannel television

One month before the convention, the Federal Communications Commission issued its final Report and Order implementing multichannel TV sound. Following the recommendations of the Electronic Industries Association's Broadcast Television Standards Committee (BTSC), the FCC more or less went on record as supporting the FM/AM stereo system developed by Zenith (which is similar to the Westrex FM stereo radio format), along with a noise-reduction scheme designed by dbx, to prevent coverage-area loss of the stereo signal.

I use the phrase "more or less" because the

Commission did not exactly put the BTSC's findings into law—to do so, one can assume their thinking goes, would be to invite antitrust lawsuits from those manufacturers whose formats were not recommended. Instead, the recommendations were sneaked in sideways—broadcasters are free to use any format they wish, but if they use a stereo audio subcarrier with a pilot tone at 15.734 kHz (a convenient frequency for a pilot, in that it coincides with the horizontal synchronisation signal of US television broadcasts), then they must use the Zenith and dbx systems.

The Zenith format puts L+R on the main audio and L-R on the subcarrier. It does not allow for second-language broadcasts—so, to make bilingual programmes possible, a third, mono, 10 kHz audio channel, called the Secondary Audio Program (SAP) can be broadcast and decoded separately from both the main and stereo audio channels. Since the majority of home TV sets will not be able to decode the main and stereo audio simultaneously with the SAP (and viewers wouldn't be able to deal with all those voices coming at them at the same time anyway—subtitles are bad enough), the SAP must be a complete soundtrack, with dialogue, music, voiceovers and effects, all in mono.

There will also be room for a *fourth* channel, dubbed the 'professional' channel, which will eventually be used for internal station purposes, such as telemetering data back to the studio from a remote transmitter site, or as an 'intercom' system for mobile units.

Even with this background, it came as a surprise to many when James Gibbings of NBC, the first speaker at the multichannel-sound-for-television session, revealed that his network has been experimenting with various kinds of stereo for television for the past couple of years, and the *Tonight Show* has been recorded in stereo since October 1982. Gibbings outlined some of the problems he has already experienced in converting to stereo. Although the show is pre-recorded, he explained, it's only two hours between taping and airing, which is not long enough to do any post-production, so it had to go down right. The mix is 'bundled' to keep things from getting out of hand, but because there's also lots of leakage between the cast mics and the music mics the task isn't made any easier.

"The console we're using is 20 years old," he said. "It is configured into 53×20×6×2×1, so we can do stereo by taking signal off the submasters, but it has no panpots. When we have music groups on, we bring in an auxiliary Yamaha console to mix them."

Gibbings pointed out that today's television productions use the 'Academy roll-off' on their audio tracks to accommodate the limitations of optical film tracks, which restricts the bandwidth to about 200-8,000 Hz. Using audio tracks on videotape, however, allows the sound to take on 'album quality', with the upper limit stretched to about 12 kHz. At the same time, he cautioned mixers not to apply music recording techniques too strongly to TV sound: "The typical viewer position sees the TV picture covering 16° of an arc, while the optimum stereo listening position covers 60°."

For the time being, he said, although music and effects for TV shows can take full advantage of



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CONVENTION REPORT

stereo, dialogue will still be mixed to mono at centre—panning dialogue tracks to follow actors' movements just doesn't work on the small screen. He suggested a technique for expanding the apparent stereo stage without generating a 'hole-in-the-middle' effect: while on-screen sound effects can be localised by panning them between the left and right channels, off-screen effects can be made to appear as if they are coming from outside the stereo image by recording them as minus-left and minus-right signals. "This widens the stereo image by as much as 25% without pushing out the image location," he explained.

He also demonstrated another technique for keeping the centre image stable: three-channel 'motion-picture-style' audio. The format is feasible within the Zenith system, he claimed, by broadcasting the third channel in quadrature to the stereo difference signal.

Kevin Dauphinee of ABC departed slightly from the technical discussions and talked about the economic advantages of the SAP. "Stereo itself will not increase audiences," he maintained. "The programming must do that." But SAP can represent a tangible return on the investment broadcasters put into upgrading to stereo: it can attract new segments of the viewing public, especially those for whom English is not a first language.

"The US has 24 million Spanish-speaking people," Dauphinee explained, "and by 1990 there will be 30 million. Sixty percent of them are concentrated in six cities, and 86% live in 30 metropolitan areas." He noted that there are currently 18 Spanish language television stations in the US, and five more on the Mexican border that have significant US audiences, and that \$93 million a year is being spent by advertisers to reach Spanish-speaking TV audiences.

Doug Dickey of Solid State Logic discussed mixing and caring for multichannel TV sound. The first requirement for producers, he said, is a good monitoring environment. "Most current control rooms are not set up well," he said. "The sound mixer is in the wrong place. But this doesn't mean rebuilding your control rooms: near-field monitoring, combined with judicious equalisation and some minor acoustic improvements, will provide a workable solution. The point is not perfection, but that your listening areas must provide a reference standard that results in excellent quality at the receiver.

"You may need equivalent sets of monitors for the mixer, the sound effects director, master control, and probably the technical director. Other areas can probably get by with good old mono. In some situations, you must be able to switch the monitors quickly between mono, stereo and SAP. You might also want to be able to switch in filters at times to accurately compare the main and SAP mixes."

Dickey explained that there will have to be modifications in equipment, as well. "C-format tape cannot handle stereo audio, timecode, and SAP at the same time," he said. "You can lock the VTR with a 4-track audio tape recorder, which is OK for occasional special programming, but in everyday use it becomes a horrible nightmare. It might make sense to put the timecode in the vertical interval instead, freeing up that track, which has limited bandwidth anyway, for the SAP."

He maintained that it is "unlikely" that discrete

three-channel stereo will ever be used on television, as the format is much more important in large theatres, and there would be serious compatibility problems with existing mono and first-generation stereo TV sets no matter how it was implemented. He did offer one intriguing possibility, however: that a third audio channel could be used to broadcast a compatible surround-sound format, such as Ambisonics.

At the pre-production level, there will be more reliance on multitrack tape recorders—4-track to 32-track—as opposed to sprocketed magfilm gear. "It's important to keep the dialogue, music and effects all separate, so that the SAP track can be done easily and quickly." He also noted that post-production computers will be very helpful for assembly and mixing, and "will pay for themselves in short order".

The most interesting talk of the multichannel TV session was given by Mark Schubin, an independent consultant from New York. Schubin addressed himself to the problems of mono compatibility, and presented some radical, but eminently practical, new ideas.

Mono compatibility will be important, he said, as long as there are mono sets out there—and given the dubious premise that *all* of the TV sets sold in the next 10 years will be stereo, half of the sets in use will still be mono. He stressed proper miking, the need to be acutely aware of how connectors and cables are wired, and gave tips on how to avoid phase errors caused by processing and tape-azimuth errors. This last may be difficult to deal with, he pointed out, because no stereo audio alignment tapes exist for C-format videotape machines.

Schubin's solution to all these problems is simple: instead of distributing the stereo audio throughout a facility as separate left and right channels, he proposed, why not wire the place with sum and difference channels? "Just change the labels on your patch bay," he said. When using discrete left and right, he maintained, the mono signal needs a great deal of care, but with sum/difference distribution, problems on the difference channel are far less noticeable at the listener level. "Distribution networks, wiring harnesses, and tape recorders don't care what the signals are," he said. "Only the consoles and microphones do, and they can have encoding and decoding networks put in."

Schubin's proposal was apparently met with a great deal of interest, and the next day he reported that the Public Broadcasting Network (which has had a stereo-TV network in place for several years, the audio often being handled by stations of the National Public Radio Network) had approached him after the seminar for more details.

Among the assembled conveners, there were plenty of questions about multichannel TV, and there were also several other presentations on the subject during the rest of the conference. There was a certain amount of concern expressed about the 'chicken-and-egg' syndrome—which would come first, the broadcasts or the receivers that could pick them up? Many in the industry felt that ABC's previously announced stereo and bilingual coverage of the summer Olympics would be the new medium's first great shot in the arm. Unfortunately, a few weeks before the convention (even before the Eastern-bloc boycott was announced), the network reversed its decision,

citing logistical complications and, ironically, the lack of available decoders. There is also the unresolved question of whether cable-TV systems will carry stereo and SAP audio.

AM stereo

"I feel like Alan Alda in *Same Time Next Year*," said the NAB's Michael Rau as he opened the Tuesday afternoon free-for-all on AM stereo. Although stereo has been a reality on the AM broadcast band for two years now, the controversies that have plagued the format since it was first proposed 15 years ago have not gone away, and the same question—"How are we going to make this work?"—is still on the mind of every AM broadcaster. It was foremost in the minds of the 400 or so who showed up for the session, who brought with them curiosity, questions, good and bad experiences to share, and—mostly—anger.

The Tuesday meeting, which for many was the closing event of the convention, was actually the second meeting on the subject. (There was a luncheon the following day, but many participants decided to get out of strike-torn Las Vegas as quickly as possible—a decision that seemed even more judicious when Paul Anka, who was scheduled to perform at the luncheon, announced he would not cross the picket lines set up by the musicians' and hotel workers' unions.) The previous day, station managers and sales people had heard about the best ways to promote the medium in an admittedly bad environment. Among the speakers were engineers and sales managers from several stereo stations, large and small, and a representative from Sony.

On Tuesday, however, there were no speeches, and Rau wisely decided instead to open the floor to questions right off. Judging from the questions there was a lot of bitterness over the way the FCC has handled the issue—the Commission's reasonable approach to multichannel TV this year was in marked contrast to how it dealt with AM stereo just two years ago. Instead of supporting one of the four competing (and non-compatible) formats presented to it, it simply ducked the issue and announced it was letting "the marketplace" decide. As Dan Dalton of Los Angeles station KFI put it, "They said, 'Here's four systems, guys—have fun!'" Since then, the four systems (Harris, Kahn/Hazeltine, Magnavox-PMX, and Motorola) have engaged in a political, economic, and technical slugfest, each trying to prove that the others are somehow inferior.

The battle so far has been punctuated by two major developments: Delco, the electronics arm of General Motors, announced in December 1982 that it had chosen Motorola's system for use in GM's car radios, and the first models finally hit dealers' showrooms in February 1984. In July 1983, however, Sony released the *SRF-A100*, a portable AM/FM stereo radio containing a chip that could decode *all four* systems. According to Sony's John Strom, demand for the model has consistently outstripped supply.

And there have been a couple of minor developments: the Harris system was denied type-acceptance for a few months by the FCC, due to some technical problems (pointed out to the Commission by the competitors, of course). The company made a few changes and got back on the Commission's good graces, but it then announced, on the first day of the NAB convention, that it was lowering the frequency of

its system's pilot tone to match Motorola's. The systems are still not compatible, but hearing Harris-format broadcasts on a Motorola set gives the listener some semblance of stereo. As one company spokesman said, "This way, at least we can be picked up on the crappy receivers that are out there."

Tuesday's panelists were proponents of the four major systems; representatives of Sony, Panasonic, and Sansui; two gentlemen from the FCC (who remained remarkably quiet throughout); and a disinterested observer or two. Had there been a vegetable stand immediately outside the convention hall, no doubt there would have been several panelists leaving the session wearing a light garden salad.

There was a general consensus that AM stereo cannot succeed unless the audio quality of both the transmissions and the receiving equipment improves to where it is at least comparable to FM. Therefore, most of the participants' ire was directed towards Delco, the makers of what Leonard Kahn, inventor of the Kahn system, likes to call "2.2 kHz radios". Although Kahn's characterisation of them may be something of an exaggeration, most listeners agree that Delco's stereo car radios, which use an IF stage only 6 kHz wide to avoid adjacent channel interference, do not sound significantly better than their mono radios, which have never been known for their sonic performance.

"Why don't you stay out of it until you're ready

to do a multi-system radio?" asked one audience member of Delco representative Bill Gilbert. The beleaguered Gilbert, whose introduction as director of Delco's "entertainment and comfort-control division" got a snicker out of at least a few in the crowd, said that multi-system receivers do not have the performance Delco wants. "Not enough distortion?" someone hollered. "Aren't you the people who screwed us up with the windshield aerials?" called out someone else. Kahn pointed out that the solution to eliminating 10 kHz interference whistles is to spend a few extra dollars and install a 10 kHz filter, not simply to block out half the audio.

Someone else accused Delco of trying to corner the marketplace by putting single-system radios into cars, and said "We're allowed to choose who makes our transmitters, so why shouldn't we be able to choose which stereo system to use?" There were more chuckles when one broadcaster began his question with, "I'm using the Harris system—that is, last week's Harris system..." But there were positive sides to the meeting as well. Sony's John Strom pointed out that there were now 233 stereo stations on the air, which represented a fourfold increase over the previous year. There was considerable applause when he said "We think our decision to do a multi-mode radio is behind that." Session chairman Rau then suggested that Strom should consider a run for the presidency.

Strom noted that of the 29 US cities that have

three or more stereo AM stations, in only *one* are all of the stations using the same format. He also said that installing the multi-mode chip in Sony's receiver represented a retail price increase of about \$15—not a huge sum, but not insignificant in a unit that sells for just over \$100. "We didn't want to make multi-mode receivers," he said, "but we have to sell radios."

Sony recently released the *SRF-A1*, an AM stereo Walkman, and Strom announced that the company will be making a car unit and a 'boom box' by the beginning of 1985, and that they are 'studying' hi-fi components. Ishi Ishikawa of Sansui used the occasion to announce that his company planned to release their first AM radio—a multi-system high-end car unit—within a few weeks.

Despite the venom, there was plenty of enthusiasm in the crowd for the future of AM stereo. The chief engineer of WQXR, a New York station that simulcasts classical music in stereo on both its AM and FM outlets, made the rather surprising claim that on the Sony receiver, he could A/B his AM and FM signals, and not tell the difference. (Another broadcaster, after the session, suggested that this might be because the Sony's FM section is not very good.) There was a suggestion that component-receiver manufacturers be pressured into publishing meaningful specs on their AM tuner sections, and Rau replied that the NAB is asking writers for *Stereo Review* and other magazines to discuss the

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CONVENTION REPORT

AM sections in the receivers they evaluate.

But a note of caution was sounded by KFI's Don Dalton. "Radio is not penicillin," he said. "We're not that important. If the number-one station went off the air tomorrow, we'd get a few cards and letters, and then the listeners would push the button and go somewhere else. If we're going to succeed, we have to push the hell out of it."

Exhibits

The exhibition floor in Las Vegas's huge convention centre was divided into two sections: radio and television. The majority of the audio equipment was on the radio side (which consequently made it a lot noisier), but there was also plenty of interesting stuff in with the TV exhibits. Unfortunately, it was harder to find—the audio booths tended to be much smaller than those of the video giants like Sony, JVC and Convergence Corporation. Adding to the difficulties was the fact that the TV section was about four times the size of the radio area, and in deference to the many cameras, editing systems and projection TVs on display, it was pretty dark.

One exhibit hidden over in the TV section was Alpha Automation, a division of Alpha Audio, a full-service recording and production facility in Richmond, Virginia. Alpha was showing *The Boss*, a new computerised editor for audio-for-video, developed in-house with some co-operation from btx. "It gives you the big picture," explained Alpha's Bob Tulloh. "It doesn't force you to look at just one thing at a time—there's more data on the screen."

The system is built around a 16-bit microcomputer with 192 K of usable program memory and a full-colour video display, and can use 5 1/4 in or 8 in floppy discs or Winchester hard discs for storage. It can be used with any audio or video machine that can lock to a synchroniser. "The system doesn't care what the source is," said Tulloh. "We're looking at writing sound effects on LaserVision discs." The software contains a separate list-management program that can deal with 999 different events. Not only will it handle edit lists, but it will also interface with automated mixing consoles and microprocessor-controlled effects units, as well as with MIDI-equipped music synthesisers.

Alpha is trying to avoid tying *The Boss* to any one model of synchroniser. "We designed it around *The Shadow*," said Tulloh, "and we're now working on interfacing it with Adams-Smith equipment, as well as our own synchroniser, which will probably be built around Otari's resolver. We've got 90 per cent of the work done on that—everything except the capstan override.

"The process of editing is getting in the way of the art," he opined. "Decisions are being based on the available hardware. We want to make that transparent. The whole point of the system is to make it quicker, faster and allow the studio to bill more dollars." Base price for *The Boss* is \$16,900.

In another corner, Quad-Eight/Westrex was showing its new futuristic-looking *Westar* mixing console. The current configuration is for recording studios, but versions for video and film mixing are under development. The *Westar* is unusual in two respects. One is that it can be very easily customised—besides room for up to 52 inputs, the buyer can choose from seven different mic preamps, three types of equalisers (3- and

4-band parametric, or graphic) and three fader systems (audio only, VCA and computer-interfaceable intelligent digital). A Westrex-built automation system using 10 Mbyte hard-disc storage will be available in September. The other unusual aspect is the relatively low price: the basic 36 x 24 console sells for about \$65,000.

Neve was on hand as well, showing their *Necam 96* VCA-less timecode-based console automation system, hooked up with a colour video monitor and a qwerty keyboard. Also on display was a new 4-output version of the suitcase mixer, as well as a VCA version of same, which can be linked to a video editor, such as a CMX. The VCA model was developed for the US market, but will be available in the UK shortly.

A couple of yards away Dolby Laboratories, in an uncharacteristically small booth, was handing out literature on their digital audio transmission system for use in landlines, microwave links and satellites. Dolby sees the need for a new digital format, according to project manager Mark Yonge, because PCM systems have problems with the low error rates that crop up in real-world transmission situations: "Rainclouds and airplanes cause errors, and the system can crash. Therefore, we need a system whose performance will degrade gradually, so that the audio is still listenable as long as the picture is viewable."

Dolby is using an adaptive delta-modulation system. Unlike dbx's digital system, however, it uses no companding. "That leads to bad transient performance," Yonge claimed. "We were considering it, but junked the idea two years ago." The system uses a 'smart' encoder and a 'dumb' decoder—"The price of the encoder is not significant, but the price of the decoder definitely is." The decoder, he said, can be built with five dollars-worth of Radio Shack parts.

In addition to the main data, which flows at

about 250 kbit/s per channel, the encoder transmits a separate control-bit stream at a much slower rate, which can be embedded, for example, in the vertical interval. This data keeps the decoder abreast of step size and sliding bands of pre- and de-emphasis.

Dolby claims the system will deliver a 15 kHz bandwidth, with greater than 90 dB signal-to-noise under optimum conditions. "Errors raise the noise floor," explained Yonge, "and in extreme conditions, can add distortion. But you can still follow the ball game with an error rate of one in 32."

All the way over on the radio side, among the fire-extinguisher and library-music booths, was being shown another approach to the problems of digital audio transmission. The small but fascinating exhibit was provided by Sansui, who were demonstrating a hard-wired prototype of their DC-PCM (Differential-Companding) 'bit-reduced' transmission system. The setup was simple: one programme source was routed to headphones through a switcher marked '16-bit PCM', '12-bit PCM', and 'DC-PCM', and passers-by were invited to compare. The Sansui system sounded quite respectable, but exactly why this was so was a little difficult to determine.

According to the literature being handed out, the system compresses the input signal digitally, but instead of truncating the compressed bits, it accumulates them. Good sound quality, it said, is available with but eight bits, while using 10-bit words improves the performance. A gentleman manning the booth said that unlike linear PCM formats, dynamic range in the Sansui system is equal to the number of quantising bits, not the number of transmitted bits, but the frequency response is still equal to half the sampling frequency. Two versions have been built, one using a 32 kHz sampling rate, the other 48 kHz. Possible applications are said to be in cable systems, satellite networks and broadcast studio-to-transmitter links. Sansui is not aggressively marketing the system; rather, they are simply demonstrating it and waiting for other companies to make them offers to license the technology.

Sony had a booth on the television side that looked like the *Mother Ship* from *Close Encounters* which featured a staggering range of cameras, monitors, editors, etc. They also had a booth on the radio side, and the *CDK-7000P* Auto Disc Loader, stuck unobtrusively behind it, was getting a lot of attention—even though there was not a single word of English printed anywhere on it. Despite the language barrier, it didn't take long to figure out what the thing was—essentially, a compact disc juke box. The unit holds 120 discs, and gives access to any selection on any disc in 20 seconds. "It's not available in the US," said a spokesman. "We're just seeing what people think of it." People were amused, and impressed.

On a more practical level, Sony showed a prototype of its first digital 2-track reel-to-reel tape recorder, the *PCM 3102*, which uses the DASH format, and although it is being manufactured in Florida, bears no resemblance to MCI's analogue machines. It will be available either during the last quarter of 1984 or the first of 1985 (depending on whom you talked to) at a price of between \$20,000 and \$25,000 (ditto). Besides the digital tracks, it contains two analogue tracks with staggered heads, and an SMPTE track. Timecode information can also be derived from capstan pulses. It features analogue cueing,

Sony compact disc 'juke box'



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CONVENTION REPORT

soft-edit capabilities, a dump edit mode, and an RS422 interface for external computer control.

An SMPTE track is also now available on a Sony/MCI analogue machine that was on display—the *JH-110C*. So that the headblock is not too dimensionally different from previous *JH-110s*, the company has put SMPTE playback and audio erase functions on the same head. It is remotable, and has four memories plus return-to-zero. Price is \$7,950. Sony also showed the *MX-P61* portable mixer. An impressive unit, it has 12 inputs and 7 outputs, built-in limiters and 3-band EQ, phantom powering, VU meters and PPMs, very comprehensive signal routing, and weighs in at a hefty 40 pounds, with a price tag to match—about \$10,000.

Next door to Sony's radio booth, **Gotham Audio** was displaying the *Systex* automated audio programming system, for which the company has Western-hemisphere distribution rights. Although it has applications in film, television and recording, the system's principal use initially will be at radio stations. Using 330 Mbyte hard discs, each of which can store an hour of mono digital sound, the system gives 80 ms access to any selection, under the control of any standard RS232 computer. It allows digital-quality programme assembly and editing, using a computer command language with a vocabulary of about 20 instructions. It includes Motorola 68000-based control hardware and EMT 48 kHz, 16-bit linear PCM audio hardware, as well as software developed for Gotham by Dynatron, a Massachusetts 'think tank'. Up to four sequence controllers can be linked together, each of which can handle 15 disc drives. The starting price is \$125,000 and delivery is scheduled for the end of 1984.

In one of the larger radio exhibits, **McMartin** was showing a slew of SCA equipment—generators, encoders, decoders, receivers and analysers. The most impressive item on display was their brand new *BFM-S-500* generator, which can generate five different subcarrier pilots, from 57 to 95 kHz, each pilot tone derived from

the 19 kHz stereo pilot tone to avoid 'birdies' and other forms of interference. The system keeps the various SCA signals out of each other's way by using single-sideband suppressed-carrier modulation, and by rolling off the audio on each channel by 8 dB/octave at 4.8 kHz. The subchannels can be used for audio or data.

Mike Werner, of Broadway Video, showed a novel application for SCAs that his company developed with McMartin—graphics. It was rather startling to see a television screen showing full-colour pictures underneath a sign saying "FM SCA"! The system he designed uses just one of the SCA channels, interfaced with 300-baud modems and appropriate encoders and decoders.

There were lots of new goodies at the **Studer/Revox** booth. An update of the *PR99* tape recorder now includes varispeed, a digital counter and return-to-zero. The company's new *Series 900* mixing consoles offer a wide range of options, including several types of mono and stereo input modules and room for 19 in rack mount auxiliary equipment. The consoles can be configured for broadcast, radio or television production, remotes, or multitrack recording, with frames handling up to 50 inputs and 24 outputs available.

Also on hand was a Revox compact disc player, with infrared remote control, back cueing, three second selection location, time elapsed and time remaining readouts, and 10 memories for sequencing or looping. A Studer version, with balanced inputs and outputs and a hard-wired remote, will be out soon.

Getting the most attention was Studer's new *TLS4000* synchroniser, which can handle up to 30 machines, each capable of running on its own timecode format—the synchroniser, which simply reads data and co-ordinates operations, can automatically convert and deal with drop-frame and non-drop SMPTE, EBU code, and even resolve tone. A local control unit can display timecode numbers, but as a spokesman explained, if each machine has its own computer, the display is more or less redundant.

Two new configurations of **McCurdy's SS8800**

series broadcast mixing consoles were on display—the *8810* 10-channel on-air model, and the *8816* 16 x 4 production console. Up to 24 inputs are available. The *8800* uses totally solid-state switching, digital logic control, and interlockable source on-off switching, routed through dry contacts for maximum reliability. All inputs and outputs are balanced, and all the input modules have pre-fader cueing, which is in mono on the stereo and 4-track models. Options available include quasi- and fully-parametric equalisers, comp/limiters, timers and remote input selectors.

A small company in Pittsburgh, Pennsylvania, known as **McGraw-Edison**, was showing an SCA system for AM transmitters. Exact figures on the system's capacity were a little vague, but apparently it is good enough for such data-based tasks as paging, utility-load management, traffic flow, etc. It operates by phase-modulating the AM carrier with the data stream, and apparently has no effect on the audio portion of the signal, even when used with stereo AM systems.

In Las Vegas, it never rains nor snows, and so it didn't seem unusual that a large portion of the parking lot outside the convention centre was set up with exhibits. Twenty four companies, ranging from Ampex to Wolf Coach, decided to show their wares outside in trucks, semi-trailers, vans and recreational vehicles. Some were used for equipment displays or demonstrations, while others were complete mobile production units whose owners took the occasion to show them off. Interspersed among them was a veritable forest of satellite dishes.

One company that took advantage of the relative quiet and ease of crowd control afforded by a stand-alone exhibition unit was **Eeco**, who did a very slick multi-media introduction of *Emme*, a new computerised video editing system. *Emme* is available with any of three workstation configurations: 'Independent', which creates and assembles edit lists with a keyboard with plenty of dedicated function keys for one-stroke operation; 'Integrated', which uses a track ball or computer mouse to interactively control the company's *Video Production Switcher*; and 'Cinemagraphic', which presents pictures and sound only—no timecode numbers—so as to make traditional film editors more comfortable.

The capabilities and functions of *Emme* are too involved to go into here, but suffice to say it is quite a system, and promises to sell for a reasonable price—\$35,000 to \$65,000 depending on the bells and whistles—when it is released at the end of 1984. But it is worth mentioning that the company's presentation may indicate a dangerous new trend in the way suppliers to the entertainment industry show their wares. Eeco apparently hired an actor to provide the 'live' element in the show and although the gentleman in question was obviously talented and very well briefed in the proper buzzwords, he displayed all the sincerity and familiarity with his subject matter of a local game-show host in a 50th-rated market. It's one thing to use such methods to sell consumer products to an unsophisticated viewing public—but it's quite another when the people who make the equipment try it on the folks who are going to use it to sell soap. The television executives at NAB were getting a taste of their own medicine—and the disturbing thing is, a lot of them seemed to like it. □

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BBC EXTERNAL SERVICES BY SATELLITE

Worldwide short wave broadcasting has traditionally relied on short wave radio links to provide programme feeds to distant transmitters. However, like short wave broadcasts, these links are affected by fading, distortion and interference. The BBC is gradually changing over to digital satellite distribution for its external broadcasts, a process which is already providing millions of listeners with dramatically improved reception quality.

Gordon Lean

The BBC has been broadcasting its World Service for over 50 years and today listeners can receive BBC programmes in any one of 37 different languages. For many of them, the BBC overseas service represents the only accurate account of events in their own country, and keeps them informed of what is happening in the rest of the world on a day-to-day basis.

In order to provide more effective world coverage, the BBC operates a network of short wave relay stations around the globe. These stations re-broadcast programmes received from the United Kingdom to adjacent countries, which results in a higher signal strength being received by the listeners and provides a service which is less susceptible to interference. However, in recent years, with competition from other national external radio services, it became apparent that to maintain its leading position, the BBC had to do something to improve the quality of reception, and it was for this reason that in 1979 the Improved Audibility Programme was launched. Apart from improving and updating its high power transmitters, the BBC decided to implement a scheme whereby the programme material for the relay stations would be distributed by satellite.

Traditionally most broadcasting organisations relied upon direct reception of high power short wave transmissions from the originating country, and until recently the BBC also used this method to provide its news and current affairs services. Programmes which contained no immediate or live information, for example plays or concerts, would be recorded and sent from the UK to be replayed locally into the relay station transmitters. This was difficult operationally and involved complex synchronising and studio facilities to ensure that live and recorded programmes dovetailed correctly.

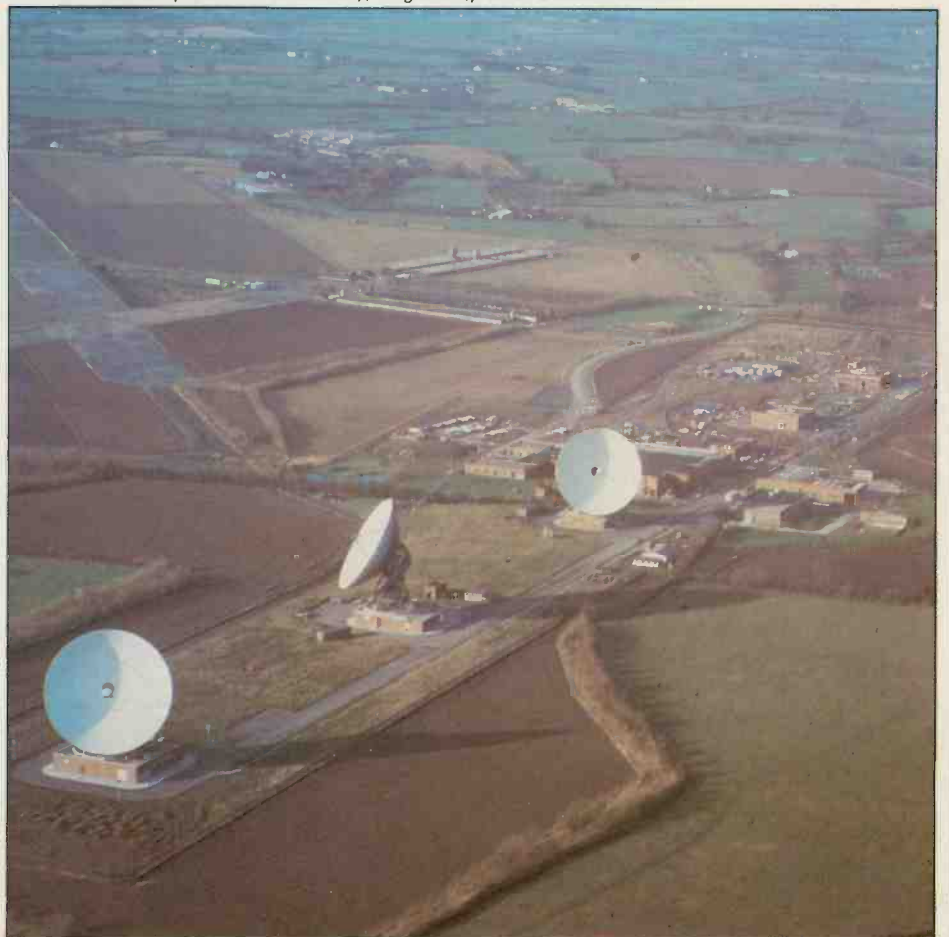
In 1979 at the start of the Improved Audibility Programme it was decided to look into a high quality solution to the problem of feeding the stations, and to try to feed all the stations from the same multi-destination satellite system. A number

of options were open at that time, some of which were currently in use by other broadcasting organisations. The options were:

- to use several channels of Frequency Division Multiplex (FDM) telephony and combine them using analogue bandwidth extension equipment which gives a higher quality than a single circuit;
- to use wideband FDM circuits as part of a telephony group;
- use existing digital Single Carrier Per Channel (SCPC) circuits and combine them in the same fashion as the first option;
- to use a new digital system involving high bit-rate circuits which could provide the high quality signal-to-noise ratio and bandwidth that was necessary.

A survey of these techniques was undertaken and it was shown that the highest quality could be achieved by using the last option. The Digital Communications Corporation (DCC) of America,

Above: BBC short wave transmitting aerials at Singapore. Below: Intelsat uplink site at Madley, England (photo: British Telecom)



MOLINARE CHOSE AMEK...

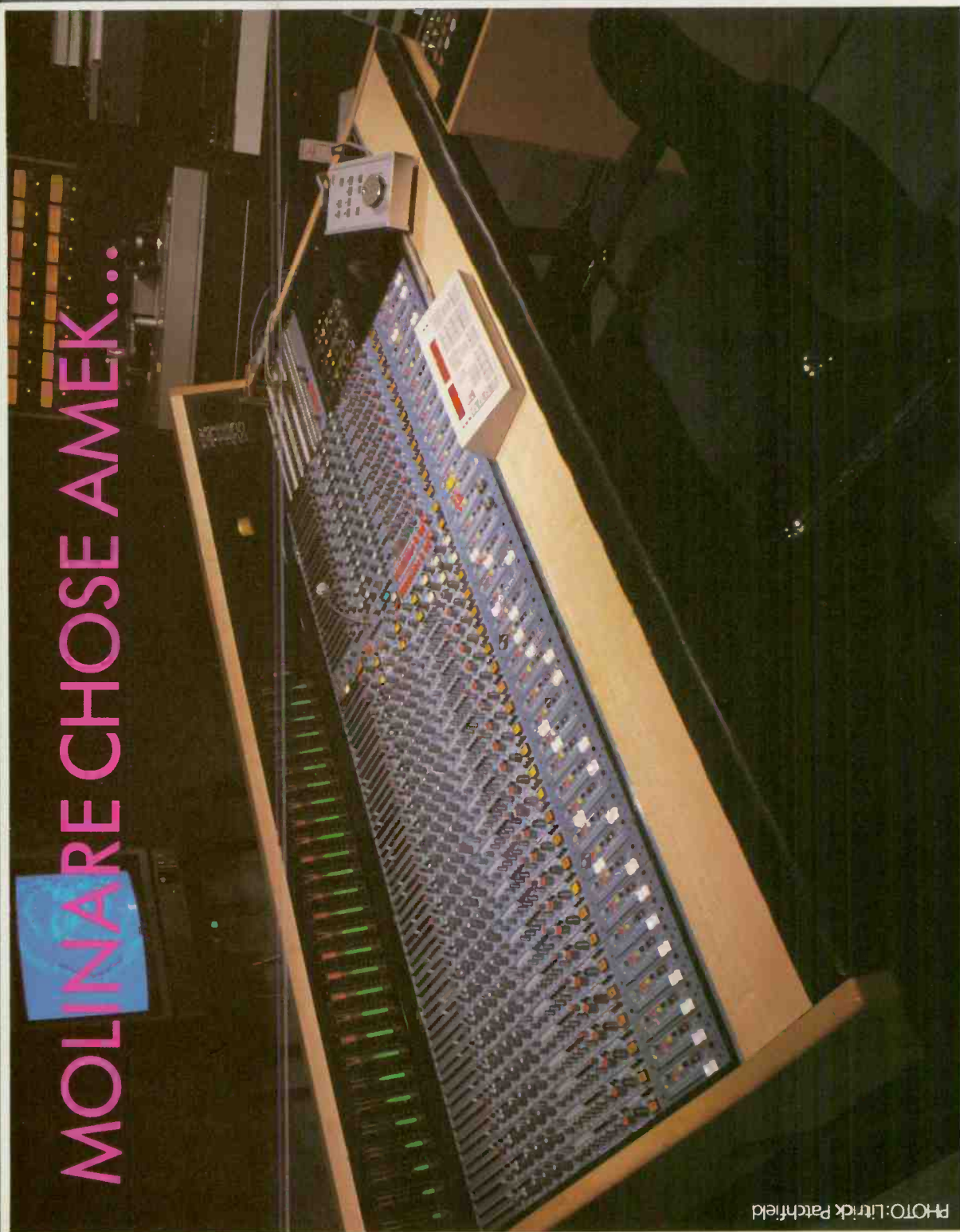


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 - Tonstudio Stroher, Innsbruck
 - Axent Recorders, Sydney
 - Universal Recorders, Johannesburg
 - Discos de Centro America, Guatemala City
 - Central Recorders, Sydney
 - Cream Studio, Frankfurt
 - Castle Sound Studios, Edinburgh
 - Post South, L.A.
 - Genesis, Guildford
 - Studio Ramses, Paris
 - Music Works, London
 - N'Koussu Productions, Gabon
 - Clan Strumenti Musicale, Milan
 - The Garden Studios, London
 - EFX Studios, Burbank, L.A.
 - Gooseberry Studio, London
 - Omega Productions, Dallas, Texas
 - Roxon Records, Stuttgart
 - Revolution Studios, Manchester
 - Melodija, Moscow, (2 consoles)
 - Molinare, London
 - Studio d'Aguesseau, Paris
 - Forum Studio, Rome
 - Tienjin Radio, P.R. China
 - Xian Film Plant, P.R. China
 - Feedback Studios, Aarhus, Denmark
 - West End Studios, Munich
 - Studio 150, Amsterdam
 - Peperoncino Studio, Milan
 - Blackwing Studios, London
 - Vince Clarke's Splendid Studios, London
 - Livingston Studios, London
 - Paramount Pictures, Hollywood
 - Tritania Studio, Rome (2 consoles)
 - Wanshoushi Concert Hall, Beijing, P.R. China
 - Studio Davout, Paris
 - Sri Siam Production Co., Bangkok
 - Guangxi Radio, P.R. China
 - Fonglin Productions, Singapore
 - P T Remacko Productions, Djakarta
 - Tonstudio Heinz, Vienna
 - TV Asahi, Tokyo
 - Sunrise Studio, Tokyo
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 - EDI Video, Milan

SATELLITE COMMUNICATIONS

which already manufactured standard SCPC telephony equipment, was developing a high bit-rate SCPC system at this time and they were approached to see if this development could also meet BBC requirements. At the same time Intelsat gave permission for a special high bit-rate SCPC channel to use parts of the spectrum previously allocated for standard telephony channels within its satellite over the Indian Ocean.

The system devised by DCC and approved by Intelsat was finally chosen by the BBC. The analogue audio signals are coded into digits using 11 bit samples at a rate of 14.2 kHz. The 11 bit samples are then companded down into 9 bits and

a 128 kbit/s quadrature phase-shift keyed carrier is produced at the 70 MHz IF ready for up-converting to the satellite. This coding and subsequent decoding process produces a low noise circuit with an audio bandwidth from 50 Hz to 6.4 kHz. Each circuit on the satellite is adjusted to operate at a received carrier-to-noise ratio of 16 dB which gives a bit error rate of better than 1 in 10^6 . The system will function satisfactorily down to a bit error rate of 1 in 10^4 at which point the 'clicks' caused by multiple errors become objectionable as there is no built in error concealment.

The centre frequency allocated for the 128 kbit/s channels within the satellite transponder is

positioned halfway between the two 64 kbit/s channel allocations which it replaces. Thus for a unidirectional broadcasting distribution system the use of two adjacent channels falls nicely within the normal communications bandwidth for 2-way channels, having been allocated two telephony channels which would have normally provided the go and return of the 4-wire telephony circuit. This is shown diagrammatically in Fig 1.

By 1982 negotiations with British Telecom finally produced agreement whereby they would install up-link equipment at Madley to feed the satellite in the Indian Ocean. This Intelsat is the primary satellite positioned in a geostationary orbit 36,000 km above the earth's surface at a

FIG 1 Spectrum of a satellite transponder carrying 800 channels of SCPC telephony with 2 BBC channels inserted.

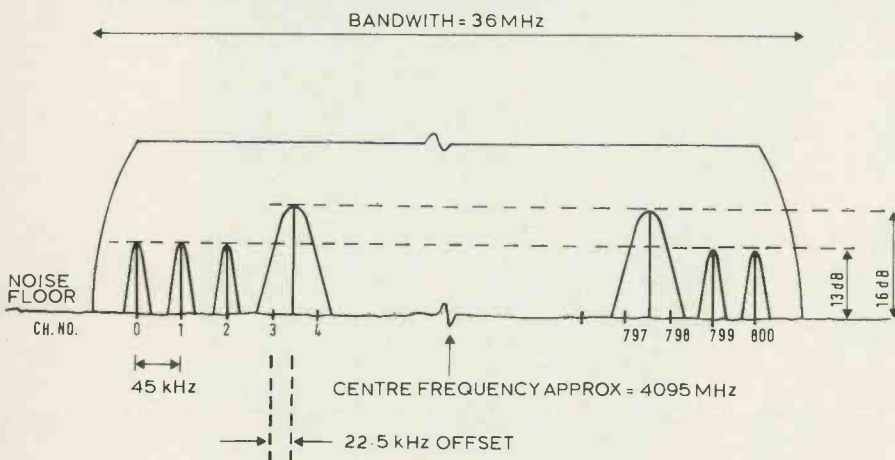
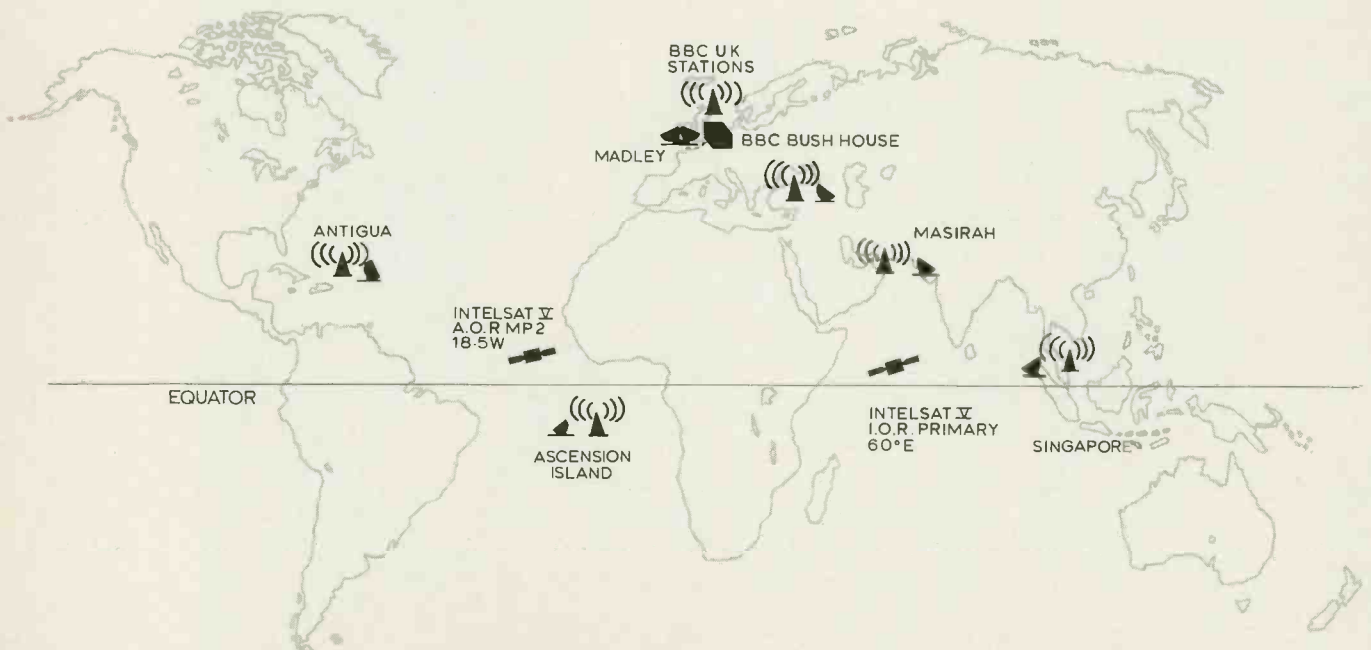


TABLE 1

Typical performance of satellite distribution system, studio output to transmission input	
Line-up error	±0.5 dB
Frequency response	
50 Hz	-1.0 dB
100 Hz	-1.0 dB
250 Hz	-0.5 dB
400 Hz	-0.5 dB
800 Hz	0
1 kHz	-0.6 dB
2 kHz	+0.5 dB
3 kHz	-1.3 dB
4 kHz	-1.7 dB
5 kHz	-1.7 dB
6 kHz	-2.0 dB
6.5 kHz	-5.0 dB
Distortion	
1 kHz zero level	1.2 %
1 kHz +8 dBm0	0.8 %
100 Hz zero level	1.0 %
100 Hz +8 dBm0	1.3 %
Noise WRT zero level	-44 dB
Weighted noise WRT zero level	-46 dB
Maximum signal level	+9 dBm0

FIG 2 BBC EXTERNAL SERVICES DISTRIBUTION NETWORK



longitude of 63° east. The requirement was for three overseas earth stations at Cyprus, Masirah and Singapore to be fed by a transponder on 4095 MHz on board the primary satellite.

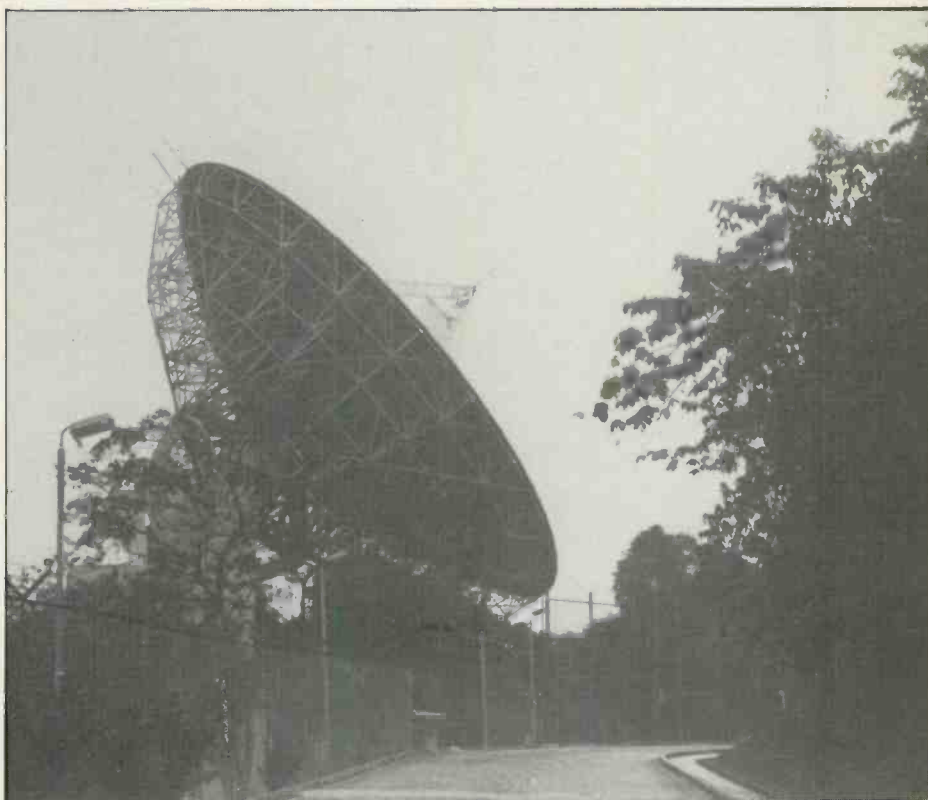
Negotiations with the Cyprus Telecommunications Authority (CYTA) which was to provide the feed to the British East Mediterranean Relay Stations at Zyyi revealed that they had no receive facilities for this satellite at their earth station at Makarios. CYTA proposed to open the route from Cyprus to Australia using the Indian Ocean region primary satellite, and the BBC channels provided the additional circuits necessary to make the new earth station economically viable. Following agreement with the BBC, CYTA installed a type B earth station within nine months, and in October 1982 the first trial of the 128 kbit/s circuits from the satellite took place exactly 50 years later than the first distribution of the World Service from Daventry in 1932.

The performance of the circuits came up to expectations and a quality similar to that leaving the studio was achieved at the input of the relay transmitters in Zyyi. This had a dramatic effect on the radiated quality, particularly for the MF transmitters serving the Middle East. This was immediately noticed by listeners and good reports were received. The actual performance of the circuits from London is shown in Table 1 which is typical of the performance which can be achieved at any point within the Indian Ocean region coverage.

Six circuits radiated from the satellite are required in order to provide all the necessary programmes and languages to the earth stations feeding the transmitters within the Indian Ocean region. It was proposed that each earth station should take a combination of the necessary channels required to provide the services to adjacent countries. In the case of Cyprus, the station at Zyyi was required to have five simultaneous programmes of a different character and thus took five of the six channels which were transmitted to the satellite. Another station on Masirah Island in Oman was to take four of the six channels from the satellite to provide its services.

The station on Masirah Island is remote from all normal communications facilities and the only economic solution to the problem of providing the feeds from the satellite was to install a receive-only earth station exclusively for the use of the transmitting station. The Omani authorities agreed to this proposal by the BBC and the Foreign and Commonwealth Office (FCO) who were responsible for the running of the station. The Communications Engineering Department of the FCO commissioned the installation of a 10 m earth station on the site in Masirah soon after the opening of the service to Cyprus in October 1982 and by January 1983 four circuits were in operation to feed the transmitters on Masirah. A similar circuit performance to that in Cyprus was obtained.

The third relay station at Kranji on the island of Singapore required four circuits to provide the programmes for the transmitters to feed East Asia. Telecoms Singapore could provide these circuits from their existing earth station on the island of Sentosa. The special 128 kbit/s equipment which was used by the BBC could be integrated with their existing equipment already being used to receive telephony from the Indian



Downlink aerial at Singapore Telecoms earth station, Sentosa

Ocean satellite. However, wideband music circuits did not exist between the earth station and the transmitting station. These had to be provided on digital circuits using a combination of cable and microwave links on two diverse routes across the island of Singapore. By June 1983 Telecoms Singapore had installed the terrestrial circuits and the satellite service started soon after.

The satellite circuits to Singapore had the most dramatic improvement in signal quality as Kranji was the furthest relay station from Great Britain and the existing feeds which used short wave multi-hop transmissions from either Cyprus or Masirah were prone to fading and interference.

Two further stations are due to be fed by the Indian Ocean satellite, the first being Hong Kong in 1987 and the second the Seychelles. These stations will be built on new sites which have previously not been used for short wave relay purposes and it is proposed to build small earth stations on the relay station site exclusively to feed the transmitters.

In the Atlantic Ocean there are two more large short wave relay stations maintained by the BBC on the islands of Antigua and Ascension. As these are outside the service area of the Indian Ocean satellite it will be necessary to use a new satellite over the Atlantic Ocean. It is proposed to use a transponder on the Major Path 2 satellite in the Atlantic Ocean. A similar 128 kbit/s single carrier per channel system will be employed using four circuits to feed the transmitters on Antigua and Ascension. It is hoped that these circuits will come into operation in December 1984 and the system will be fully digital from Bush House to the transmitters. The BBC designed *Nicam* digital coding system will be used to feed the circuits from Bush House to the British Telecom earth

station at Madley where they will be re-coded into the DCC 128 kbit/s system for transmission to the satellite. The complete worldwide network is shown in Fig 2.

On Antigua, permission has been obtained from the Government to operate a receive-only earth station similar to that used for Oman. This will be situated at the site of the Caribbean Relay Company in the centre of the island of Antigua. The Caribbean Relay Company also relays transmissions from Deutsche Welle and it is proposed that circuits from Germany will also be received via the Major Path 2 satellite to feed the transmitters on Antigua.

On Ascension Island a new earth station is to be built adjacent to the BBC transmitters at English Bay. This was the most effective solution as the terrain would make it impossible to provide wideband circuits directly from the existing earth station without a repeater being built in the volcanic mountains.

From its inception, the project to feed the five existing overseas transmitters will have taken five years to complete with the main installation programme being spread over three years from 1982 to the beginning of 1985. The cost of the provision of each of the circuits, when taken over a ten year period, is comparable to the electricity costs of operating a modern high power short wave transmitter to provide the equivalent feed. The operational convenience and savings in pre-recorded tapes makes the satellite distribution system very cost-effective besides giving improved quality and audibility to the millions of listeners around the world. □

Acknowledgement: I would like to thank all my colleagues in the BBC for their help with the project and the Director of Engineering for his permission to publish this article.

WSM, NASHVILLE

Terry Nelson

"We Shield Millions"—so said the insurance company owners of one of the oldest and most well known radio stations in the United States, WSM. In fact, the call letters could equally well read **"We Serve Millions"** as the night-time broadcasts reach over 38 states—about 80 per cent of the US population—as well as southern Canada.

Known for its heavy involvement in country music, and especially for the *Grand Ole Opry* show, WSM is no stranger to innovation. WSM was one of the first stations to go AM stereo, at the end of 1982. You couldn't hear it, of course, but the commitment had been made.

Another first for WSM Inc was the launch of its latest venture, TNN—The Nashville Network—which has seven million households on cable. A five hour live edition of *Nashville Now* linked up

six cities—Nashville, New York, Chicago, Los Angeles, Denver, Austin—for the largest live TV show in cable history. Performers in all six cities were involved, with the majority of the artists being in Nashville at the Opry House. The event was developed by TNN and Group W Satellite Communications.

For many people at WSM, the TNN launch date of March 7, 1983 would be one to remember together with the November 28, 1925 launch of the Grand Ole Opry. (Originally called the *WSM Barn Dance*, the *Opry* show came into being in 1927.)

Today WSM has a host of organisations under its corporate wing, these being WSM AM/FM, WSM-TV, Opryland (a sort of country Disneyland), The Grand Ole Opry, Opryland Hotel, Opryland Productions and now, TNN. Yes, folks, country music pays—and all that surrounds it—and that in turn means that there is an audience who want to hear—and see—it. WSM is only too happy to oblige.

The WSM studios are situated virtually in the

country (no pun intended) on the outskirts of Nashville next to the Opryland complex and new Opry House. (The original Ryman Auditorium is now a tourist attraction in Nashville.) The studio building is in an attractive colonial style and blends gracefully into the rural surroundings. A large nameplate by the entrance door proclaims to the world at large 'WSM Radio' and it was here that I presented myself at the ungodly hour of 9 o'clock in the morning last November in order to look over the studios and meet the people who run them.

Unfortunately I was unable to meet chief engineer Charlie Burch (though we did manage a few words over the telephone) as he was away on the day of my visit. However, engineer Tony Dickson proved a very helpful guide in showing me around and explaining the running of the station.

The building is all ground floor, so there are no stairs to climb and the rooms have a bright and airy feel that befits a house more than a radio station.

The first studio to be visited was that of WSM Radio 650 where Harold Hensley was presenting his morning show of music interspersed with news and traffic reports.

The studio is basically for one-man operation, with a second announcer's table backing onto the console for news and bulletins. The equipment consists of an ADM *ST160* console with input channels for two tape machines, a cassette recorder, six NAB cartridge machines and four microphones. There is also a phone-in input. Routing facilities consist of two audition buses, two programme buses and one mono bus. Record and tape playing equipment includes two Technics turntables, two Revox *PR99* recorders, a Revox cassette recorder (which they are very pleased with) and International Tapetronics NAB cartridge machines. All fairly straightforward and no-frills.

About the only concession to external processing that I noticed was a Moseley Associates *TQR-340* Audio Gain Rider.

Monitoring is by two Eastern Acoustics speakers, though the majority of listening is done with an odd-grot speaker that "effectively simulates the average domestic radio"! Because of this, headphones are only used occasionally and thus they avoid ears becoming like 'lamb cutlets'! (Listen in to Hancock's *The Radio Ham*).

As mentioned earlier on, the studio is used for music programmes and news broadcasts and I was present during one of the bulletins where an informal style was bounced between the two presenters.

Shure *SM5-B* microphones are used which give a "natural warm sound to the voice that is good for radio use". Harold Hensley should know a thing or two about microphones for presentation use as he is also one of the announcers for the *Grand Ole Opry* show. The *Opry* itself is mixed in the Opry House on a Neve *48/16* console and sent down lines into the WSM 650 control room for transmission.

Apart from being the world's most famous country music show, the *Grand Ole Opry* (every Friday and Saturday night) is the longest running live broadcast in the history of radio, which, in itself, represents no small achievement and it is still a mark of recognition for an artist to be invited to play on it.



Above: WSM Radio building.

Below: Harold Hensley plus newscaster in AM studio.



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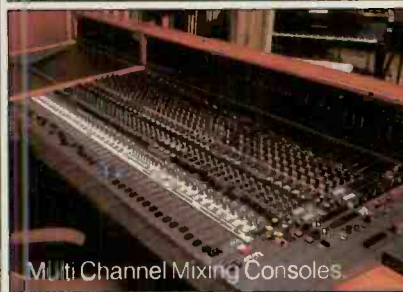
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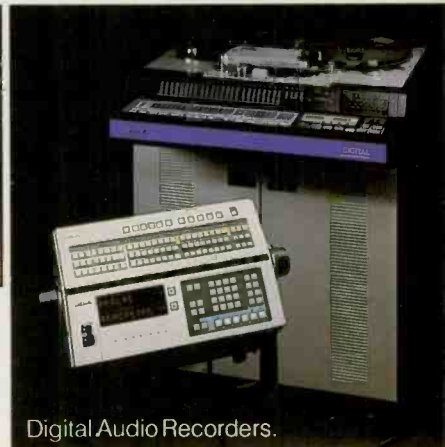
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COUNTRY MUSIC RADIO

However, Radio 650 is not just the *Opry*. Live broadcasts would appear to be something of a station trademark. *The Waking Crew* goes back to 1951 and is broadcast from 7.45-9.00 am every weekday. The show is a mixture of music, news and humour—most of it totally unrehearsed—and features the only live studio band left in the States. As well as the resident band, guest country artists are also featured. Starting out as a public broadcast, ie in front of an audience, the programme then moved around various studios where space precluded audience participation. However, the wheel has turned full circle with *The Waking Crew* now being broadcast live from the Stagedoor Lounge at the Opryland Hotel.

Present host is Tony Lyons who comes from WSM-AM late night shows, among other things. The change from late night to early morning was quite brutal and took a bit of settling in. "Rehearsal would kill this type of show," says Lyons, adding that judgment and timing are crucial factors for a live radio programme of this type where anything can happen and you have to go with it in the best possible way. "We know we're taking chances but it has been the key to our success and popularity." For many listeners over a certain age, the *Opry* and *Crew* programmes are a reminder of the heady early days of radio where live studio bands were the norm and not the exception. More and more younger listeners are tuning in too, as they discover the joys of broadcasting that is not straight out of a can.

News and general information play an important part on Radio 650, with local bulletins and national news via hourly feeds from NBC. A staff of 10 people under news director Paul Dickerson comprise Tennessee's largest radio news team. In-depth features, as well as fast, as-it-happens reports, are all part of the day's work. A weekday 65 minute programme *All That's News* summarises the day's events at the end of the afternoon together with weather, sports and stock market reports.

Weather and sports are, of course, covered during the day and WSM even has a reporter in the person of local police sergeant Richard Thomas who deals with airborne traffic reports around the early morning and late afternoon rush hours in order to get you home faster. ("The reporter even other stations listen to", it says here.)

Daytime coverage of WSM Radio 650 is 70 counties in three states. WSM is rated as a 50 kW 'clear channel station', which means that no other station can operate on 650 during peak night time hours and thus cause interference. As has been noted earlier, WSM reaches 38 states at night as well as southern Canada.

Radio competition in Nashville is fierce with 26 stations competing for the airwaves. There has been a notable increase in the FM stations and you never know when a new one is going to pop up. The WSM people agree: "that's a lot of stations—but it keeps us on our toes!"

The conversation came round to the recent conversion to AM stereo. On December 6, 1982, WSM chairman E W Wendell turned the switch that made AM 650 stereo—although nobody could receive it. WSM obviously feels that there is a future in AM stereo and wants to be a part of it.

WSM chose the Harris system and at inauguration were the tenth station to do so, joining others such as KFI in Los Angeles,



Harold Hensley in AM studio.

WNOE in New Orleans, WQXI in Atlanta and CKLW in Windsor, Ontario. Director of strategic planning for Harris, Roger Burns, notes with satisfaction that "5,000 watt and 50,000 watt stations are leading the way in adoption of AM stereo" and was even more pleased to say that Harris had 120 or more orders from stations throughout the US.

WSM general manager Tom Cassetty had this to say about the upgrade. "We're trying to show listeners that AM stereo is not a gimmick and is as good, if not better, than FM. Another advantage is that the signal carries farther. A 100 kW FM station has a 65 mile range whereas a 50 kW AM station goes to around 200 miles. If you start on a trip you won't have to worry about the radio fading in and out." (Especially if it's your favourite radio serial.)

By now both Motorola and Delco should have AM stereo receivers available and while I was at WSM I had a listen to a Sony radio that had just come out. The WSM staff felt that the main reason AM had a poor quality reputation was that manufacturers have concentrated on FM to the detriment of AM and that to succeed "AM will have to be at least equal to FM." However, if the Sony radio with a bandwidth of up to 13 kHz is anything to go by, the chances appear very good. The AM v FM war is on and record companies are among the main fans—after all, who makes mono records any more? Talking about the different systems available, Cassetty felt that as soon as enough stations choose a particular system, AM stereo will be as commonplace as FM stereo. "It's coming", he says, "one (system) is going to survive."

Be that as it may, Grand Ole Opry's Roy Acuff observed that though radio had come a long way since his joining in 1939, the best thing was "to come see us in person."

WSM Radio 650 also goes nationwide to 100 affiliate stations via satellite with the Music Country Radio Network from 10 pm-7 am CST, thus covering all time zones. Primary host is Charlie Douglas, who also carries one of the largest collections of DJ awards in his vest pocket. The format of the show is recorded music and live



Distribution and monitoring racks.

interviews with guests from the world of country music—both invited and uninvited. "We never know exactly which artist might just drop by to talk... or maybe even pick awhile." The live variety show format is in keeping with the WSM policy of live broadcasting as opposed to all recorded programming.

"The New Country. You bet your life! And it's on Nashville 95 FM, the first commercial FM station in the little ol' USA." The New Country slogan comes from a recent decision to make the station 'all-country', there being enough rock and MOR stations in the area. The new format has been heavily market researched and thrives on listener input. Interruptions are limited to news and the only airborne traffic reports on FM—otherwise it's music all the way and back to back country hits, both past and present. "Our decision to change the format of WSM-FM followed a hard study of the station's previous performance," said Tom Cassetty. "The market



WSM FM studio with Gary Bailey.



WSM FM cartridge storage rack.

has an abundance of rock and adult contemporary stations. We've picked one thing to do better than anyone else—popular country. Country music delivers the demographics most advertisers want, and is WSM's driving force."

The FM studio is just down the corridor from Radio 650 and features an identical ADM console. This makes for versatile operation as the two studios can be run easily without worrying about differences in the console. Other equipment includes two B67 recorders, Technics turntables with SME arms and Shure cartridges, ITC cartridge machines and Shure SM5/Sennheiser MD421 microphones. The studio is equipped with remotes for the transmitter and monitoring for AM/FM stereo. As with Radio 650, Eastern Acoustics monitor speakers are installed, as is daylight.

About the only operational differences between the AM and FM studios is the recording medium.

95 FM plays about 99% of music from carts, whereas 650 AM uses more albums.

Adjoining the 95 FM studio is a small back-up studio for the Music Country Network. This features an ADM 160 desk with 12 inputs, two B67 recorders, a PR99 with monitor module, two turntables and three ITC cartridge machines. Signal processing confines itself to two Urei LA-4 limiters, and monitoring is done on JBL 4313B speakers.

The only way to get a studio tan at WSM is to work in the production studio on jingles, tape editing, etc. This is in the centre of the building and the only room without daylight. Equipment consists of an A80 and two B67s with an Audiotronic console. The studio is also capable of functioning as a back-up if need be, thus giving WSM two full on-air studios and two back-up studios.

The corridor outside the back-up studio houses

the distribution racks and overall monitoring facilities, thus giving easy access to anyone who needs to patch in something or check up on transmission status. Overall system gain for both AM and FM is controlled by Moseley Gain Riders.

Two Audioarts parametric equalisers can be patched in as needs dictate. Commercial tuners are used for checking programme with a Sansui for FM (and a Pioneer for second choice) and a Dymek for AM. However, the choice for AM stereo was not final and Motorola seemed a likely candidate. Logging recorders are Magnasync, with a Revox PR99 and cassette recorder available as required. ADM audio distribution is used. Marti transceiving equipment is used for the link with the Opry House, with AP being used for the satellite uplink/downlink. WSM has two dishes out in the garden at the back of the building, one of which is devoted to NBC, with a Scientific Atlanta 7300 receiver coupled to a 7325 digital processor.

Timing is always a matter of importance and WSM uses a Leitch master clock system — including one more as back-up.

This brought me to the end of my visit though I did just go and have a quick look at the newsroom with its quite impressive collection of telexes, typescripters and telephones. It's easy to see why WSM have a reputation for news coverage.

Tony Dickson had been very helpful as a guide and everyone at WSM had shown a warm welcome. However, it was time to be moving on and besides, Tony's slow Tennessee drawl was becoming infectious. (Y'all come back and see us now!) So, my thanks to everybody for an interesting visit and I hope to see them again.

In closing, mention ought to be made of the WSM Radio 650 tower located at the transmitter building in Brentwood, south of Nashville. One of four built by the Blaw Knox company of Pittsburgh, the antenna is unusual in that it is supported by only eight guy wires at the centre bulge of the two tapered tower sections.

The tower was built in 1932, its design a result of calculations that a vertical antenna slightly taller than one half of the station's wavelength would concentrate the energy along the ground instead of radiating most of it upward into space (such as with the 'long wire' antennae). The limited number of guy wires owed itself to the vertical radiation theory as well, it being thought the fewer the better.

The tower was originally 878 feet high (WSM wavelength being 462 m) and the tallest in America. However, it is now at 808 feet, the other 70 being removed in 1942 for technical reasons.

The only other tower of the four built that remains is that of WLW in Cincinnati. WSM chief engineer Charlie Burch is doubtful that these towers' design will ever be duplicated. "The WLW and WSM towers are the only diamond shaped towers in existence, and the building at the transmitter site was even designed to fit in with the countryside of Williamson County."

Today AM 650 sends microwave signals from the studio to a six foot dish on the transmitter building roof, where they go into the 50 kW transmitter and out to the tower.

As well as making landmarks in radio history, WSM reminds Nashville of their presence with a landmark of its own — and that ol' country music just keeps rolling along. □

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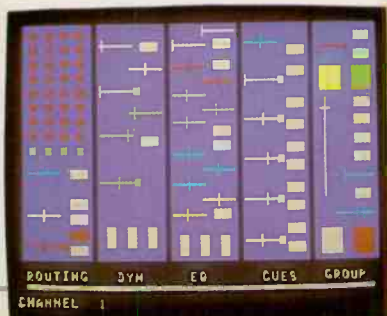
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ANDREW (USA)

Andrew Corporation, 10500 West 153rd Street, Orland Park, IL 60462. Tel: (312) 349-3300.
UK: Andrew Antennas, Lochgelly, Fife KY5 9HG. Tel: 0592 780561. Telex: 72491.
UK: Megasat Ltd, 8 Poland Street, London W1V 3DG. Tel: 01-439 9234. Telex: 8813271.

ANIXTER-MARK (USA)

Anixter-Mark, 2180 South Wolf Road, Des Plaines, IL 60018. Tel: (312) 677-2600.

ANTENNAS FOR COMMUNICATIONS (USA)

Antennas for Communications Inc, 486 Cypress Road, Ocala, FL 32672. Tel: (904) 687-4121.

ANTENNA DEVELOPMENT (USA)

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ANTENNA TECHNOLOGY (USA)

Antenna Technology Corporation, 895 Central Florida Parkway, Orlando, FL 32809. Tel: (305) 851-1112.

ARVIN/DIAMOND (USA)

Arvin/Diamond, 4465 Coonpath Road, Carroll, OH 43112. Tel: (614) 756-9222.

AUTOMATION TECHNIQUES (USA)

Automation Techniques Inc, 1846 North 106 East Avenue, Tulsa, OK 74116. Tel: (918) 836-2584.

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BBC (UK)

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BLONDER-TONGUE (USA)

Blonder-Tongue Laboratories Inc, One Jake Brown Road, Old Bridge, NJ 08857. Tel: (201) 679 4000. Telex: 9980695.

BRITISH AEROSPACE (UK)

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California Microwave Inc, 990 Almanor Avenue, Sunnyvale, CA 94086. Tel: (408) 732-4000.

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Calstar Satellite Communications, 4552 Auburn Boulevard, Sacramento, CA 95841. Tel: (916) 482-8255.

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Hamilton Satellite Systems Inc, 1101 East Chestnut Street, Santa Ana, CA 92701. Tel: (714) 543-5217.

HARRIS (USA)

Harris Corporation, Satellite Division, PO Box 1700, Melbourne, FL 32901. Tel: (305) 724-3000. Telex: 567488.
Harris Corporation, Box 4290, Quincy, IL 62301. Tel: (217) 222-8200. Telex: 404347.
UK: Harris Corporation, 153 Farnham Road, Slough SL1 4XD. Tel: (0753) 34666. Telex: 848174.

HUGHES (USA)

Hughes Microwave Communication Products, Box 2999, Torrance, CA 90509. Tel: (213) 517-6141.

IBA (UK)

Independent Broadcasting Authority, Engineering Centre, Crawley Court, Winchester, Hants SO21 2QA. Tel: (0962) 822444.

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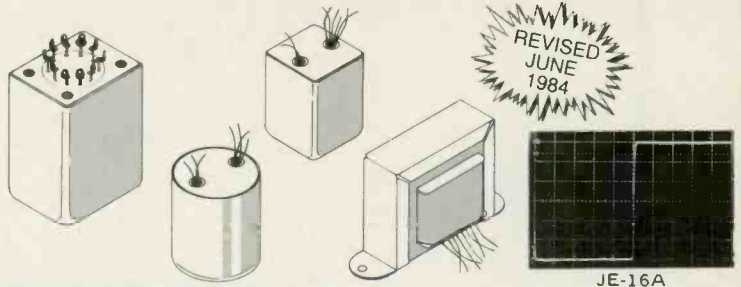
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INPUT TRANSFORMERS AND SPECIAL TYPES

JE-16A
2 kHz Square Wave

Model	Application	Impedance Ratio Pri-Sec	Turns Ratio Pri-Sec	20Hz Max Input Level ¹	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Band-Width ² -3 dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot (%)	Noise Figure (dB)	Magnetic Shield ⁴ (dB)	Number of Faraday Shields	PRICES		
													Package ⁵	1-19	100-249

MICROPHONE INPUT

† JE-16-A	Mic in for 990 opamp	150-600	1:2	+8	0.036/0.003	-0.08 / -0.05	200	-8	<1	1.7	-30	1	A=1	64.21	42.89	29.60
JE-16-B													B=2	68.86	45.99	31.74
† JE-13K7-A	Mic in for 990 or I.C.	150-3750	1:5	+8	0.036/0.003	-0.09 / -0.21	85	-19	<2	2.3	-30	1	A=1	64.21	42.89	29.60
JE-13K7-B													B=2	68.86	45.99	31.74
JE-115K-E	Mic in for I.C. opamp	150-15K	1:10	-6	0.170/0.010	-0.50 / +0.10	115	-5	<7	1.5	-30	1	3	42.03	28.07	21.92

LINE INPUT

JE-11P-9	Line in	15K-15K	1:1	+26	0.025/0.003	-0.03 / -0.30	52	-28	<3		-30	1	1	103.47	69.13	47.69
JE-11P-1	Line in	15K-15K	1:1	+17	0.045/0.003	-0.03 / -0.25	85	-23	<1		-30	1	3	40.05	26.76	20.90
† JE-6110K-B	Line in bridging	36K-2200 (10K-600)	4:1	+24	0.005/0.002	-0.02 / -0.09	125	-12	<1		-30	1	B=1	62.86	42.01	30.83
JE-6110K-BB													BB=2	71.52	47.79	32.97
* JE-10KB-C	Line in bridging	30K-1800 (10K-600)	4:1	+19	0.033/0.003	-0.11 / -0.08	160	-9	<2		-30	1	3	41.56	27.76	19.16
JE-11SSP-8M	Line in / repeat coil	600/150-600/150	1:1 split	+22	0.035/0.003	-0.03 / -0.00	120	-9	<3.5		-30	1	4	151.90	101.47	70.01
JE-11SSP-6M	Line in / repeat coil	600/150-600/150	1:1 split	+17	0.035/0.003	-0.25 / -0.00	160	-5	<3		-30	1	5	79.22	52.91	36.51

SPECIAL TYPES

† JE-MB-C	2-way ³ mic split	150-150	1:1	+1	0.050/0.003	-0.16 / -0.13	100	-12	<1		-30	2	3	34.60	23.13	18.06
† JE-MB-D	3-way ³ mic split	150-150-150	1:1:1	+2	0.044/0.003	-0.14 / -0.16	100	-12	<1		-30	3	3	60.09	40.15	31.35
JE-MB-E	4-way ³ mic split	150-150-150-150	1:1:1:1	+10	0.050/0.002	-0.10 / -1.00	40	-18	<1		-30	4	1	96.90	64.73	44.66
JE-DB-E	Direct box for guitar	20K-150	12:1	+19	0.096/0.005	-0.20 / -0.20	80	-18	<1		-30	2	6	43.57	29.11	22.73

- (dBu) Max input level = 1% THD; dBu = dBv ref. 0.775 V
- With recommended secondary termination
- Specifications shown are for max. number of secondaries terminated in 1000 ohm (typical mic preamp)
- Separate lead supplied for case and for each faraday shield
- Except as noted, above transformers are cased in 80% nickel mu-metal cans with wire leads.

PACKAGE DIMENSIONS:

W	L	H
1 = 1 1/16" Diam.		1 1/16"
2 = 1 1/16" x 1 3/16"		1 5/8"
3 = 1 1/8" Diam.		1 1/16"
4 = 1 1/2" x 1 3/4"		2 1/2" w/ solder terminals
5 = 1 5/8" Diam.		1 3/4"
6 = 1 1/8" Diam.		1 5/16"

NICKEL CORE OUTPUT TRANSFORMERS⁶

Model	Construction	Nominal Impedance Ratio Pri-Sec	Turns Ratio Pri-Sec	20 Hz Max Output Level ⁷ (dBu)	20 Hz Max Output across (n) windings	600 Ω Load Loss (dB)	DC Resistance per Winding	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Band-Width -3 dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot ⁸ (%)	PRICES			
													Package ⁹	1-19	100-249	1000
* JE-123-BMCF	Quadfilair 80% nickel	600-600 150-600	1:1 1:2	+28	2	-1.1	20 Ω	0.002/0.002	-0.02 / -0.02	>450 160	-2.1 -4.1	<1	7	87.41	44.17	30.47
* JE-123-DMCF	Quadfilair 80% nickel	600-600 150-600	1:1 1:2	+21	2	-1.0	19 Ω	0.004/0.002	-0.02 / -0.00	>450 230	-1.2 -2.5	<1	8	50.71	33.88	23.38
JE-123-BLCF	Quadfilair	600-600 150-600	1:1 1:2	+32	2	-1.1	20 Ω	0.041/0.003	-0.02 / -0.01	>450 170	-1.9 -4.0	<1	7	61.30	35.79	24.70
* JE-123-DLCF	Quadfilair	600-600 150-600	1:1 1:2	+27	2	-1.0	19 Ω	0.065/0.003	-0.02 / -0.01	>450 245	-1.2 -2.5	<1	8	39.61	26.45	19.42
JE-123-SLCF	Quadfilair	600-600 150-600	1:1 1:2	+23.5	2	-1.1	20 Ω	0.088/0.003	-0.03 / -0.01	>450 245	-1.2 -2.8	<1	9	33.48	22.35	15.43
JE-112-LCF	Quadfilair	600-600 150-600	1:1 1:2	+20.4	2	-1.6	29 Ω	0.114/0.003	-0.03 / -0.01	>450 205	-1.2 -3.2	<1	10	25.48	17.01	12.49
JE-123-ALCF	Quadfilair	66.7-600	1:3	+26.5	3	-1.3	8 Ω	0.125/0.003	-0.04 / +0.06	190	-4.6	<6	8	42.14	28.15	19.42
JE-11S-LCF	Bifilar w/ split pri.	600-600 150-600	1:1 1:2	+30	1 (sec)	-1.7	63 Ω	0.058/0.002	-0.02 / +0.01 -0.02 / -0.05	>10MHz 155	+1.1 -4.1	<1	8	42.14	28.15	19.42

- Multifilar construction has no faraday shield: cannot be used as input transformer. All specifications are for 0 Ω source, 600 Ω load.
- Max output level = 1% THD; dBu = dBv ref. 0.775 V
- Source amplifier -3 dB @ 100 kHz
- Output transformers are horizontal channel frame type with wire leads, vertical channel frames available.

PACKAGE DIMENSIONS:

W	L	H	Mounting Centers
7 = 1 1/2"	2 5/16"	1 15/16"	2 3/16"
8 = 1 5/16"	1 15/16"	1 5/8"	2 3/8"
9 = 1 1/8"	1 11/16"	1 3/8"	2"
10 = 1 1/16"	1 1/16"	1 3/16"	1 3/4"

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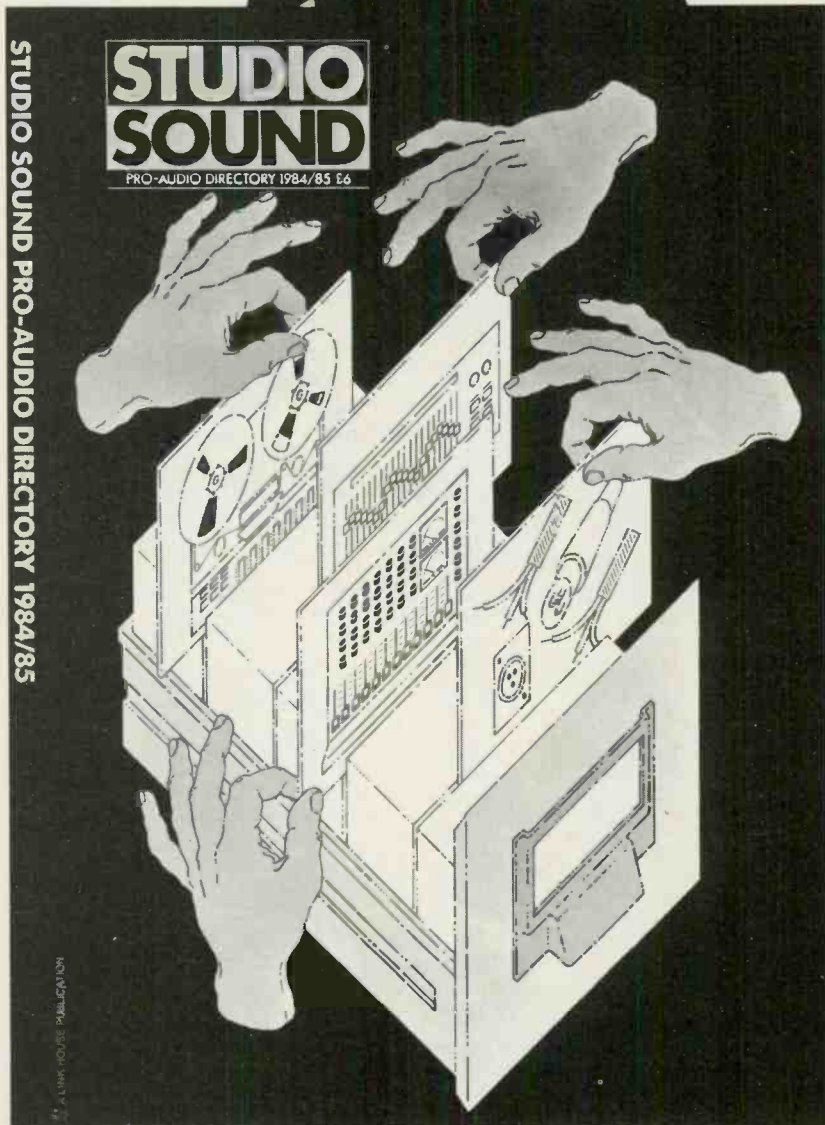
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MICHAEL BARTLETT

DRAMA WRITER AND PRODUCER

Felicity Stephen

There are very few full time, professional people in Independent Local Radio who specialise in radio drama on a regular basis. Michael Bartlett is one of this rare breed and was discovered to be alive, well and flourishing in the Countysound countryside around Guildford where he is known as the head of drama & documentaries. Michael is a freelance writer, director and painter of 'sound pictures' with a wealth of varied and interesting experience which he shared with us before escaping to the Radio Festival in Manchester.

Why does ILR do so little drama? The lack of appropriately experienced people in ILR is one reason: at the moment, those people form a minority of three. And there are other considerations. Radio drama need not be expensive in general programming terms but set rates for Equity members and accepted rates for writers add up to make it comparatively more expensive than a three hour show of DJ, music and local personality interview. Another problem is lack of facilities. Countysound has a small production studio which is used a lot for commercial production and it is therefore not often available for two consecutive days to do a play. The studio has really only one acoustic which means it is not ideal for drama although the acoustic can be varied slightly electronically. The fact is that drama studio facilities are very specialist. And drama doesn't fit too neatly into standard ILR programming. There is an expectation of short items and plenty of music for the audience who listen while they're doing something else, whether driving or pottering around the house. On the whole, it is seldom that people will settle down with an ILR station to listen intently for an hour. They might, late in the evening or on a Sunday night, but the expectation during the day is little short sharp snippets rather than 90 minutes of Shakespeare.

At Countysound, Michael Bartlett is experimentally setting up a series of 15 minute plays. Although a final decision has not yet been made, there is a possibility that these plays will be run in *The Late Show*. That is a genre which Michael is very familiar with from his *Just Before Midnight* days at the BBC. A BBC apprenticeship started some years earlier in a tape library but his imagination leapt in another direction.

"I had always fancied the idea of writing and even making some money from it, as many people do. In my teens I wrote a number of what I now judge to be extremely bad short stories — none of which were ever touched, quite rightly! I keep them and look at them from time to time just as a salutary lesson. My first manuscript to earn any money was a short piece sold to the BBC's *English by Radio* in 1970. It was used for a series of four

minute short stories they were running at the time. In return I received a cheque for £8.70 and was awfully proud. About then I joined one of the social sections of the BBC Club, the Studio Amateur Dramatic Group (SADG) who were busy making radio plays and enjoying the use of the BBC drama studio facilities. This was an extremely pleasant way of passing your evening when you spent your days as a clerk in the tape library. And it offered the opportunity to learn a bit about studio management and production. Most important of all — I began to write plays for them because up until then I had only written short stories. I must have written about seven



Michael Bartlett: 'These days the only way into (BBC) radio drama is to do a spell in Script Unit—a practice I thoroughly approve of.'

plays for SADG members to produce — they were all bad as well! But it showed me that, whereas my prose was a bit turgid and the plots were pretty grim, I had a knack for dialogue. In 1971 the president of SADG, Raymond Raikes (one of the senior drama producers) instituted a new award for scriptwriting. Original plays of anything between 15 and 45 minutes in length were invited to be submitted anonymously. I think there were eight entries that year and I came first and second which was rather nice!

"This was definitely a large step forward and was a tremendous boost to my confidence. The following year I came nowhere but the year after

that, whilst writing a play for the same award, everything suddenly 'clicked' into place and flowed easily for the first time ever. The play didn't win. It was far too long but it was highly commended so I submitted it to Radio 4 and they bought it. The title was *Happy Deathday To You* and it was broadcast at around the end of 1972 in what was then the *Midweek Theatre* slot. Incidentally, although I'd written it as 75 minutes I cut it back to 45 minutes for transmission and that was one of my first lessons in creative cutting.

"During this time I had become a Studio Manager in the BBC's External Services where I remained for 10 years but during the last five years there I did a number of production attachments. I worked in a variety of departments including Children's Drama as a director, Schools' Radio as a producer and Television Script Unit as a reader. I was attached to Radio Drama initially as a reader, then as a producer and finally won a permanent job there as a script assistant/producer at the end of 1977. These days the only way into radio drama is to do a spell in the Script Unit — a practice I thoroughly approve of. Within a short space of time the then editor of *Afternoon Theatre* went off on attachment and I was asked to stand in for him for three months. When it came to applying for a job in Radio Drama Department I have no doubt that my writing was an important factor which helped get me in there but I'm pretty sure that the knowledge I had of popular writing helped as well. I bypassed academic life, 'Oxbridge', and every other university. I admit to having barely any knowledge of 17th century German literature — preferring to do battle with Nevil Shute. Yet, I still managed to discern how to run *Afternoon Theatre* when I later became editor."

At that time the BBC was just launching a new late night drama series, *Just Before Midnight*. It was a series of 15-minute plays and an 'extra' editor was needed to handle the work. Michael was appointed and stayed for the two years of *Just Before Midnight's* life. Soon after that there was a general re-allocation of duties and a shuffling of jobs; it was an awkward time because the BBC was deliberating over redundancies and Drama Department had to find its share of those. In the end, the majority went through natural wastage but it was a time of uncertainty and Michael was determined he was not going back to being reader again.

"I wondered if I might be one of those victims. In the end I wasn't: I became the full-time editor of *Afternoon Theatre* which I did for about two years until my resignation at the end of 1982.

"The reason for resigning is complex really. I was extremely happy in Drama Department — I loved editing *Afternoon Theatre* and producing radio plays. The only thing I was a little sad about was the fact that I wrote virtually no radio plays at that time apart from some work for Schools' Radio and a play for Children's television. However fair the system is in assessing your work on its own merits, it never looks that way to the outside world. And having spent all day slaving over scripts I was reluctant to come home and spend five hours over a typewriter. But on the whole it was a job I loved. I just didn't quite see where I went from there. A sideways move perhaps — editing *Saturday Night Theatre* or *The Monday Play* instead — or become a full-time director? Upward moves were limited and almost

certainly would have taken me into administration or out of the department altogether. All of this was at the back of my mind when David Lucas, who is now managing director of Countysound, popped up."

David Lucas was a contemporary studio manager on the World Service. He had left to join Capital Radio as a music producer when commercial radio first began and he moved from there to become programme controller at Swansea Sound before becoming chief executive at Cardiff Broadcasting. David and Michael had worked together on one or two projects during those years.

"When David Lucas was programme controller at Swansea Sound he approached me one day for some help with a project he wanted to launch. It was a sort of drama documentary concerning a Welsh religious revival which had taken place at the turn of the century and had begun at a place just outside Swansea called Loughor. A man called Evan Roberts, a very sincere, believing Christian who felt filled with desire to travel through Wales and tell of the Saviour, began preaching in his home town of Loughor. He preached with such emotion that he began a complete revival which spread from the churches in which he preached to others all over the country. It spread through South Wales, right through the coalfields and you'd get 800 people crammed into a small Welsh chapel with services running for eight or nine hours. Pubs were closing, football matches were being cancelled, swearing in the mines noticeably decreased and even the crime rate fell. It really was the most incredibly powerful movement which spread into parts of England — mainly the Liverpool area.

"The revival began in 1905 and after it had been going for about nine months, Evan Roberts suddenly quit. He was in his mid-20s when this happened and he didn't die until 1951, but he never preached again. Those who remember him and supported him talk about '... the word of God moving in Wales... services so alive, so live with God that it made you feel that he was there amongst people'. His detractors described him as an hysterical man who was running a con trick but I do not believe that Evan Roberts was a con man; I believe he was perfectly sincere. Hysteria seems to be bred by these occasions and I don't think he set out to cause it. He certainly didn't make a bomb of money out of it and he may eventually have just burnt himself out."

Swansea Sound wanted to make a documentary all about it. Their religious producer Philip Stephens had done a lot of research but had no experience of writing a radio documentary and David Lucas asked if Michael would write it for them.

"I thought it sounded interesting. Philip Stephens had found about half a dozen people who actually remembered Roberts and interviewed them, so I had all of that material to work from. But I could not get it right—it was becoming a plod—it was boringly factual and twice I hurled my papers across the living room! And then I suddenly hit on the idea of using not one but two narrators: a third person narrator describing what Evan Roberts did and a first person narrator who portrayed the man himself. I dramatised a number of the services from documented reports of them and then I hit on the second bright idea of actually trying to recreate

those revival services. When it came to it, David Lucas asked me if I would go to Swansea to direct this show. By now I was thoroughly caught up in the magic of this and wanted to direct it—so I took five days holiday from the BBC, adopted the pseudonym of Michael Jones and went and did it!

"We found an old Welsh Chapel with a genuine organ, in a nice quiet spot. On the morning of our day on location we had a Welsh choir in and recorded half a dozen hymns in binaural stereo. They were so beautiful sung in Welsh—absolutely magic. That afternoon we had 300 folk brought in from all over Wales to form the congregation and join the choir. I planted the actors around the congregation with Welsh speaking Sion Probert in the pulpit portraying Evan Roberts and we recreated revivalist services, all in binaural."

If you listen to that recording on headphones—you are actually there: you're getting "hallelujahs" from behind, an impromptu hymn starting up beside you and Roberts' voice crescendoing out from the pulpit. All the sounds blend to create a real, atmospheric power to move you. This strength of feeling also came through in mono.

"I scripted *A Nation in His Hand* very carefully. As well as the third person narration of Philip Madoc and the first person of Roberts' voice, I introduced a mono voiceover which was Roberts' thoughts taken from his diaries and other documents. These 'thoughts' were recorded separately which meant that one had to leave atmospheric gaps for the thoughts to drop in and these gaps had to be calculated very precisely. So there was the whole of the Welsh congregation, the choir and choirmaster, Sion Probert out front, people all around—and me in me plimsolls and smock with a stop-watch, dancing up and down the chapel trying to orchestrate the whole thing! A lot of things happened impromptu—you can't

Philip Madoc narrates the story of the religious revival in the Swansea Sound studio for 'A Nation in His Hand'



script it all—and at one stage I needed a few bars of impromptu praying. I was introduced to a Minister who was deeply suspicious of the whole project but after persuading him that we were not making a mockery of Evan Roberts, he became extremely enthusiastic and helpful. He willingly provided us with precisely 23 seconds of impromptu praying—he timed his 'Amen' perfectly—should have been in Equity!

"The whole occasion was tremendous and at the end of the afternoon, I wanted to go round and thank people for being so marvellous. Instead, they were coming up to me and saying, 'This has been wonderful! The Spirit of God has moved here this afternoon!' Whether it was the Spirit of God or not, there was certainly a magic in that place that afternoon and I will never forget it."

The show, which received rave reviews when it was transmitted, was completed in five days. Day one was spent recording the 'thoughts'; day two, the location scenes; day three with Philip Madoc in the studio; day four dedicated to mixing, and on the final day the mixing was completed and *A Nation in His Hand* was edited.

"*A Nation in His Hand* had offered me the chance to both write and direct a tremendous project in a new environment. One of the nice things about working in ILR is that one is not constricted by having to stop for lunch and coffee and having to knock off at 6 o'clock. The job was there to be done and we were able to go on until it was finished, and that would not have been possible at the BBC because of such things as union agreements. I enjoyed working in that environment though at the time I never dreamed of coming out of the BBC and going to work for ILR. It was only when David Lucas came to Guildford, having been appointed managing director of the new ILR station there, that I had

to consider breaking with the security of the BBC—where I had been, man and boy for 17 years! Although part of me rebelled against the BBC's security, there are very few people I would have wanted to go and work with instead. I've got a great respect for David and when he proposed a partnership where we would set up the new station together (an offer which nobody had made before) I thought it was an interesting challenge and fancied having a go at it.

"I went to Countysound at Christmas 1982 and the station itself went on the air in April 1983. I effectively ran the programming department for the whole of 1983. Everyone involved with Countysound felt that commercial radio in Guildford could not be just 'pop and prattle'—it simply wouldn't work. There had to be elements of Radio 4 as well as of Radio 2—and my job was to introduce those elements and develop them."

Amongst Countysound's varied programming of music, plays, short stories, poetry, occasional documentary—and much more—are a number of popular (Radio 4 type) shows which Michael was instrumental in putting into the schedules.

"We have a weekly programme called *My Favourite Things* which is a sort of cross between *Desert Island Discs* and *With Great Pleasure*. Somebody who is usually well known, or they may be a local person who has a particularly interesting job, talks about their life and their favourite music, poetry or book. We have another weekly show called *Village Voice* where we go and visit neighbouring places like Compton and talk with some of the inhabitants who each choose a record; and *Workplace* which is similar but visits a factory or shop instead of a village. All those programmes are a regular part of our output and that sort of programming is unusual for ILR because they are mostly pre-recorded. Pre-recorded programmes are rare because it's much easier to bring a guest into a live show and chat to them than to try to find the time to pre-record them. As well as shortage of time, there is a shortage of facilities and, of course, people. On an ILR station, unlike a BBC station, you've got no operators, no secretarial back-up. You've got just the presenter with a show which may be a mixture of short speech items, interviews, music; and this all has to be set up single-handedly. Guests have to be organised, the show has to be driven and the paperwork tackled afterwards; so the presenter's job is a really demanding one. There is a permanent staff at Countysound of 34 and that is comparable with a small BBC local radio station. The BBC station might actually have about 25 people but our staff includes a whole sales department. The big difference between BBC and ILR stations is that we are on the air 18 hours a day—entirely form our own engendered material. We are dependent on ourselves for that whole period of time whereas a third of the BBC's airtime might be simultaneous broadcast of Radio 2.

"Although we have no operators as such at Countysound we do have an engineering department consisting of a chief engineer and one other. If it is necessary to have an operator for drama—a situation where it is difficult to concentrate on technical things and direct at the same time—then one of the engineers will come and do it for you. On some stations you will find there is a great rift between engineering and all the other departments. We are very fortunate at

Countysound because when we were conducting interviews for a chief engineer we were looking for someone who was not only extremely competent technically but also would share our philosophy of programming. We found a man called Richard Lawley who is superb! He and I have just done a programme together about the Wey and Arun Canal as part of a series of monthly documentary programmes, which I have been running since March. I think that intermix between departments on a small radio station is very desirable. When I became a producer at the BBC I was no longer allowed to drive a desk but now I've jolly well got to and it is a great pleasure. I'm not pro-ILR and anti-BBC or indeed the other way round; because I've enjoyed aspects of both of them, and aspects of both of them are at times frustrating."

At the end of 1983 Michael resigned from the staff of Countysound to become freelance and now works under contract for the station with the title Head of Drama & Documentaries.

"For that first year, and while the station was finding its feet, David Lucas was the programme controller and managing director of Countysound. My title was programme organiser but the principle was that I would do much of the work of controller and eventually take on the post. This made sense because I was totally new to ILR and David wasn't. Towards the end of 1983 I began to realise that I didn't want the post of programme controller; I still think it is the most

awful job imaginable! I was working 14 or 15 hours a day and having sleepless nights over such things as where I would find a receptionist to man the desk next Sunday morning. By the time I'd got through all the administrative work and answered the correspondence and organised the rotas, there simply wasn't time to do all those things it was originally intended I should do—such as be involved with programme-making. So I thought I must resign. I had a long chat with David and in the end he offered me a new deal which means that now my brief is to produce specific programmes and a couple of series, which really suits me down to the ground and allows me to become involved with other projects."

A project which Michael has been involved in recently—in his freelance hat—is the radio version of Somerville and Ross's stories, *The Experiences of an Irish RM*.

"I was hired by an independent company called Amplicity Limited, which is run by Aidan Day who used to be programme controller at Capital, to direct *The Irish RM* for the ILR network. We did it with four of the main lead characters from the television series: Peter Bowles playing the RM, Anna Manahan playing Mrs Cadogan, Doran Godwin playing Philippa Yeates and Bryan Murray playing Flurry Knox. The copyright for the stories is no longer with the Somerville and Ross Estate—it is now held by the television company who made the TV series for Channel 4. So we had to negotiate the copyright with them and the agreement was that we were allowed to use any of the stories they had already done, or were preparing to do. Barry Campbell went back to the original stories and dramatised them for radio with the result that we have got superb scripts. The television version scored because you can see all those wonderful expressions on Peter Bowles' and Anna Manahan's faces, and you get the beautiful shots of the Irish countryside but the radio series scores in another way. We used Peter Bowles as the first person narrator and those narrative passages are the prose direct from Somerville and Ross's stories. And it's that prose that contains the main humour. There are some lovely phrases such as: 'Flurry Knox is a stable boy amongst gentlemen and a gentleman amongst stable boys!' and, 'I wasn't so much drunk your Lord as having drink taken.' The latter is a phrase I now use regularly!

"Recording it was murder! You see—for the first time in my life I was faced with a major drama project: six technically complicated plays—without the facilities of the BBC behind me. We had to go acoustic hunting and the biggest problem was creating a good 'dead' acoustic for all the outside scenes. We were able to do these scenes, in the end, at the National Broadcasting School in Greek Street. There is a big studio there which can be used for either sound or video and it's got some nice acoustic treatment. We hired the Duke of York's Theatre from Capital and ran microphone cables all over the building so that we could do courtroom scenes on the stage, others in the stalls' bar(!) and a lot of scenes in Capital's very nice technical area up in the roof of the theatre. And we had a day or two actually in Capital Radio itself—in studio 4. I took the whole six plays and broke it down like a film so that all the courtroom scenes were done at one time, all the outdoor scenes at another—all shot wildly out of sequence. It was all layed down on



'I didn't want the post of programme controller; I still think it is the most awful job imaginable!'

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PROFILE

16-track, then finally mixed at the Duke of York's and at a commercial studio centre called Silk Sound in Soho—which has excellent facilities. FX had to be garnered and they were added later, along with the music by Nick Biçat (as heard in the television version).

"It was an interesting way of working though it took far longer than doing it all in one go, as in a BBC studio. I think the results are good because if you are doing all your FX, music and speech at the same time, inevitably—and I don't mean this as a severe criticism—somewhere along the line you have to make a compromise since you can't always get everything at its peak. With this production I was blessed with the joy of being able to concentrate on the performances and get those just right."

The results certainly are good and Michael hopes that this independent project which is being sold to the ILR network will start this Autumn. Six 50-minute plays were made but they are each broken down into ten minute segments. So a station like Countysound, when it carries play number one—*Great Uncle McCarthy*—will carry the first ten minute episode on Monday, the second on Tuesday, the third on Wednesday and by Friday you've heard the entire play. The station then has the option of the complete 50 minutes as an omnibus at the weekends.

"Now traditionally, none of the small ILR stations have any money because they have never succeeded in attracting large-scale national advertising. So, if you offer them programmes to buy, they are not likely to take the proposal very seriously! Aidan Day of Amplicity Ltd, who produced these plays, has tackled this problem by going to the two organisations who handle national advertising for ILR: Midland Sales in Birmingham and Independent Radio Sales in London. At the same time, Aidan has approached all the stations and sent them a sample cassette. Out of 43 stations, I think at least 27 have agreed to carry *The Irish RM* and the idea is that they are all going to start running it on the same day within the same two or three hour time block.

"Midland Sales and Independent Radio Sales are selling air-time around this format. The attraction is, firstly, that *The Irish RM* is a known product riding on the back of a highly successful television series; so the advertisers have a clear idea of what the programme is. And, equally importantly, they know that this programme will go out within a set time, on a given day. If you go to a company and say, 'Why not take out a national advertising campaign? We can offer you 43 ILR stations at peak time' they will reply, 'Yes, but what's the programme?' Normally the answer to that would be that all stations are putting out completely different programmes with completely different kinds of presenters—which means the advertisers just don't know what they are buying.

"The alternative arrangement with *The Irish RM* means that the stations are being given quality programming (free), the advertisers do know what they're buying, the production company can possibly make a modest profit, and ILR stands a chance of making some money as well. I feel that this kind of shared programming is essential if ILR is going to survive."

Michael continues to be involved with his first love—writing—and two of his radio plays are going out on the BBC later this year: an *Afternoon*



For 'A Nation in His Hand' the atmosphere was recreated in a Welsh chapel with actors and the local community

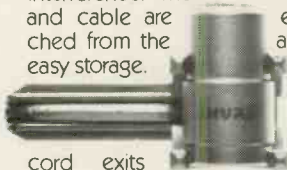
Theatre in September called *A Touch of the Mondays* and a *Saturday Night Theatre* called *I'd Give My Right Arm to be Ambidexterous!* As a parting shot, Michael put forward his persuasive argument for the preservation of drama on radio.

"You know the old gag about the child who said she preferred radio plays because the scenery's better? Apocryphal that story might be, but there are nuggets of truth in it. Radio drama is such an imaginative medium to write for and as a writer and director I think of it as providing the black and white pictures for the listener to put the colour in. There are virtually no limits to what you can do in a radio play. You can touch the emotions so easily with just a snatch of music, just a little piece of poetry or just a couple of well balanced sentences which are capable of moving the listener from the middle of Africa to the Far West of America. And there can be free movement between the thought of a character and what is actually said aloud. Giles Cooper's play *Under the Loofah Tree* which takes place entirely

within the framework of a man having a bath, is a wonderful illustration. The man in the bath is reflecting upon his past—about things which actually happened and others that never did. All the time you can hear muffled voices from the 'real' everyday world—his wife, insurance salesman, milkman wanting money, little son wanting potty—outside the bathroom door. But for this length of time they are not reality because, while he sits and reflects, the real world is him, his dreams and his fantasies. Radio is such a wonderful medium in which to do a play like that.

"I like to write things that are entertaining and make people laugh instead of writing 'message' plays. I believe if you want to make a point—make it through humour! And I think one of the greatest mistakes people make when writing for radio is thinking of it as a realistic medium. It's a stylistic medium and its biggest power is suggestion rather than statement. The eye defines an image, the ear suggests one and this is the great strength of radio for me." □

The SM83 has been specifically designed to provide superior quality sound reproduction in professional broadcasting, film, and related sound reinforcement applications. It features a wide range frequency response, specially tailored to provide more natural sound. This response is achieved by an electronically created dip at 730 Hz to overcome the chest resonance phenomenon, and by an acoustically generated high-frequency boost above 3 kHz resulting in a cleaner, more pleasing sound than other lavalier mics. In addition, a 12 dB per octave rolloff below 100 Hz helps reduce room noise and other undesirable low-frequency signals. The Shure-developed amplifier supplied with the SM83 is compact, lightweight and can easily clip onto a belt or fit into a pocket. It is powered by a standard, readily available nine-volt battery or by simplex power from an external source or virtually any microphone power supply providing 5 to 52 Vdc simplex voltage. And, the amplifier has extensive RF and hum shielding to reduce the effects of electromagnetic and electrostatic interference. The microphone and cable are easily detached from the amplifier for easy storage.



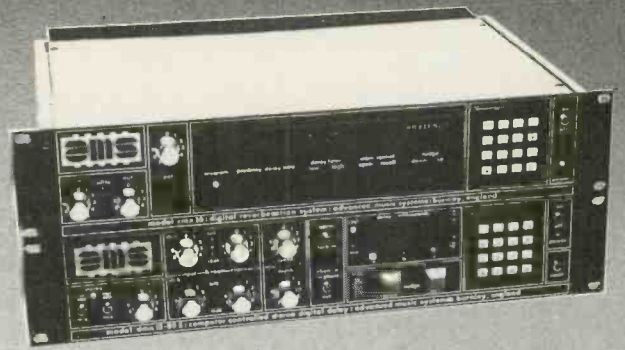
To minimize cable visibility, the SM83's cord exits from the side and can be easily hidden behind a tie, blouse or shirt. This unique design feature combined with the microphone's innovative mounting hardware, small size and non-reflective black finish provide for an inconspicuous on-camera appearance. The SM83 is supplied with a versatile system of hardware that permits a wide variety of unobtrusive mounting techniques. Three mounting means are provided: a single-mount tie bar; a dual-mount tie bar (for mounting two microphones simultaneously); and two multi-purpose mounting blocks which may be connected to a lanyard, or sewn, pinned or taped onto clothing. Also supplied is an acoustic windscreen for outdoor use. The SM83 is extremely rugged and offers outstanding reliability. In addition, it is field-serviceable. The cartridge assembly is accessible by simply unscrewing the microphone cap. Cable replacement requires only a screwdriver, no soldering is necessary.

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48V PHANTOM SUPPLY FOR ENG MIXERS

David Strange

There are many mini-mixers on the market that are very useful for a variety of tasks, but which do not offer 48 V phantom power for capacitor microphones. The unit described here solves the problem.

Although it is not the policy of *Broadcast Sound* to provide 'home constructor' articles on anything like a regular basis, we felt this gadget was a useful enough idea to make an exception. This device provides 48 V phantom power from a single PP3 type 9 V battery.

Microphone amplifiers are well documented and off-the-shelf designs for making up into practical units for ad hoc studio use abound. However, because of the difficulties in providing 48 V for phantom powering, most people stick to applying either self-powered or dynamic microphones to their in-house constructed amplifiers.

In portable equipment 48 V can of course be provided by 48 V worth of batteries, but these would tend to be bulky and expensive or awkward to replace. A solution to this is to step up to 48 V from a lower voltage from a single battery. While not expected to be 100% efficient, a converter can

be small and relatively cheap. It was therefore decided when undertaking a recent design for a small portable mixer using phantom power, to use a type of step-up converter for the 48 V.

The first task was to see if there were any published designs, since people have obviously done this sort of thing before. However, unlike the microphone amplifiers, no designs for converters could be found and it was therefore a case of starting from scratch. The constraints on the design were that it should work and be stable over a wide voltage range centered on 9 V, deliver 48 V at 2.5 mA and of course be as efficient as possible. (It was decided that phantom powering in the mixer should be from a single PP3 battery dedicated to the job.)

The circuit arrived at is basically a fly-back converter running at approximately 24 kHz where Q4 is turned hard on and off by a multivibrator made up from Q1 and Q3. When Q4 is turned off, the energy from L1 is transferred via D1 to C5 giving a step up in voltage at an efficiency of about 75%. ZD1 and ZD2 limit the peak collector voltage on Q4 and somewhat stabilise the output voltage. R8 protects Q4 against excessive current if faults occur in the microphone leads.

Originally the circuit did not include Q2 and its associated components (R2, R3 and R9), but without them it was found that the best efficiency could not be guaranteed over the required input

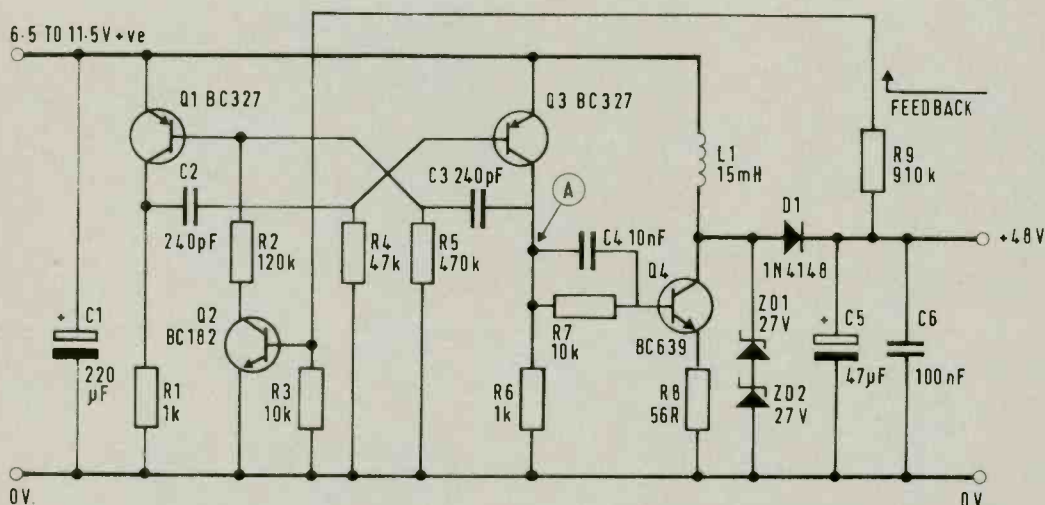
voltage range. A voltage regulator was discounted on the grounds that it would cause additional current drain, also reducing the efficiency. Finally Q2 was included so that the 'on' time of Q4 could be varied to a certain extent, depending upon the voltage existing on C5, which in turn is dependent upon the supply voltage.

The voltage on C5 is divided by resistor combination R9 and R3, and then applied to the base of Q2 which is turned on to a lesser or greater extent. Q2 and its collector resistor are therefore proportionately paralleled with R5, changing the 'on' time of Q3 (the base drive source to Q4) between 30 and 50 μ s. The input current and output voltage are substantially constant for input voltages in the range 6.5 to 11.5 V.

In the original prototype L1 was 250 turns of 0.2 mm enamelled copper wire in an RM7 ferrite core (available from RS components) but a more elegant solution was found in a ready-wound inductor (available from Ambit International Stock No. 34-15301) which worked with equal efficiency and was just 7 mm diameter \times 10 mm long. All components for the supply were fitted into a small PCB for ease of installation into the mixer. \square

A kit of parts for the converter is available from Dyer Audio Systems, 13 Molesworth, Hoddesdon, Herts EN11 9PT, UK for £6.35 + 50p postage (cash with order).

FIG. 1



48V PHANTOM POWER SUPPLY

TABLE 1
Parts list

R1,6	1 k
R2	120 k
R3,7	10 k
R4	47 k
R5	470 k
R8	56 R
R9	910 k

C1	220 μ F 16 V
C2,3	240 pF polystyrene
C4	10 nF
C5	47 μ F 63 V
C6	100 nF

L1	15 mH
----	-------

Q1,3	BC327
Q2	BC182
Q4	BC639
D1	1N4148 or 1N914
ZD1,2	27 V Zener diode

(all resistors 1/4 watt)

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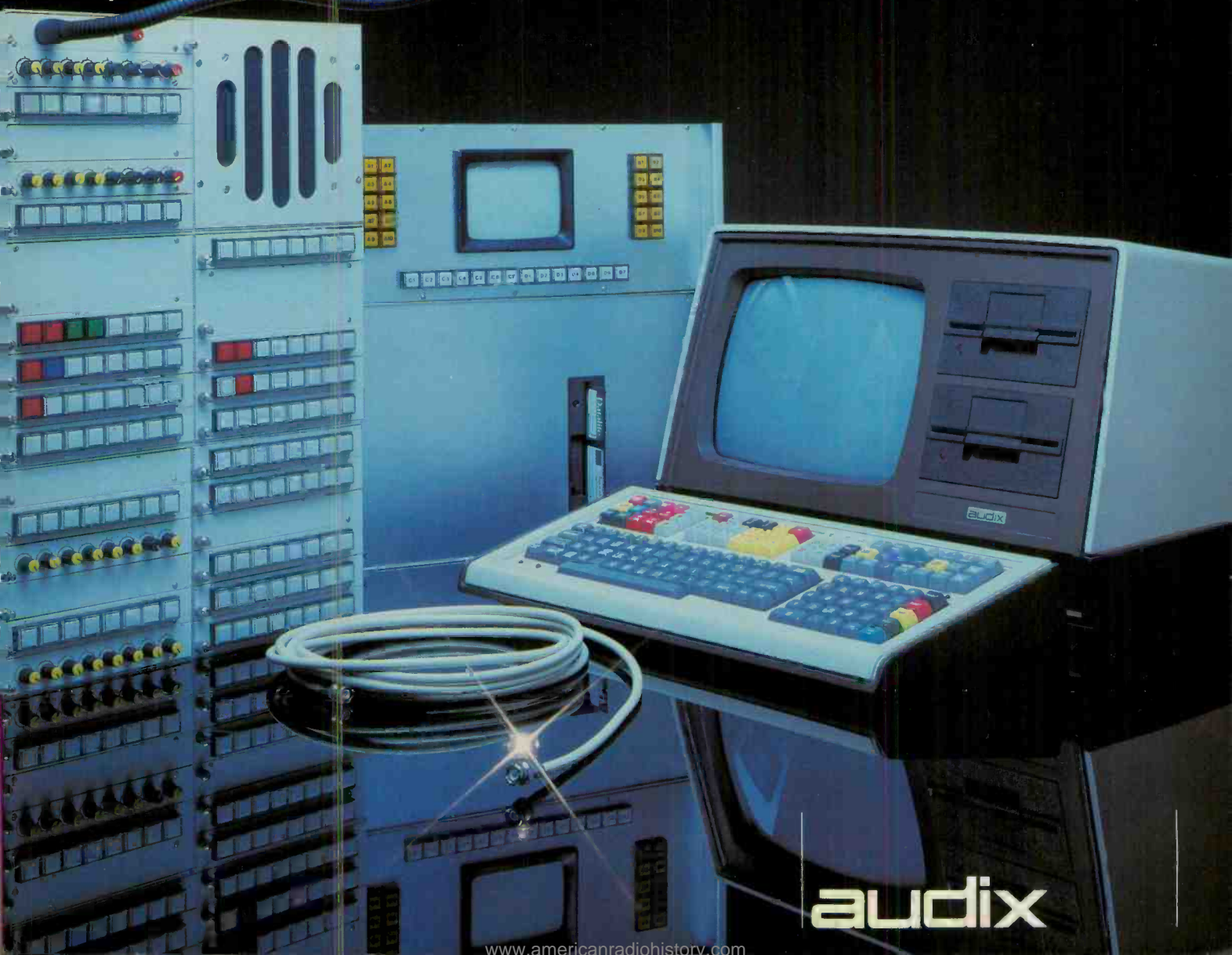
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NPR-THE SATELLITE CONNECTION

John Lumsden

Following on from Paul D. Lehrman's examination of National Public Radio in the USA (November/December 1982), John Lumsden now takes a closer look at how affiliates and the national organisation work together.

Radio in the USA has been described as the 'jukebox of the airwaves'. There are stations catering for most musical tastes—classical, MOR, big band, rock, mellow rock, contemporary rock, country and talk radio—the list is endless. All the stations are striving to deliver the largest possible audience to the advertising agency. Generally the format is about 15 minutes of music with few interruptions, then commercials or news headlines, then more music.

Unfortunately, in the battle for advertising revenue, technical quality has suffered and most stations, in an effort to win their audience, have entered the 'loudness war'. Overall, slow acting gain controls, vicious peak limiters and tri-band compressors are used to squeeze the already often small dynamic range. It should, however, be borne in mind that the American radio audience is almost exclusively a 'car radio' audience with its attendant high background noise level. Under these circumstances, compressing the dynamic range is somewhat more justifiable.

The discriminating listener who wants classical music, jazz or in-depth news, usually listens to National Public Radio (NPR). Dedicated to providing high quality broadcasting with

minimum interference with the dynamic range, NPR largely achieves this.

The NPR network basically operates in three parts: the programme origination centre in Washington DC, the satellite distribution/contribution network, and the member station.

The NPR network presently comprises 281 member stations as far apart as Hawaii, Puerto Rico and Alaska. These member stations are independent, autonomous broadcasting stations whose broadcasting format is tailored to fill the needs of the community each serves. The member station has the choice of taking programming and programmes off the satellite. However, almost all stations take NPR's award-winning *Morning Edition* and *All Things Considered*. These programmes are world leaders in broadcast journalism. Other offerings off satellite, in addition to the general output from Washington, include programmes in Spanish and for the 'print handicapped'.

NPR receives financial support from The Corporation for Public Broadcasting, membership dues, grants from individuals, foundations, corporations and other federal agencies. NPR is non-profit making and non-commercial.

The listening audience to NPR is growing and shows a 100% increase over the last six years. Presently more than 8.5 million Americans listen to NPR each week.

The Washington operation

The heart of the NPR network is in Washington DC and in anyone's terms the technical facilities can only be described as superb. The large

number of studios are similarly equipped with, in the main, Ward Beck mixers, Technics *SP-10 Mk 2* turntables, Broadcast Electronics cartridge machines, and MCI/Sony tape recorders.

Each studio suite comprises a control room, studio and in some cases a booth for news, etc. The microphone used throughout the complex is the Neumann *U87* which probably accounts for the warm, pleasing sound from studio productions. The control rooms are each equipped with a rack of audio processing equipment including dbx *160* comp/limiters, Urei filters, Orban graphic equalisers and de-essers.

Operationally, technical operators and producers are used with little, if any, 'self-drive'. This mode of operation is reflected in the high standard of production and engineering of the programming and in this respect NPR could be called 'the BBC of America'.

The engineering department of NPR is highly competent and has come up with a number of innovative ideas; for example, all the microphone amplifiers are located externally to the consoles and have active balanced inputs and outputs with DC gain control. NPR was totally responsible for the design and production of these devices.

Satellite distribution/contribution

In the late '70s NPR moved into the satellite era with what has grown to be possibly the most comprehensive radio distribution/contribution network in the world. Western Union's *Westar 1* and *Westar 4* have been employed for this network. Presently, transponder number 2 on *Westar 4* is used exclusively by NPR. This provides member stations with 12 audio channels each with 15 kHz bandwidth. Additionally, three other high quality channels exist on the transponder, one of which is currently used for the Muzak service. There are, of course, a large number of narrow bandwidth channels used for data control and audio. The latter are used for sport and voice items.

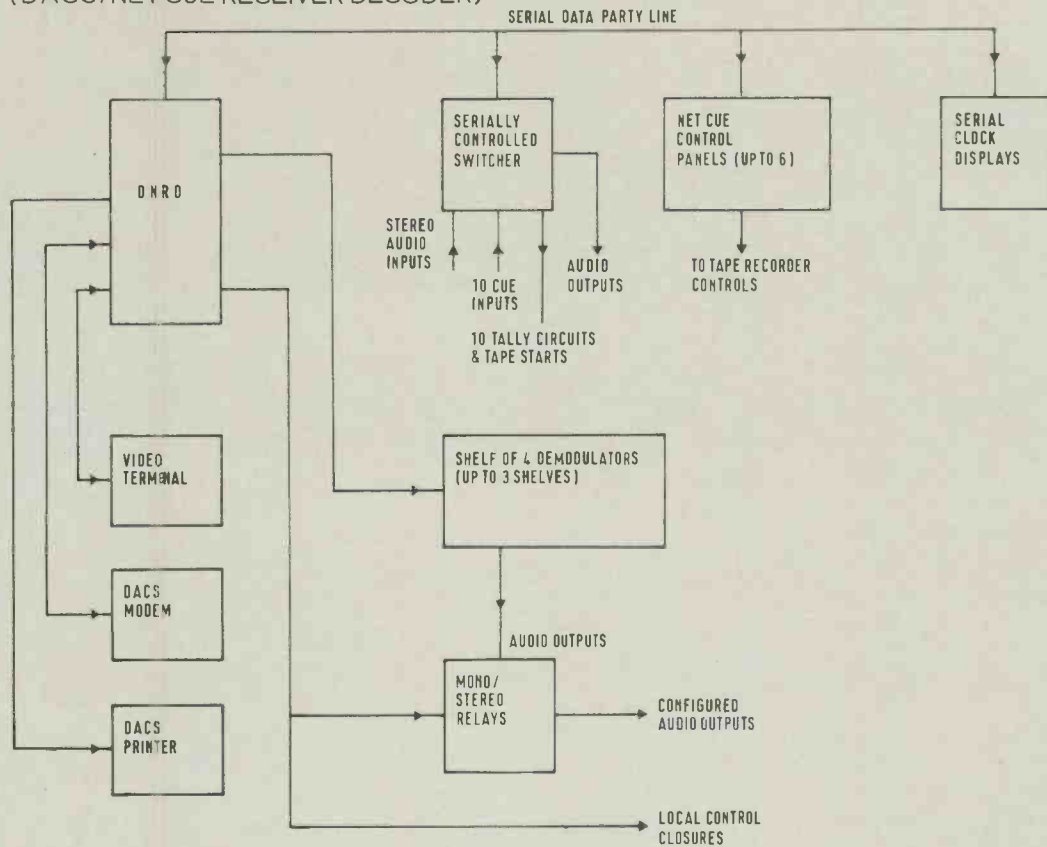
The present satellite system contrasts greatly with the AT&T 5 kHz mono line network previously employed. This system, although suffering from high cost and poor quality, did have multi-point origination capability.

The 12 satellite channels can be used singly for mono or in pairs for stereo operation, which makes for greater flexibility. Each member station is provided with a parabolic antenna, LNA, down converter, and up to 12 tunable demodulators. Seventeen of the member stations have uplinks and can therefore originate programming. This is beamed by satellite to MOTC (Master Originating Technical Centre) in Washington and on to all member stations. The flexibility of this contribution/distribution system is obvious. However, this flexibility introduced some unique operational difficulties for member stations that did not exist with the previous system. Prominent among these was the action required by personnel at member stations to capture a programme and record it for subsequent transmission, and the need to monitor multiple channels for advisory information. With the previous system, tape machines were put into the record mode by tone signalling. The present system, with 12 channels

Antennas at NPR member station Stereo 91 (WHRF FM), Boynton Beach, Florida



FIG. 1
BLOCK DIAGRAM OF FULL FEATURE DNRD
(DACS/NET CUE RECEIVER DECODER)



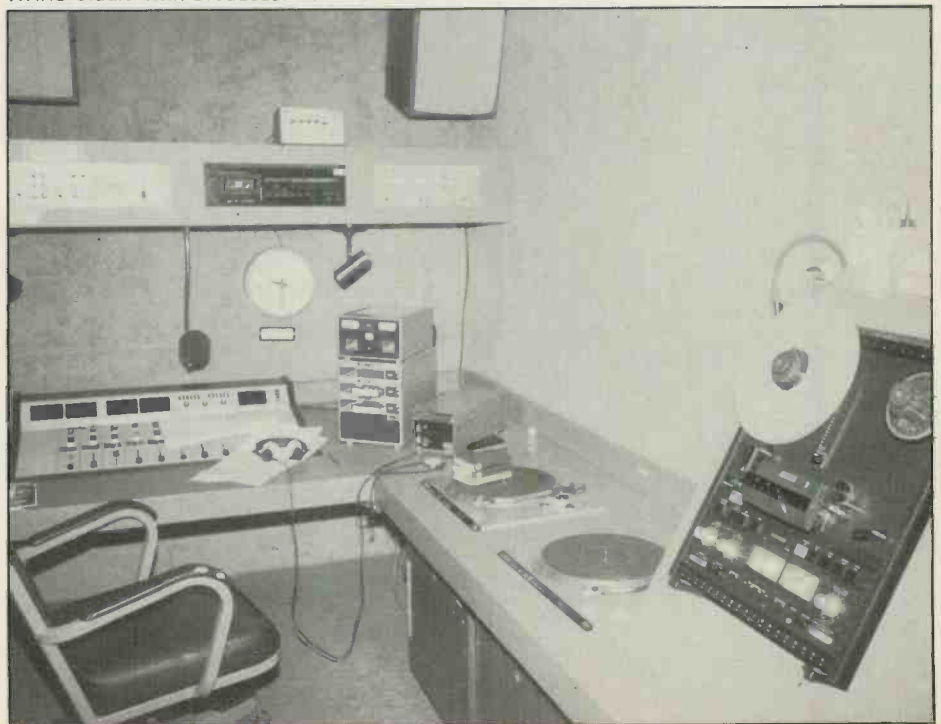
WHRS studio with Broadcast Audio console

available, and with start, stop and record modes necessary, led to the conclusion that the tone signalling system was not the best.

In 1977 NPR engineers polled other broadcasting organisations to find out if they had similar problems and how they dealt with them. The Canadian Broadcasting Corporation had the closest answer to the problem and the present system employed by NPR is an extension of that arrangement. The additions to the systems are automated control of uplinks and automated assistance at downlinks. Packet switching on the data channel allows simultaneous use of 'net cue' (machine control) and DACS (direct access communication system). The latter function provides printouts of all relevant data including programme schedules, advisories, information, etc.

All this information is handled at MOTC by two Data General *Nova 3* computers, each equipped with a 10 Megabyte disc drive. One *Nova* drives video displays with future events, handles local switching in Washington and—by a serial data stream—the net cue/DACS. The second *Nova* is used for programme development and also serves as a back-up.

At the member station, this data is received by satellite, decoded and fed to the DACS printer and net cue decoder (see Fig 1). The heart of this decoder is a Motorola *M6809* microprocessor with



NATIONAL PUBLIC RADIO

32K of dynamic RAM (expandable to 60) and a 2K EPROM. Power is backed up with batteries.

Operating the system is extremely simple. The event code, read from the DACS printout, is entered with thumbwheel switches and immediately displayed on a numeric LED readout. The operator then presses the 'arm' switch and the equipment awaits its instruction from Washington. At scheduled programme times (-50 s) a tape start command is received. 10 s later a record instruction is received, after a further 10 s line-up tone is received, and the last 10 s is silent. After the programme has been transmitted, a stop code is received. Every hour a special message is transmitted from Washington to synchronise station clocks. Obviously all net cue commands take priority over DACS traffic. The satellite operates at a 1200 baud rate while the printers operate at 300 bauds. The difference allows the printer to operate continuously even in the presence of heavy net cue transmissions.

Member stations

A typical member station is Stereo 91 (WHRS FM) in Boynton Beach, Florida. This station is also part of the National Public Television Network and operates the ITV (instructional television) service for Palm Beach County. All of this is accomplished with a staff of 38 (take note UK ILR). Stereo 91 has four radio studios, each identically equipped with Technics turntables, Broadcast Audio mixing desks, ITC cart machines, Otari and Revox tape recorders and Nakamichi cassette recorders. The presenter's microphone is a Sennheiser MD421.

The Broadcast Audio desks are well suited to the operation, providing three inputs on each channel and routing to three stereo mix buses and a mono bus. Monitoring is by VU meters and there are separate selector switches for loudspeakers and headphones. By UK standards, the desk is simplicity itself and one questions whether ILR should, or will, go in this direction.

Signal processing, prior to transmission, is accomplished with Harris MSP9 and MS15R equipment. These units are interesting in their operation; after band splitting, the signals are subjected to simultaneous expansion and compression. These are complementary around 0 dB and, beneath or above this level, the audio signal is processed to varying degrees by each. This results in a very smooth control of audio level and an almost total absence of any pumping. Further control is by a hard limiter which normally does not operate; however, this unit is likewise interesting in its approach. A feedback circuit operates around what could be construed as a clipper to cancel high frequency distortion. This unit very effectively avoids over-modulation of the transmitter.

Stereo 91 uses very little overall signal processing and as a result has a very open sound, although not nearly as loud as most of the other stations in the band.

Stereo 91 broadcasts 25 kW ERP (10 kW transmitter) from a tower 1,549 ft above ground level: in Florida ground level is only a few feet above sea level. The station covers an area from West Palm Beach to Miami. Multipath distortion is no problem in Florida because of the topography. This allows the best possible coverage per kW of RF power.

About 70% of Stereo 91's output is taken off

satellite from Washington with the remaining 30% locally produced. (A typical Stereo 91 programme schedule is shown in Table 1.)

Conclusion

NPR is a quality-conscious broadcasting network dedicated to providing the discriminating American with fine arts programming, jazz and in-depth news and current affairs. The organisation succeeds in this objective admirably.

With its satellite system and the high technical quality of its facilities, it stands as a prime example of what can be achieved if American broadcasters are not wholly wedded to the race to catch advertisers. Independence, integrity and quality may be the catchwords applicable to NPR, but surely this is what all broadcasting should be about. Certainly, some of its US competitors could well take a leaf out of the NPR book and become better broadcasters as a result. □

Another WHRS studio, showing racks area in background



TABLE 1. Typical Stereo 91 programme schedule

	WEEKDAYS	SATURDAY	SUNDAY
6:00 AM	Saludos Amigos	Sabados Alegres	Sunrise
7:00			7:00 Micrologus 7:30 St. Paul Sunday Morning
8:00	Morning Edition	By Request	Request
9:00	Opus 91		
10:00	Adventures in Good Music		
12:00 PM	M Music In America The Record Shelf T Minnesota Orch. W St. Paul Ch. Orch. Th Music From Washington F Pittsburgh Sym.	Wir Machen Musik	Boston Pops
1:00		Vocal Scene	
2:00	Impromptu	Metropolitan Opera	Impromptu
3:00			
4:00			
5:00	All Things Considered	All Things Considered	All Things Considered
6:00		A Prairie Home Companion	Jewish Music & Culture Hour
	6:30 Twilight Serenade		
7:00	F - 6:30 Fla. Speaking		L'Heure en Francais
8:00	M - New York Philharmonic T - Chicago Symphony W - Wednesday Night Special	Jazz (To be announced)	Jazz Alive!
9:00	TH - Philadelphia Orchestra F - Boston Symphony	9:30 Jazz Revisited	
10:00	Adventures in Good Music (Repeat)	LP Jazz	LP Jazz
11:00	Music 'Till Midnight		

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THORENS TD524

Hugh Ford

The Thorens TD524 turntable unit is intended primarily for disco, broadcast and other professional applications where cueing facilities are required together with suitable isolation from vibration. Whilst the Thorens TP16L tone arm is standard, other arms can be fitted easily.

Based on a cast alloy chassis, suspended at each corner by a damped spring, the turntable and arm sections mount into a wooden cabinet with rather insubstantial felt feet at each corner. The bottom cover is made of hardboard!

When in transit, the turntable and arm sections are locked to a sheet metal section in the base by three screws. The motor is locked onto the main casting by three metal tabs secured by Allen screws.

Reverting to the turntable section, the damped alloy platter is secured directly to the DC drive motor, which has a solenoid-operated braking mechanism. Motor speed is controlled by a 256-pole tachogenerator, which normally locks the motor to a crystal source. However, variable speed is provided up to (nominally) $\pm 25\%$ about the fixed $33\frac{1}{3}$, 45 or 78 rpm speeds.

At the centre of the turntable a pop-up spigot is fitted for use with large centre-hole 45 rpm records. This is spring loaded so that it will automatically retract when normal records are placed on the platter. Alternatively, it can be locked down by pressing the spigot and turning it.

A natural rubber mat 300 mm in diameter covers the centre of the turntable platter, leaving a 14 mm rim for cueing. Beneath the platter a series of drillings around the edge forms a stroboscope, which is clearly visible through a side window.

To the right of the turntable a heavy plywood section is bolted onto the main casting to support the pickup arm and its raising and lowering system. The latter is a motorised platform, adjustable in height, with the motor's limits being controlled by a leaf spring switch. A knob at the end of the arm is used to lock the pickup arm in transit. When not locked into position, the arm is held on the arm rest by a permanent magnet.

The arm itself is a two-piece assembly comprising a 'cartridge wand', as opposed to a normal cartridge head, and the pickup balancing unit. The 'wand' accepts cartridges with the standard $\frac{1}{2}$ in mounting centres and has the common type of four pin connector and locking ring on the end of the approximately 100 mm long 'wand'.

Tracking force, which may be set from 0.5 g to 3.0 g, is adjusted by first balancing the arm with a movable counterweight, and then screwing a smaller weight in or out. All these are rubber-suspended on the arm. Tracking force is then adjusted with a calibrated dial above the arm bearings. A further dial adjusts the magnetic



MANUFACTURER'S SPECIFICATION

Drive system: Thorens direct drive.
 Motor: DC motor with 256-pole tachogenerator.
 Motor speed control: quartz.
 Speeds: $33\frac{1}{3}$, 45 and 78 rpm.
 Vario control: $\pm 6\%$, switchable to $\pm 25\%$.
 Run-up time: < 250 ms, corresponding to a rotation angle of 40° .
 Turntable platter: aluminium alloy, damped by a special mat of natural rubber.
 Platter diameter: 330 mm, affords a rim for cueing.
 Wow and flutter: (according to DIN 45507): $< 0.035\%$.
 Rumble (unweighted according to DIN 45539): > 52 dB.
 Rumble (weighted according to DIN 45539): > 72 dB.
 Rumble (measured with Thorens rumble measuring device according to DIN 45539): unweighted > 62 dB, weighted > 80 dB.
 Remote control: start/stop, fader start, quartz/vario switch, vario control tone arm lift, muting relay terminal.
 Mains voltages: 100, 120, 140, 200, 220, 240 V

50/60 Hz mains selector located on the underside of the unit.

Power consumption: 65 VA.
 ISOTRACK TONE ARM TP16L (TP63 cartridge wand)
 Effective length: 247.7 mm.
 Effective mass: 11 g.
 Stylus overhang: 17.7 mm, adjustable.
 Offset angle: $\leq 0.18^\circ$ /cm of radius.
 Skating compensation: frictionless magnetic assembly.
 Tracking force: by calibrated spring dial adjustment.
 Bearing friction: ≤ 0.15 mN (15 mg) in both planes.
 Cartridge mounting: standard $\frac{1}{2}$ in.
 Capacitance of tone arm: 35 pF.
 Dimensions: turntable with base (WD) 500×445 mm, height with cover closed 160 mm, height with cover open 410 mm.
 Weight: 22 kg.
 Manufacturer: Thorens/Gerätewerk Lahr GmbH, D-7630 Lahr, Postfach 1560, West Germany.
 UK: Wilmex Ltd, 35 High Street, New Malden, Surrey KT3 4DE.

skating compensation, with four separate scales for spherical or elliptical styli, playing the record wet or dry.

Beneath the surface of the arm platform, the vertical shaft of the bearing is extended to support a lightweight cam, the position of which is detected optically. The output from this is used for the record end sensor.

To the front of the unit an alloy 'L' section forms the front and top surface for the controls, in addition to supporting the printed circuit board for all the electronics (except the arm position sensor).

There is a rotary power on/off switch, and a three-position rotary switch selecting turntable speed. This has three LEDs to show which speed is selected, and to act as power on indicators.

To the right are two momentary pushbuttons

with adjacent LEDs, one being start/stop and the other the arm lift control (its LED illuminated when the arm is down or moving down). The LED by the start/stop button is illuminated green when the platter speed is locked, in either the quartz lock mode or the vari-speed mode, but red when phase lock does not exist.

The next section is the variable speed section. A momentary pushbutton switches between vari-speed and quartz lock, with an adjacent LED showing green for quartz lock or red for vari-speed. In the vari-speed mode, a potentiometer varies the speed over a $\pm 6\%$ range when its knob is pushed down, or $\pm 25\%$ when pulled out.

Finally, there comes the mode control in the form of a three-position rotary switch with three red LED indicators marked 'O', 'L' and 'ML'. In the 'O' mode the turntable functions as a manual



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REVIEW

unit with no auto-stop. In the 'L' mode, the pickup arm is raised at the end of the record, but the platter continues to run. The 'ML' mode also stops the platter motor.

To the rear of the unit power is supplied via a removable lead. The fuse and line voltage selector are beneath the unit.

Audio outputs are at twin phono sockets for each channel, the idea being that the second socket may be used for adding any desired capacitive loading. The ground of the audio circuits is completely isolated. A decent separate ground connection is provided.

Finally, there is the remote control connector in the form of a 15-way 'D' connector. This provides for remote start/stop, fader start, tone arm lift and variable speed, in addition to the appropriate indicator LEDs and drive for a 12 V 40 mA muting relay.

Inside the unit the good quality, tidy printed circuit board has full component identifications together with socketed integrated circuits for ease of servicing. In addition, electrical parts are readily removed as connections are made by ribbon cables and connectors. However, the user's manual does not contain servicing information.

Not supplied with the review unit was the plastic top cover which hinges at the rear on the unit.

Mechanical considerations

The small central spigot diameter was 7.143 mm, giving a clearance of 0.097 mm on the minimum IEC record centre hole diameter—a satisfactory clearance for broadcast use where discs must not jam on the spigot. Similarly the large (45 rpm) spigot was 37.95 mm diameter, giving a clearance of 0.20 mm on the IEC minimum sized centre hole. The horizontal run-out at the centre pin was good at 0.01 mm total indicator reading (TIR) but reached 0.076 mm at the edge of the platter.

Likewise, the vertical location of the turntable spigot was positive, but run-out at the edge reached 0.28 mm on the platter, or 0.36 mm at the outside of the mat. These figures are certainly short of the best available.

The arm could be balanced for cartridges weighing between 3 g and 11 g, with accurate balancing being rather fiddly. Once balanced, the calibration of the tracking force adjuster was very accurate, with a worst-case measured error of 0.2 g, over the 0.5 g to 3 g range.

As is desirable, the anti-skating force varied between the inner and outer grooves with the range of adjustment at the outer grooves of a 12 in record being 0.05 g to 0.5 g.

Alignment of the cartridges within the 'wand' is straightforward. A special gauge for cartridge height is normally supplied with the turntable. A clever idea, not mentioned in the instruction book, is that the reverse side of the turntable mat has a grid for overhang adjustment.

Electrical matters

As no mains earth is provided, the chassis of the turntable and the drive electronics is available at a ground terminal for grounding to the external amplifier.

All pickup cartridge connections are fully isolated from this ground, with the pickup 'wand' being connected to the signal ground of the right channel.

Within the 'wand' the capacitance between leads was minimal at 5 pF, with the remainder of the internal wiring having a capacitance of 38 pF per channel. Using suitable external leads it is easy to adjust the system to the recommended capacitance for any common cartridges, generally 250 pF to 500 pF, with examples being quoted in the instruction book.

Using the Stanton 680EL cartridge supplied there was no audible or measurable pickup from the turntable motor at any speed. However, the wires connecting to the cartridge were rather exposed and could be a source of hum pickup.

Another feature was the quite exceptional isolation from vibration. Even tapping the base of the unit at very high level settings had little audible effect.

Wow, flutter, speed

Using a specially prepared lacquer, the speed at a nominal 33 $\frac{1}{3}$ rpm was found to be within 0.01% of nominal, with the 45 rpm and 78 rpm speeds having a precise relationship with 33 $\frac{1}{3}$ rpm (ie 45.00 rpm and 78.26 rpm to the 60 Hz standard).

In varispeed, the central position of the potentiometer was closely matched to the nominal speed, with the control offering +8%/-8.3% or +23.9%/-23.0% on nominal speed for the two nominal $\pm 6\%$ and $\pm 25\%$ ranges.

Again using a special lacquer, carefully centered with a microscope, the IEC quasi-peak weighted wow-and-flutter was remarkably good at less than 0.035% irrespective of the turntable speed.

The start time at 33 $\frac{1}{3}$ rpm was consistently just short of 250 ms to the rated speed and wow-and-flutter, corresponding to approximately one tenth of a turn of the platter.

Rumble

Weighted rumble to DIN 45539 was measured at -71 dB using a DIN 45544 rumble test disc. However, the measurement of rumble this way is always limited by the quality of the disc.

Because of this, Thorens have developed a rumble test jig consisting of a steel spigot which clamps onto the turntable spigot with a collet fixing. A lightweight arm hangs on the test spigot in nylon bearings, with the pickup stylus placed on a pad on the arm. Using this device the turntable rumble was measured at -81 dB which is a more realistic figure than that obtained from a test disc.

Conclusions

This is a generally well made professional/semi-professional turntable with the arm suitable for many cartridges, the arm resonance being very well placed at 9 Hz with the Stanton 680 EL cartridge supplied with the review sample.

Whilst the run-out of the platter can be bettered, the measured rumble and wow-and-flutter performance was of a very high standard.

The remote control facilities and the fast start time make this unit well suited to broadcasting. The excellent suspension of the turntable is an asset for many other applications. □

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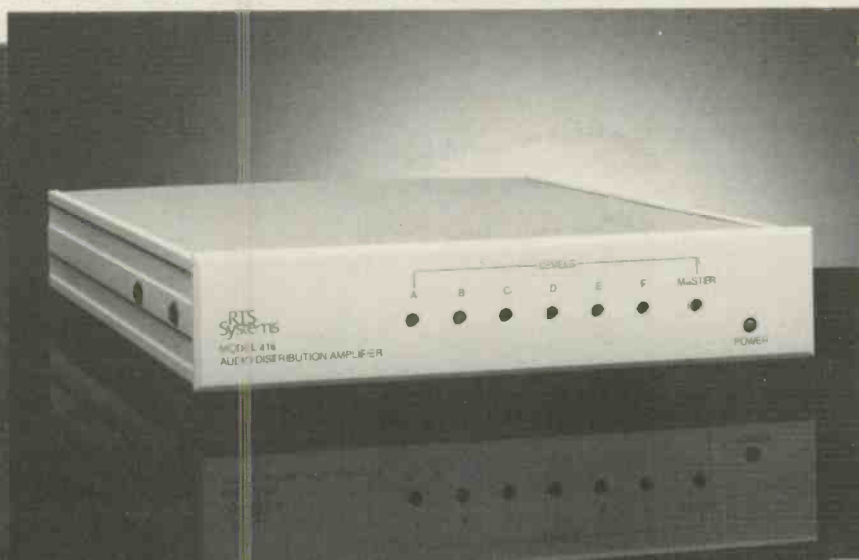
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STANTON 310

Hugh Ford

This Stanton pre-amplifier is intended to accept the output from stereo moving coil cartridges and provide an equalised line level signal. In addition, a flat response is provided which is useful for certain test discs.

The pre-amplifier is housed in a steel case provided with universal mounting brackets which may be positioned for mounting into a hole in a front panel, hanging below a surface or surface mounting.

On the front, three self-illuminating locking pushbutton switches select an equalised/un-equalised characteristic, switch a high pass filter in/out and mains power on/off. There is also a power indicator LED.

Recessed behind the front panel are screwdriver-operated multi-turn gain controls for the left and right channels, and screwdriver-operated high frequency trim capacitors.

The power cable is fixed on the rear, with a recessed slide switch selecting American or European line voltages. An internal line fuse is mounted onto the printed circuit board.

The inputs from the cartridge are on phono

sockets with a recessed DIL switch providing a choice of capacitive loading in 50 pF steps. The remaining rear panel feature is the barrier strip connector for the audio outputs plus a ground terminal. These are all isolated from the power line ground.

Within the unit there is a single printed circuit board supporting all of the components, which are clearly identified by screen printing. The instruction book contains full servicing information. All integrated circuits are socketed for ease of servicing and the general standard of construction is reasonable.

Two complaints arise from inspection of the unit. First, the power cord does not have the correct UK colour coding and does not have labelling to tell the user the correct connections. Second, the clearance between the case of the line voltage selector switch and its terminals does not meet British Standard safety requirements.

Inputs and outputs

The gain at 1 kHz from the inputs to the outputs could be adjusted from 32 dB to 63 dB in the equalised or flat conditions, the gain as supplied being 40 dB.

At the inputs the measured input impedance with no added capacitive loading was 48.4 kΩ in parallel with 12 pF and 47.4 kΩ in parallel with 11

pF for the two channels. Adding capacitive loading showed the capacitors to be reasonably accurate at 201/196 pF, 100/92 pF and 48/45 pF for the nominal loadings of 200, 100 and 50 pF. The maximum acceptable input voltage was more than adequate at 220 mV.

The unbalanced outputs had a very low output impedance capable of driving +20 dBm into 600 Ω. It was, however, felt that the output configuration might cause trouble with some amplifiers, as the unisolated output is at +13.5 VDC, which feeds the output terminals via 100 μF capacitors which may take a considerable time to charge.

Frequency response and noise

The frequency response of the two channels when in the equalised condition and fed via an inverse RIAA network is shown in the two top plots in Fig 1, with the flat position shown in the two lower plots. Clearly the unit (as supplied) is close to the optimum conditions.

Fig 2 shows the extended response in the flat setting, together with the characteristic of the high pass filter which operates in the equalised and flat conditions, the filter being well designed with its -3 dB point at 28 Hz. Below this it rolls off at 18 dB/octave.

The high frequency equaliser capacitors are only operational in the equalised mode, providing

MANUFACTURER'S SPECIFICATION

Output: +20 dBm maximum.
Frequency response: ±0.5 dB from 20 Hz to 20 kHz in FLAT or NAB positions of mode selector.
Distortion: THD <0.05% at 20 dBm.
Output source impedance: 5 Ω, designed for loads 150 Ω or higher.
Gain: adjustable 30-60 dB.
Rumble filter: 3 dB knee at 28 Hz, -35 dB at 5 Hz.
Maximum input level at 1 kHz: 120 mV.
Noise (input terminated by cartridge): -70 dB below 10 mV input at 1 kHz NAB curve, 44 dB voltage gain; -74 dB or lower with rumble filter in.
Input resistance: 47 kΩ.
Input capacitance: 15 pF, switchable in 50 pF steps to 350 pF maximum.
Channel separation: 60 dB minimum (20 Hz to 15 kHz).
Input connectors: RCA phono jacks.
Output connector: 5 terminal barrier strip.
Power requirements: 100-125 VAC or 200-240 VAC, 50-60 Hz, 5 W maximum.
Indicators: LED pilot light.
Dimensions: 57×127×184 mm (2¼×5×7¼ in).
Manufacturer: Stanton Magnetics Inc, Terminal Drive, Plainview, NY 11803, USA.
UK: Wilmex Ltd, Compton House, 35 High Street, New Malden, Surrey KT3 4DE.



FIG.1
STANTON 310 PREAMPLIFIER
FREQUENCY RESPONSE

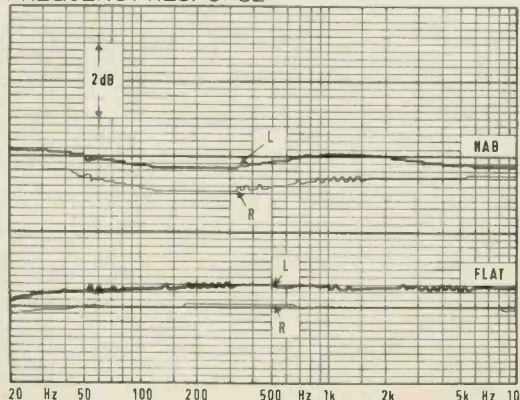
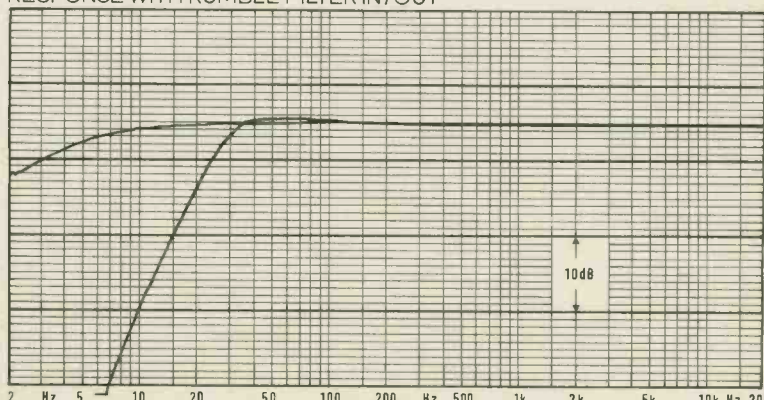
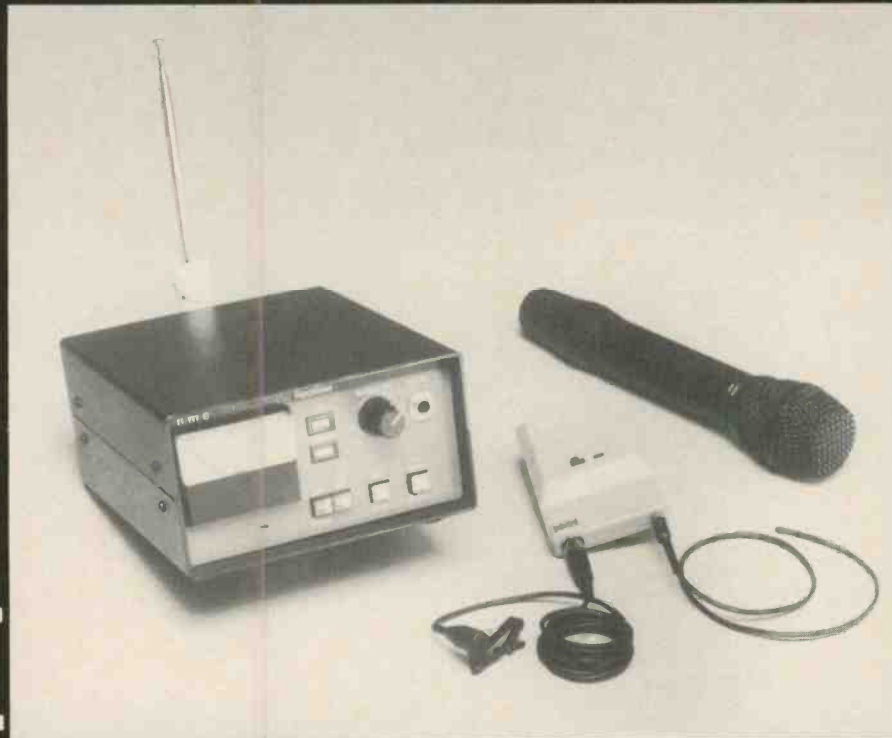


FIG.2
STANTON 310 PREAMPLIFIER
RESPONSE WITH RUMBLE FILTER IN/OUT



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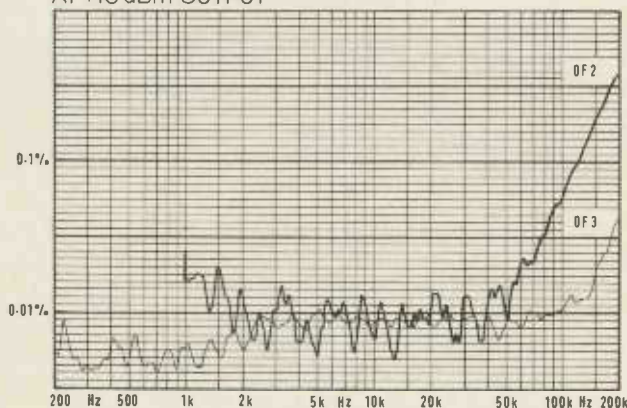
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REVIEW

FIG. 3
STANTON 310 PREAMPLIFIER
HARMONIC DISTORTION AT +20 dBm OUTPUT



FIG. 4
STANTON 310 PREAMPLIFIER
INTERMODULATION DISTORTION (CCIF)
AT +10 dBm OUTPUT



Stanton 310 preamplifier back panel

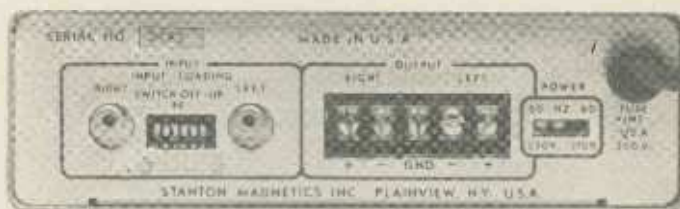
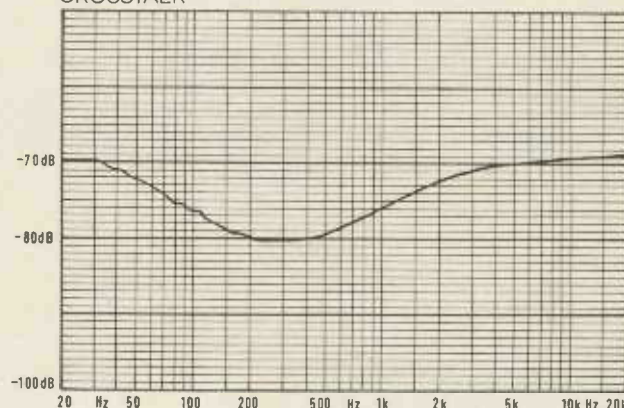


TABLE 1

	Noise in output (dBm)			
	Dummy cartridge		Shorted	
	Left	Right	Left	Right
22 Hz to 22 kHz RMS	-64.0	-66.0	-63.0	-66.0
A weighted RMS	-75.5	-78.0	-77.0	-80.0
CCIR weighted RMS	-70.0	-72.0	-75.5	-76.5
CCIR weighted quasi-peak	-65.5	-68.0	-71.5	-72.5
CCIR/ARM ref. 2 kHz	-76.5	-78.5	-82.0	-83.0

FIG. 5
STANTON 310 PREAMPLIFIER
CROSSTALK



-0.5/+1 dB at 10 kHz, or -1.0/+1.5 dB at 15 kHz with respect to the standard equalisation curve. This means that calibration discs without pre-emphasis cannot be used for alignment unless appropriate compensation is added.

Noise in the equalised condition was measured in the output at 40 dB gain with the input terminated in (a) a dummy cartridge (625 Ω and 700 mH) and (b) a short circuit as shown in Table 1.

This noise performance, while good, does show significant differences between the two channels which for some reason did not occur in the unequalised mode, where the noise with shorted input was identical to that of the left channel when loaded with a dummy cartridge.

Power line hum was insignificant in the outputs with the internal power transformer being well shielded from the outside world.

Distortion

Individual second and third harmonic distortion at 40 dB gain and +20 dBm output is shown in Fig 3, where the third harmonic is rather high. However, at 10 dBm and lower output levels the second and third harmonics were below 0.02%.

CCIF twin tone intermodulation distortion at +10 dBm output is shown in Fig 4 to be at a very low level within the audio band, only rising above 50 kHz. At lower levels this form of distortion dropped further.

Other matters

The square wave performance was very good both in the equalised and unequalised modes with no sign of ringing.

As shown in Fig 5 the crosstalk between the two channels was insignificant, being less than 70 dB at any frequency of interest.

The pre-amp recovered from overload without any undesirable long term effects such as blocking.

Summary

This Stanton pre-amplifier is a good general purpose phono pre-amplifier suitable for broadcast and similar applications.

The unit offers a suitably versatile interface for most cartridges with a gain and output level suitable for professional use. However, the manufacturer should attend to the power cord colour coding and the quality of the power line voltage selector. □

BROADCAST MONITOR RECEIVER 150kHz-30MHz



Reviewed in
Broadcast Sound
March/April

We have taken the synthesised all mode FRG7700M communications receiver and made several well thought out modifications to provide a receiver for rebroadcast purposes or checking transmitter performance as well as being suited to communications use and news gathering from international short wave stations.

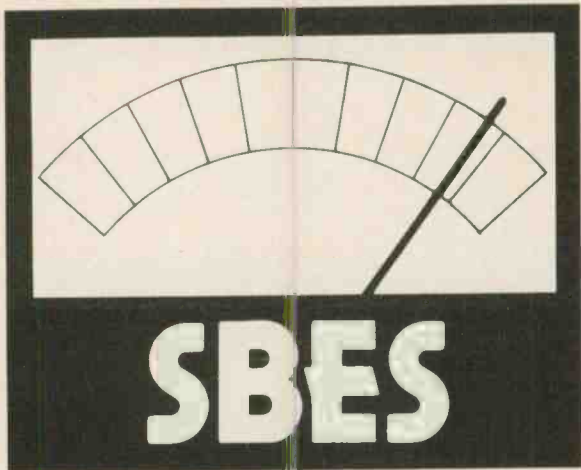
PRINCIPAL MODIFICATIONS: * Radically redesigned front end stages yielding improved noise figure and overload levels, TOIP -2dBm (originally -21dBm) * Balanced audio line output * Reduced AM distortion * Buffered IF output for monitoring transmitted modulation envelope on an oscilloscope * Mains safety improvements.

The receiver is available in free standing or rack mounting form and all the original features are retained: The new AM detector board achieves exceptionally low distortion; THD, 200 Hz - 6kHz at 90% modulation - 44dB, 0.6% (originally - 20dB, 10%).

Stereo Disc Amplifier 3 and 4 * Peak Deviation Meter * Programme and Deviation Chart Recorders * Stabilizer * Frequency Shift Circuit Boards * 10 Outlet Distribution Amplifier * Peak Programme Meter Illuminated Boxes, Circuit Boards and Ernest Turner Movements * PPM5 Dual In-line Hybrid * Stereo Microphone Amplifier.

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RE 20 Variable D Dynamic Cardioid

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RE 50 Shock-mounted Dynamic Omnidirectional

This mike was designed expressly for hand-held newsgathering work. It has the same tailored frequency response and high output level as the famous 635A. The RE 50's rubber shock-mount "mike-within-a-mike" design achieves a degree of shock isolation never before known in the industry. The construction is also highly resistant to damage from mechanical shock.



RE 50

RE 20

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SHUTTLESOUND

STANTON 680EL AND 680SL

Hugh Ford

Both these cartridges are of similar design with the cartridge fitted into a metal body, providing screening from external hum fields. At the back of the cartridge the four 1.27 mm diameter connection pins are identified with the channel and colour coded with the standard pickup coding—a good feature.

At the front the interchangeable stylus 'plugs' into the cartridge proper. A good stylus guard is supplied. The 680EL cartridge, with its elliptical diamond stylus, is specifically designed for back cueing and general broadcast and disco purposes, while the 680SL has a nude stereohedron stylus and is intended for 'home disco' use, according to

the manufacturer.

Initial inspection of the styli under a microscope showed both to be in good condition, but the stylus on the 680SL needed cleaning.

Interfacing

The recommended load for both cartridges is the normal 47 k Ω in parallel with 275 pF. This load was used for all tests, which were undertaken using the Thorens TDS24 turntable and arm, set to track at 3 g unless otherwise stated.

At 1 kHz the output voltage of the 680EL was 0.87/0.92 mV/cm/s; with the 680SL slightly more sensitive at 1.1/1.15 mV/cm/s, the former being just on the manufacturer's tolerance limit.

The DC resistance for the 680EL was 1290 Ω and the 680SL was 1240 Ω . The inductances were close to the specified 930 mH.



FIG. 1
STANTON 680EL
FREQUENCY RESPONSE



FIG. 2
STANTON 680SL
FREQUENCY RESPONSE

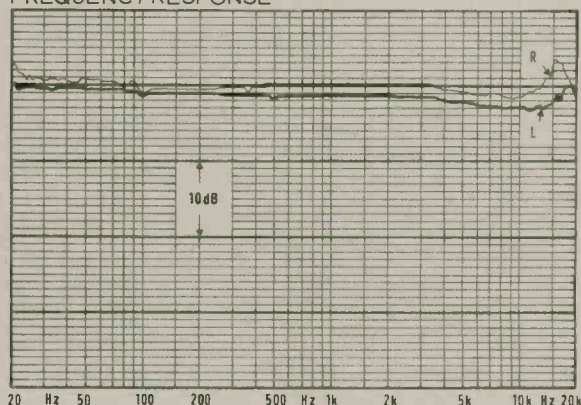


FIG. 3
STANTON 680EL
CROSSTALK

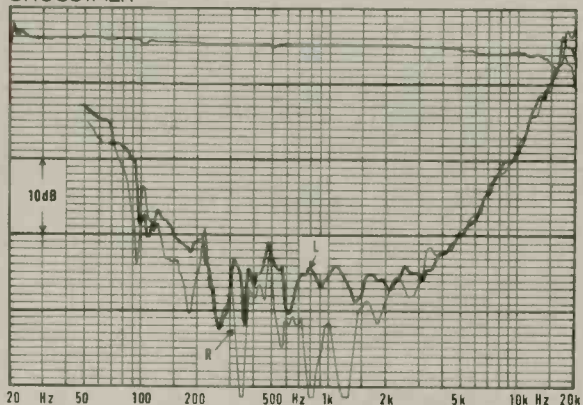
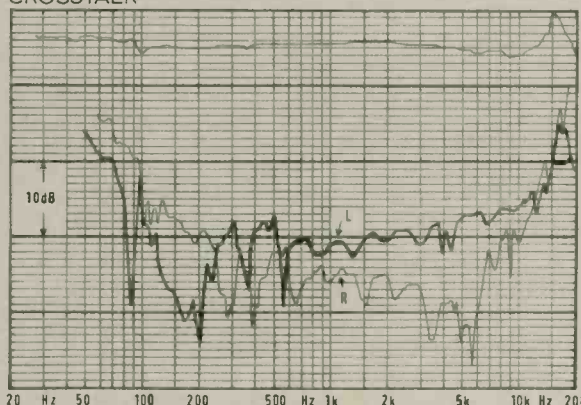


FIG. 4
STANTON 680SL
CROSSTALK



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REVIEW

Both cartridges weighed 5.5 g, with the compliance being measured as 19 CU for the 680EL and 15 CU for the 680SL, both well matched to the pickup arm in use giving resonant frequencies of 9 Hz and 10 Hz respectively.

The vertical tracking angle was satisfactory at 18° for the 680EL and 21° for the 680SL, measured with the CBS STR-160 vertical tracking angle measuring disc.

Frequency response and channel separation

For these tests the outer tracks of the Bruel and Kjaer QR2010 test record were used. Fig 1 and Fig 2 show the responses of the two channels for each cartridge. While the left/right matching of both cartridges was good at 1 kHz, the 680EL showed a slightly better match and more controlled frequency response than the 680SL, which had a slightly extended high frequency response.

Channel separation was measured selectively using a Bruel and Kjaer 2010 Heterodyne Analyser in conjunction with a type 1901 Tracking Frequency Multiplier. Figs 3 and 4 show the results of the two cartridges, with the upper plot showing the output of the right channel related to the crosstalk in the left and right channels in the lower traces. Table 1 summarises the properties of the worst channels.

MANUFACTURER'S SPECIFICATION

Frequency response: 680EL—20 Hz to 20 kHz.
680SL—20 Hz to 20 kHz.
Nominal output: 1.1 mV/cm/s ± 2 dB.
Channel separation: 30 dB.
Load resistance: 47 kΩ.
Load capacitance: 275 pF.
DC resistance: 1,300 Ω approx.
Inductance: 930 mH approx.
Channel balance: within 2 dB.

Stylus tip: 680EL—0.4×0.7 mil elliptical diamond. 680SL—nude stereohedron.
Tracking force: 680EL 2-5 g. 680SL with brush: 3-6 g.
Resulting tracking force: 2-5 g.
Cartridge weight: 5.5 g.
Manufacturer: Stanton Magnetics Incorporated, Terminal Drive, Plainview, NY 11803, USA.
UK: Wilmax Ltd, Compton House, 35 High Street, New Malden, Surrey KT3 4DE.

TABLE 1: crosstalk

Crosstalk	100 Hz	1 kHz	10 kHz
680EL	20 dB	30 dB	13 dB
680SL	20 dB	26 dB	20 dB
Test disc limits	20 dB	30 dB	30 dB

TABLE 2: mistracking levels

Tone	400 Hz		200 Hz	
	Vertical	Lateral	Vertical	Lateral
680EL at 3 g	>+18 dB	>+12 dB	>+18 dB	>+12 dB
680SL at 3 g	+15 dB	>+12 dB	+18 dB	+9 dB
680EL at 1 g	+12 dB	+12 dB	+15 dB	+9 dB
680SL at 1 g	+12 dB	+9 dB	+12 dB	+9 dB

Tracking and distortion

Figs 5 and 6 show square waves reproduced from the CBS STR-111 test disc for the 680EL and 680SL cartridges respectively, taking the worst channels. Both cartridges exhibited a degree of ringing on the edges.

Using the same disc the intermodulation tracks were used to audibly check the amplitude at which mis-tracking occurred, with reference to a peak amplitude of 1.12 μm (see Table 2). This shows that the tracking capability of both cartridges is good with the 680EL being marginally better than the 680SL.

Further objective tests were done using the Shure Audio Obstacle Course Era III which confirmed the above results. Tracking at 3 g, both cartridges managed the musical bells test and just managed the drum test. Level four of the sibilance test was marginal on both, with level five giving a 'spitting' sound. Level four of the violin test distorted on both cartridges.

Conclusions

These are respectable cartridges offering a good performance when tracking at 3 g or more. Hi-fi pundits may not like the idea of 3 g, but they are ideal for professional use. □

Fig 5

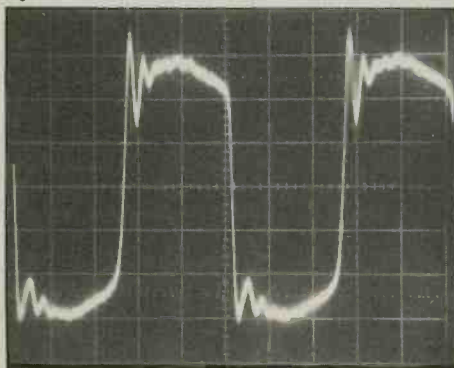
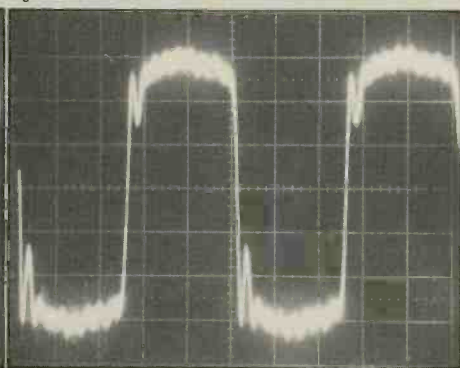


Fig 6



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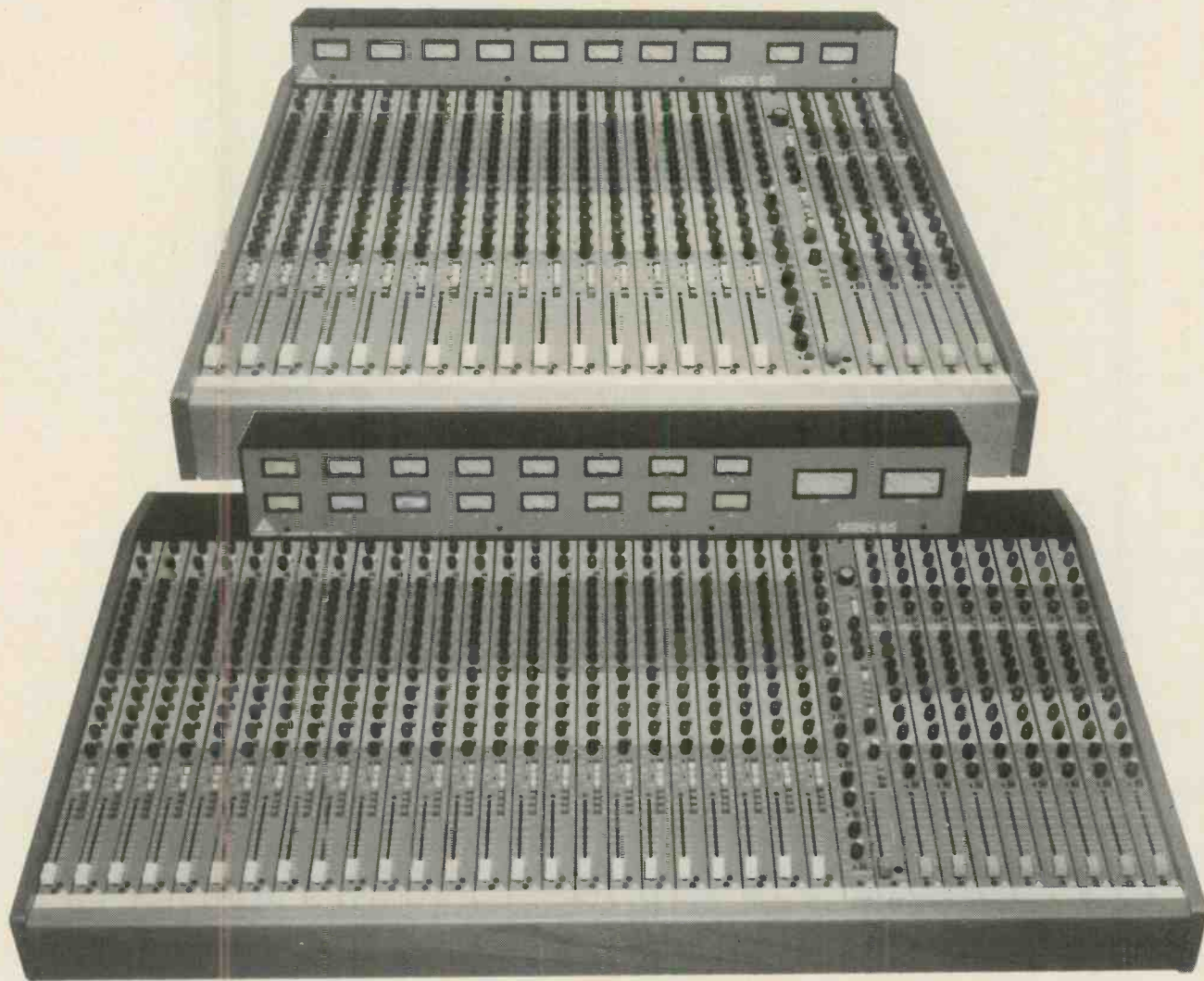
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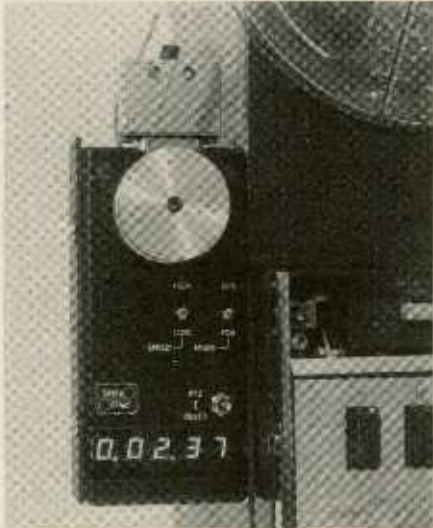
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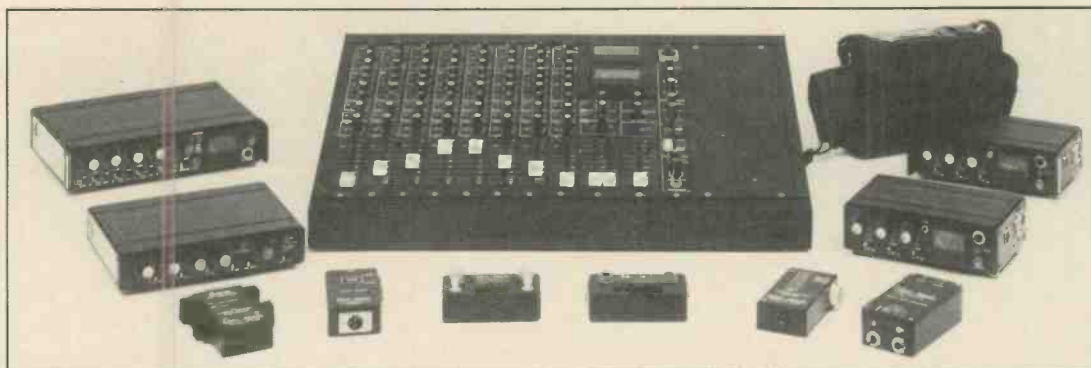
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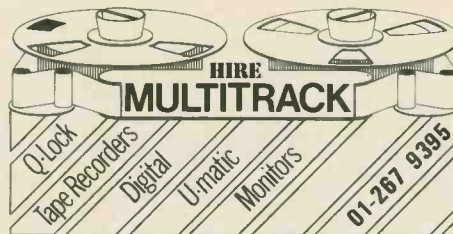
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