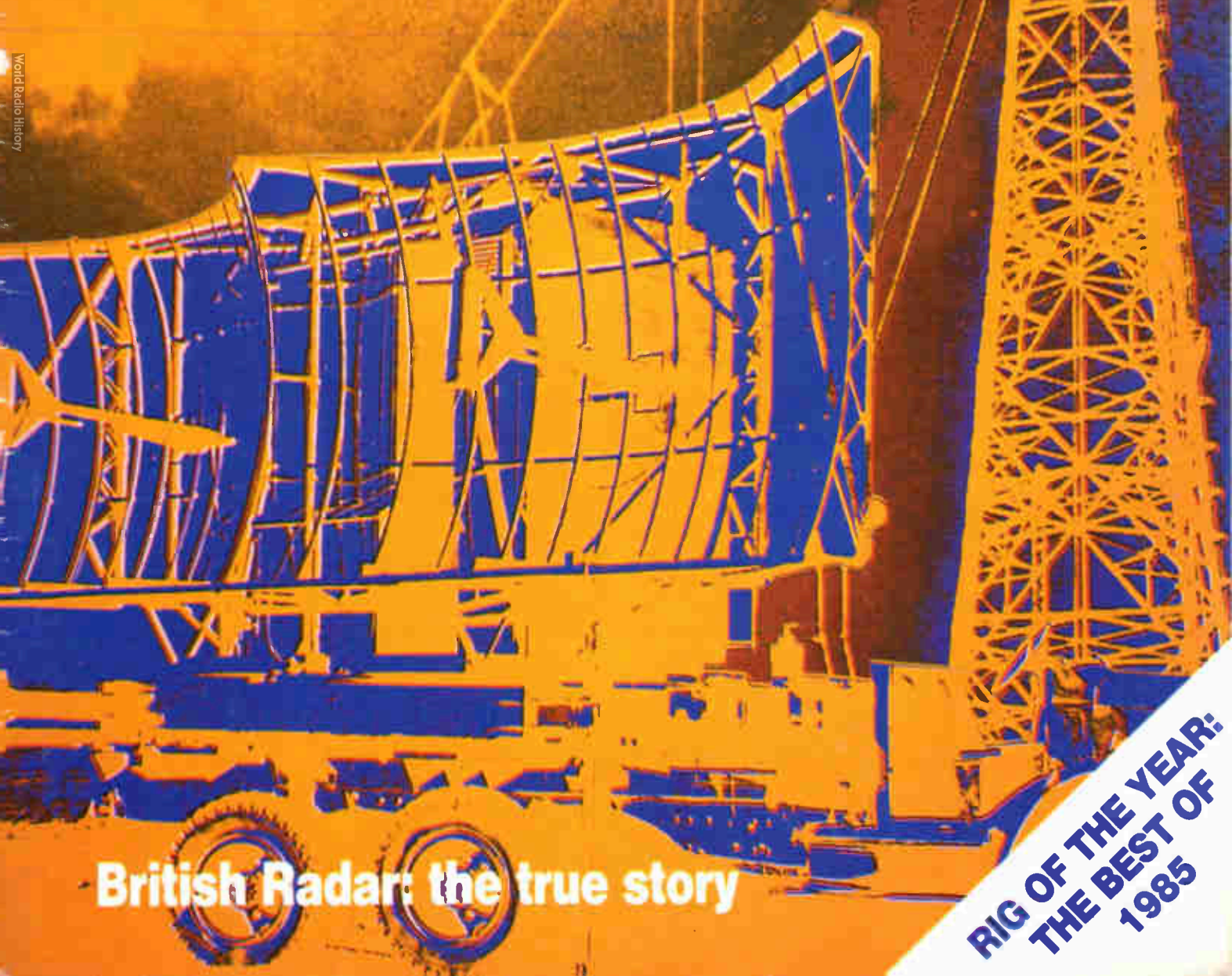
MARCH 1986 £1.20

Amateur RADIO

For all two-way radio enthusiasts

Microwaves: 10GHz made easy

Cobra 10m conversion



British Radar: the true story

RIG OF THE YEAR: THE BEST OF 1985

Tune into Withers Bargain Centre!

RAYCOM EXCLUSIVE PRODUCTS

Beta 3000 10FM 5W RPT/shift ...£79
Revco RS2000E Scanner £225
Raycom RF Amplifiers 1-3W input
V25F 25W..... £49.50
V45G 45W FM.....£62.30
V15L 15W SSB.....£49.50
V35L 35W SSB.....£59.50
10mtr FM BETA 3000 mod £79
Unmodified BETA 3000 .....£69
10FM FBX/SANYO MOD BOARD fits into most CB's with the Sanyo LC7136/7 chip fitted £22.50 or we can fit it for £30 inc post
FBX/SANYO 10FM kit of parts £17.50
DNT/LCL 10FM MOD KIT..... £12.95
YAESU FT757GX fast tuning mod kit c/w instructions £29.50
or we can fit it for .....£37.50 inc
NEW FRG9600 Mod Kit extends the UHF range up to 950 mhz, + improves 'S' meter + sensitivity Send Radio and £25.00 inc post.

HAND HELDS

WE'VE THE LARGEST SELECTION OF HAND-HELDS IN THE UK!
KENPRO KP202 6ch 2mtr XTAL £49.00
TRIO TH41 70cms £165.00
TRIO TH21 2mtr.....£185.00
KENPRO KT200EE 2mtr 2W £169.00
KENPRO KT40OEE 70cm 2W £189.00
YAESU FT209RH 2mtr 3W.. £245.00
YAESU FT203R 2mtr 2W..... £195.00
YAESU FT703R 70cm 2W.... £239.00
YAESU FT709R 70cm 2W.... £259.00
ICOM IC2E 2mtr 2W..... £199.00
ICOM IC4E 70cm 2W..... £249.00
ICOM ICO2E 2mtr 2W..... £269.00
ICOM IC04E 70cm2W.....£279.00
ALINCO ALM203E 2mtr 3W £239.00
++ MANY MORE MODELS AVAILABLE.
FREE PORTABLE ANTENNA WITH EVERY HANDHELD PURCHASED.
PHONE FOR LATEST USED LIST

POWER SUPPLY UNITS

3A G-Com (UK made).....£19.50
5A G-Com (UK made).....£29.50
10A Bremi (Italy).....£52.50
10A Moonraker (Italy) £62.50
10-12A Moonraker (Italy).....£69.00
Yaesu FP757HD 20A Cont...£175.00
Yaesu FP757GX 20A S/M £140.00
Yaesu FP700 20A PSU £150.00
ICOM PS55 matches IC 735 .....£165.00
SPECIAL universal NI-CAD chargers, takes any cell £6.50
WE HAVE MANY BRANDS OF PSU'S IN STOCK TO SUIT YOUR NEEDS.

ANTENNAS

SUN ANTENNAS (JAPAN)
Gamma Twin.....£9.50
HB9CV 2 metre £6.99
HB9CV 70 centimetres.....£5.99
10/11mtr loaded 1/4 wave £13.50
2mtr 7/8 mobile tilt/over £14.50
2mtr 5/8 mobile tilt/over £13.50
Gutter-Clip and cable ass.....£9.50
REVCO (British Made)
2mtr 5/8 coil/whip/base £11.89
10mtr 1/4 coil/whip/base £10.99
70cm Colinear double 5/8 ....£12.50
Revco Discone scan/ant £29.95
Revco NEW 2045 scan/ant....£59.00
SMC (Japan)
70N2M Dual band mobile £20.95
358 70cm triple 5/8 mob.....£30.95
HS770 diplexer 2&70cms.....£19.55
WE HAVE NUMEROUS TYPES OF ANTENNAS IN STOCK INC FULL RANGE JAYBEAM AND TONNA.

£1000 INSTANT CREDIT. HP/PERSONAL LOANS AVAILABLE
RWC CREDITCARD (written details on request)

ORDERS UNDER £50 SEND £2.50 p&p

ACCESS VISA AMERICAN EXPRESS

R Withers Communications – agent to the stars!

RWC are main agents/distributors for Yaesu, Icom, Kenwood, M Modules, Jaybeam, Tonna, Revco Antennas, Cleartone, MuTek, AKD, Drae, FDK, Welz, Tait, and Neve Radiotelephones to name but a few! We also stock a wide range of BT approved cordless telephones and telephone systems!

Tune into our specialist service!

* We manufacture our own range of VHF/UHF beam antennas
* We're the only company in the UK that produces modular VHF/UHF Raycom power amplifiers (15-50 watts output)
* We supply a large range of power transistors/ modules imported directly from Japan
* We supply/repair amateur/business radio systems
* We check transceivers on our spectrum analyser – £12.50 for a comprehensive report
* Only supplier of modified Revco RS2000 60-520MHz extended coverage scanning receiver modified by RWC
* Probably the UK's largest seller of used radio equipment
* We offer the largest selection of radio allied services under one roof

GET YOUR LATEST BARGAIN USED LIST. SEND LARGE ENVELOPE NOW!

Even more basement bargains!

TURN THAT BEAM KOPEK ROTATORS 50kg loading **£38.50**	**HI-Q INSULATOR TRAP-FORMER £6.99 (2X FORMERS – INSULATORS)**
DATONG AND DRAE MORSE TUTORS £49.50 PASS YOUR MORSE TEST QUICKLY!	**G5RV HG MULTI-BAND DIPOLE ANTENNA** ½size **£12.95** full size **£14.95**
TRAVELLING JIM 2m £6.95 Incl lead 2m **£8.95**	**STEEL QUAD SPIDERS** for 2 ELE Quad Aerials **£12.50** Build your own super aeriel!
FT290R + Nicads, charger, listen on input **£329** **FT690**+Nicads (6mtr) **£269**	**100W 0-500MHz** Dummy Loads (200 watts intermittent) 2ith lead an PL259 connector **£12.50**
Sun gutter mount + cable assembly, PL259 fittings **£9.25** Full Sun range in stock	**SPECIAL OFFER REVCO RS2000** Ext Coverage 60-179 & 380-520MHz AM/FM. 70 memories. Auto search, lock priority **£225**

R. WITHERS COMMUNICATIONS LTD

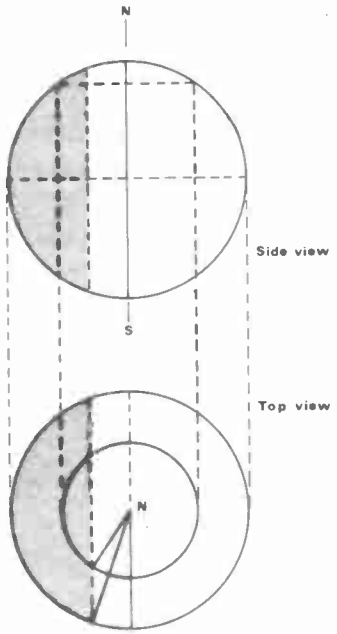
DEALER & EXPORT ENQUIRIES INVITED

584 HAGLEY RD WEST, QUINTON, BIRMINGHAM B68 QB5. Tel: 021 421 8201 (24hr) Telex: 334303 TXAGNMG

Amateur RADIO

Editor:
Anita Ley
Assistant Editor
Jane Berry
Editorial Assistant:
Angela Hall
Advertisement Manager:
Marian Vidler
Subscriptions:
01-760 0409
Accounts:
Clare Brinkman
Publisher:
Peter Williams
On sale: Last Thursday of the month preceding cover date
Next issue: Cover date April 1986 on sale 27 March 1986
Published by: Amateur Radio Magazines, Sovereign House, Brentwood, Essex CM14 4SE, England (0277) 219876
Printed: In England
ISSN: 0264-2557
News Trade Sales by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233

Front cover: The story of British Radar (p30). Photo by Jay Moss-Powell G6XIB



SERVICES

50MHz, A New Dimension for the U.K.

IC-505, 50MHz Transceiver

The IC-505 is a 50MHz band SSB, CW transceiver, and has already gained an excellent reputation worldwide. The dual VFO system has been developed using advanced computer and PLL technology. The IC-505 features 6 channel memories and can be used independent of emission modes, memory scan, program scan which searches only specified frequency band. LCD ensures clear visibility even in sunlight. The R.F. amplifier, a dual gate MOSFET features high gain and low noise characteristics. The IC-505 accepts a standard dry cell pack, rechargeable nicad battery pack (BP10) or 13.8v external power supply, 3 watts R.F. output, 0.5 watts low power, 10 watts at 13.8v. Accessory circuits include split frequency operation, noise blanker, squelch and CW break-in Options include - PS45 AC Power Supply
All these features make the IC-505 a great transceiver for operation on the 50MHz band.

IC-R71E, General coverage receiver.

The ICOM IC-R71E 100KHz to 30MHz general coverage receiver features keyboard frequency entry and infra-red remote controller (optional) with 32 programmable memory channels, SSB, AM, RTTY, CW and optional FM. Twin VFO's scanning, selectable AGC, noise blanker, pass band tuning and a deep notch filter With a direct entry keyboard frequencies can be selected by pushing the digit keys in sequence of frequency The frequency is altered without changing the main tuning control.
Options include FM, voice synthesizer, RC-11 infra-red controller, CK70 DC adaptor for 12 volt operation, mobile mounting bracket, CW filters and a high stability crystal filter

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Tha

ICOM

IC-735, The Complete HF Radio

This new HF transceiver from ICOM is compact enough to make mobile or portable use a possibility. The IC-735 covers all Amateur frequencies from 1.8MHz to 30MHz including the three new bands 10, 18 and 24MHz. Modes include SSB, CW, AM and FM, all circuits are solid-state and output is approximately 100 watts. Tuning ranges from 100KHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY and Amtor are also possible Dynamic range is 105dB with a 70.451 MHz first IF circuit. The direct feed mixer rejects spurious response and gives higher sensitivity and wider dynamic range Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Pre-amp is 10dB and attenuator 20dB.

The new IC-735 from ICOM is easy to operate and versatile, it has various scanning functions, comprehensive LCD and 12 memories. Computer remote control is possible via the RS-232C jack.

Options include: the AT-150 automatic antenna tuner and the PS-55 AC power supply SM8 and SM10 desk mics.

IC-3200E Dual-band

A new exciting set is the ICOM IC-3200E FM Dual-band transceiver (144-430/440 MHz). The IC-3200E delivers 25 Watts of output power on both bands.

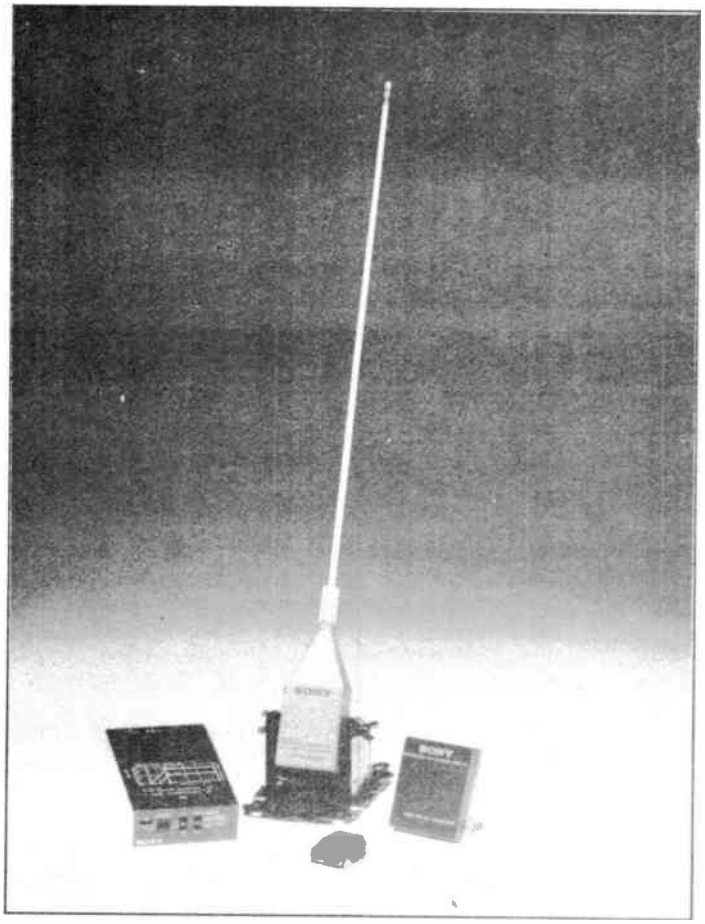
The IC-3200E employs a function key for low-priority operations to simplify the front panel. LCD display is easy to read in bright places, showing frequency, VFO A/B, memory channel duplex mode and S/RF meter information.

Other features include a 10 channel memory able to store operating frequencies, Simplex or Duplex. A memory lock-out function allows the memory scan to skip programmed channels when not required. The IC-3200E has a built-in duplexer and can operate on one antenna for both VHF and UHF. Options include IC-PS45 DC, power supply, HS-15 mobile mic, SM6 and SM8 desk mics, SP-10 external speaker, UT-23 speech synthesizer and AH32 Dual-band mobile antenna

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet Electronics

Sea Street, Herne Bay, Kent CT6 8LD
Tel: (0227) 363859.
Dept. AR

STRAIGHT & LEVEL



SONY ANTENNA

Sony has introduced an easily assembled, compact radio antenna to the UK market. Coded AN-1, the antenna is capable of receiving a wide range of bands including LW, MW and short wave (150kHz-30MHz). A low-noise and interference reducing FET has been used in the built-in RF amplifier.

Sony claim that the AN-1 antenna offers excellent value for money and, in the countries to which it has been introduced, has established a reputation for reliability and value for money.

With the growing interest in receiving radio stations in Britain, particularly on short wave frequencies, Sony now feel that it is time to introduce the AN1 to this country.

The AN-1 operates from either the domestic electricity supply or batteries, and is available now at all Sony authorised dealers, priced around £49.95.

For further information please contact: *The Grayling Company, Number One, Dean's Yard, Westminster, London SW1. Tel: 01-799 9811.*

Rx MOD

R Withers Communications Ltd have announced a modification for the Yaesu FRG9600 scanning receiver.

As many users will know, the standard frequency range is 60-905MHz. The company has now extended the range to cover up to .945MHz (940MHz guaranteed) with adequate sensitivity to cover the 934MHz range.

The modification also includes improved receiver sensitivity on earlier models, and S-meter recalibration for more realistic readings.

Customers who purchase the FRG9600 at RWC can have the option fitted at no cost. Owners of the FRG9600 can have the mod fitted by RWC (and the above improvements) for £25.00 including VAT and return post.

Further developments are in progress, including a low frequency option to enable operation below 60MHz. It may also be possible to include additional bands to be fitted in 20MHz steps.

Owners are warned, however, that the warranty will be affected on sets *not* supplied by RWC.

For further information contact: *R Withers Communications Ltd, 584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS. Tel: (021) 421 8201.*

CB POWER

CB radio enthusiasts can power their mobile radio units from the mains with a new high quality power supply kit from Electronic and Computer Workshop Ltd.

The kit, the K2556, is designed primarily for home-based applications, providing a regulated dc output, nominally 12 volts but adjustable from 11 to 13.5 volts dc. Maximum current rating is 3.5 amps.

All the necessary items are supplied with the kit, including a high quality PCB, all electronic and mechanical components, and an attractive case with front panel terminals, on/off switch and indicator LEDs. Full instructions are included to make assembly very simple.

Full overload protection is included with an overload LED. Although designed for CB applications, the performance of the K2556 makes it suitable for a wide range of amateur radio and laboratory applications.

ECW can supply the kit at a price of £30.87 including post/packing and VAT.

For further information contact: *Electronic & Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex CM1 1RY. Tel: (0245) 262149.*

All the latest news, views, comment and developments on the amateur radio scene

20m TRANSVERTER

The CM Howes Communications' HC220 enables a 2 metre SSB/CW or multimode transceiver to be used on the 20 metre band. It will produce a good 10W of RF output from mismatch proof transistors when operating from a 13.8V dc supply.

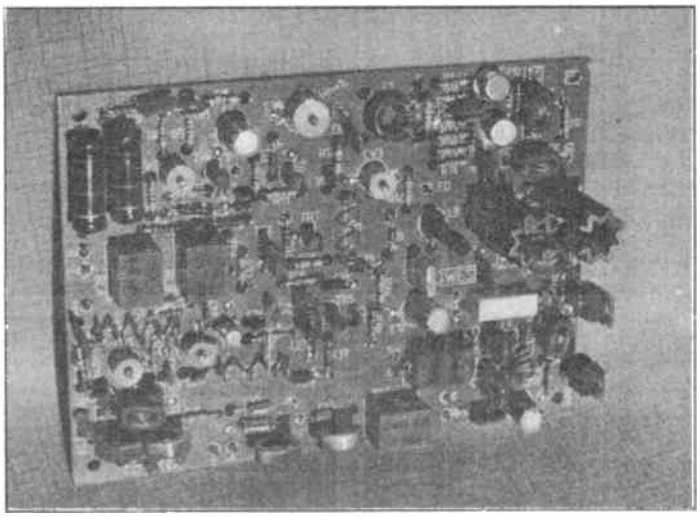
In addition to main station use, the HC220 makes HF mobile operating a practical possibility for anyone who can squeeze a 2m rig under the dashboard; the HC220 can be mounted away out of sight.

The HC220 is available in kit form or as a ready-built and tested PCB module.

Full, clear instructions, a parts list and a circuit diagram are included in the package.

The kit price is £48.90 and the assembled PCB module costs £79.90 plus 80p post and packing.

For further information contact: *CM Howes Communications, 139 Highview, Vigo, Meopham, Kent DA13 0UT. Tel: (0732) 823129.*



SPOT ON!

G4HLX has produced another gem for the radio amateur of the eighties – Spot: a comprehensive location aid software package suitable for use on the Spectrum 48K or the Spectrum Plus computers.

Features include fast, simple conversions between the universal IARU locator ('Maidenhead' system), QRA locator ('European QTH locator'), national grid reference and latitude/longitude.

It enables the user to make rapid calculations of: distance to another location; contest points; beam heading (bearing); and return bearing.

A high-resolution graphic map of Europe shows locations and the Great Circle paths between them, and this can be separated out for use in your own programs should it be necessary.

A contest log scoring facility is in a format suitable for simple copying for the RSGB, and the contest QSO map shows the locations of all locators worked and 'shades in' and counts squares worked.

All information, including maps, can be printed through a suitable printer (eg ZX printer or Alphacom 32).

The price of £4.50 covers post and packing and includes a cassette and a 6-page booklet of background information and simple instructions.

Write to: *NP Taylor, 87 Hunters Field, Stanford in the Vale, Faringdon, Oxon.*

20MHz OSCILLOSCOPE

A compact, 20MHz single-trace oscilloscope, designed to meet the need for portability and performance, is now available from Electronic and Computer Workshop Ltd.

The Crotech 3031 has a 2mV/div sensitivity and a timebase giving sweep times from 40ns to 0.2μs/div (using the built-in ×5 variable control), with triggering facilities up to 25MHz. The new 'scope has attractive, modern styling and measures just 125 × 240 × 317mm. Its weight is a comfortable 5kg.

The display is provided by a 9.5cm rectangular, flat-faced CRT with a 10 × 8 div graticule. This gives a display size of 0.66mm per div. All supplies are regulated for maximum stability, including the EHT, and accuracy is quoted at ±5%. An external horizontal amplifier can be used, connected via the external trigger socket, offering a deflection coefficient of 400mV/div and a bandwidth of 1MHz.

The 3031 has the advantage of a built-in component tester, capable of testing both active and passive components in and out of circuit. This allows performance checking of FETs, bipolar devices, Zeners, capacitors and resistors etc.

ECW offers the Crotech 3031 at a price of £238.05, including P&P and VAT.

For further information please contact: *Electronic and Computer Workshop Ltd. 171 Broomfield Rd, Chelmsford, Essex. Tel: (0245) 262149.*

POWER SUPPLY TS1515

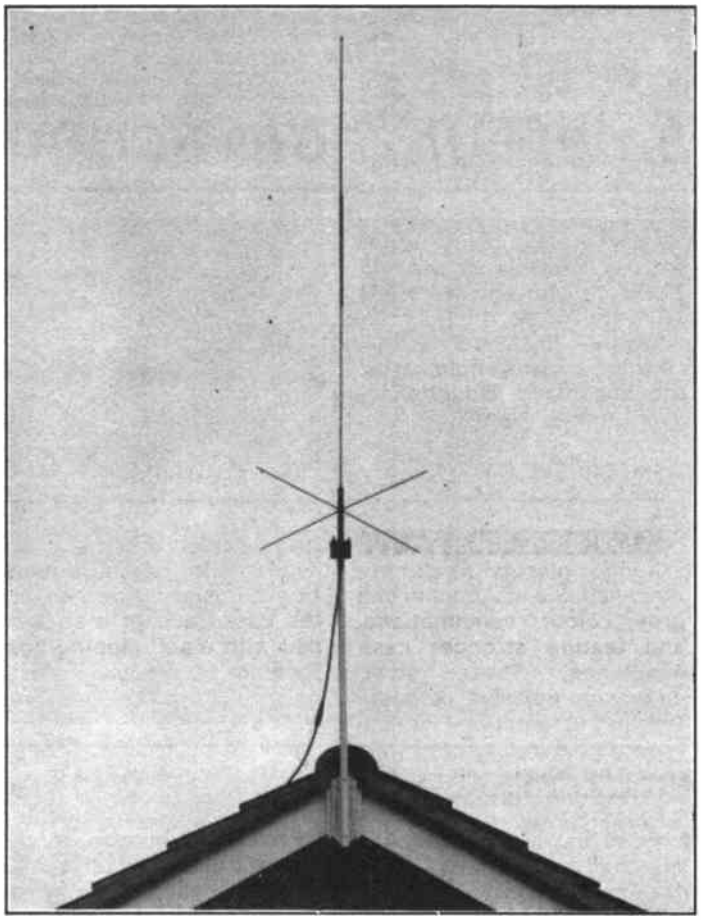
Thandar Electronics Limited has announced the launch of a new power supply designated TS1515.

The TS1515 is a robust 1.5 amp linear power supply, built to BS415/IEC 348 safety regulations, with an output voltage switchable between 5, 12 and 15 volts. Two LEDs indicated power and current limit and the output is protected against short circuits and external forward or reverse voltages. The operating voltage is set internally to 110, 120, 220 or 240 volts. Housed in a steel case stove enamelled with a grey finish, the TS1515 is complemented by an oyster reverse printed face plate.

This is the first power supply to be designed and built by Thandar Electronics Limited, and as such ideally complements other instruments in their range. Priced at £75.00, it is anticipated that schools, colleges and general training establishments will find it suitable.

For further information, please contact: *Thandar Electronics Limited, London Road, St Ives, Huntingdon, Cambs. Tel: (0480) 64646.*

STRAIGHT & LEVEL



2m COLLINEAR ANTENNA

Readers living in flat areas near the sea, where aerials suffer damage from wind and corrosion from the salty atmosphere, may be interested in a new 2 metre collinear antenna from Buckley Uvral Ltd.

The Uvral X2 is constructed using aluminium and PVC, and the Marconi principle allows the phase change necessary to feed the top element (coil).

The end result is a high gain omni-directional antenna (6dBd) which gives a good performance and is resistant to damage from the wind and rain.

It is 3.14 metres long, weighs 1.2kg and wind load is 4.6kgf at 100mph. It comes with 0.5m of UR67 cable, fitted with an 'N' socket, and has an SWR of 145MHz. Maximum power handling is 100W, with a face mounting diameter of 25mm. It costs £28.37 plus £1.50 P&P.

For further information contact: *Buckley (Uvral) Ltd, Beta Works, Range Road, Hythe, Kent CT21 6HG. Tel: (0303) 60127/8.*

PORTABLE MULTIMETER

Now available from Electronic Brokers is the Thandar TM351 multimeter which has a 3½-digit liquid-crystal display (LCD), with a 0.1% basic dc accuracy.

Features include a dc voltage range of 200mV to 1000V, an ac voltage range of 200mV to 750V with a 100μV to 1V range of resolution, current to 10A, resistance to 20MΩ and diode check facility. Offering 29 ranges, the TM351 has a maximum common mode voltage of 1000V dc or ac peak, a common mode rejection ratio (CMRR) of more than 100dB at dc 50/60Hz, and a common mode noise rejection of more than 60dB at 50/60Hz. The reading rate is 2½ per second and the input impedance is 10MΩ.

Battery operated with a life of typically 4000 hours from alkaline C type cells, the TM351 is supplied complete with batteries and test leads. An optional ac mains adaptor is available.

For more details contact: *Electronic Brokers Limited, 140-146 Camden Street, London NW1 9PB. Tel: 01-267 7070.*

FILTER BROCHURE

A F Bulgin & Company has produced a new brochure illustrating its broad range of mains inlet filters.

Designed to protect electronic equipment from mains borne interference and to reduce any similar emission the equipment itself may produce, the Bulgin range of mains filters incorporates models suitable for baseboard, bulkhead, panel or PCB mounting, with current ratings of 1-10 amps, according to the application.

Complying with international specifications, with approvals either gained or pending, all Bulgin filters, with the exception of the PCB mounting versions, are enclosed in drawn steel casings with provision for earthing. All versions are encapsulated.

Medical type filters (PS 621) exhibit exceptionally low earth leakage currents of less than 100 microamps, while in all other cases leakage currents are less than 0.35mA. The filters have an operating temperature range of −25°C to +85°C.

Bulgin's new 12-page filter brochure incorporates full technical data, plus details of recommended appliance connectors and accessories for use with these products.

For further information contact: *A F Bulgin & Company plc, Bypass Road, Barking, Essex. Tel: 01-594 5588.*

OXLEY DEVELOPMENTS

Designed for direct mounting to printed circuit boards, Oxley surface mounting pi-section filters (type SLT/P/1500/SMI) are leadless devices offering high insertion losses over a wide frequency range.

The Oxley Developments Company are manufacturers of high quality passive electronic components for the professional, industrial and military markets.

The product's low residual self-inductance and high self-resonant frequency is the result of the use of the unique square Ceramox dielectic in a feed-through configuration. The special low Q ferrite material provides a 'lossy' series impedance, which is essential for maintaining insertion loss over a range of source/load conditions.

The use of a high melting point solder (300°C mpt) for all internal joints allows vapour phase soldering techniques to be used without loss in the component's performance.

A new range of high capacitance solder-in filters is also available from the company.

Designated type dBZ4/P/−, these electromagnetic interference (EMI) suppression filters have a working voltage of 200V dc (−55°C to +85°C). Values of 22,000pF and 44,000pF nominal capacitance are available, due to the use of multilayer discoidal capacitors which enable high capacitances to be obtained in a diameter of only 4mm.

All joints are made with high melting point solder (mpt 300°C) which facilitates user assembly with 60/40 Sn/Pb solder (mpt 180°C).

The Oxley dBZ/P/− range employs a unique method of construction whereby the discoidal capacitive elements are soldered into a tubular body. This results in a strong assembly preventing handling damage.

For further details, please contact: *Oxley Developments Company Limited, Priory Park, Ulverston, Cumbria LA12 9QG. Tel: (0229) 52621.*

HEARD ISLAND ODYSSEY

This paperback, written by Kirsti Jenkins-Smith, tells the complete story of the DXpedition to this uninhabited and remote island isolated by stormy seas in the Antarctic ocean.

In 1983 the multi-interest private expedition set off for the island in a 36 year old whale-chaser, *Cheynes II*. But as the ship travelled south through the 'roaring forties', the expeditioners and crew onboard learnt that there was more than rough seas to worry about. The *Cheynes II* herself presented numerous problems that had not been anticipated.

After considerable delays, the expedition finally reached Heard Island where the members lived ashore for 11 days in primitive conditions, pursuing their aims.

At the end of their stay, they re-embarked, only to find that it was the voyage home which would really test their mettle.

The book :(ISBN 0-9589185-0-3) can be ordered from your local emporium on request, or further information can be obtained from: *HIDI-'Y' Enterprises, PO Box 90, Norfolk Island, Australia 2899.*

STRAIGHT & LEVEL

WAY DOWN IN DIXIE

Opelika may not be Alabama's best known city, but if H D Norman Jr has his way it will soon be one of the news and entertainment capitals of the world.

The 34 year old Alabama native is launching a new world-wide high frequency (HF) stereo radio station, NDXE Global Radio, that he hopes will capture listeners from Australia to Zaire, and all countries in between.

NDXE (pronounced 'In Dixie') has been several years in the making. Norman, who started as a radio station record librarian at the age of 8, conceived the idea with his mentor, the late John Herbert Orr, who produced the first US manufactured magnetic recording tape and the Orrox CMX Video Editor.

As the world's first privately owned HF stereo station, NDXE will offer programming that is totally different from the Voice of America, BBC, Radio Moscow and other government-run short wave stations. Instead of political rhetoric, NDXE's programs will feature live concerts and sporting events, world-wide phone-in shows, news, international weather and music by the world's most popular recording artists.

'A station like NDXE would have been inconceivable a few years ago because HF radio was not nearly as accessible as it is now,' Norman said. 'With today's inexpensive but sophisticated digital short wave receivers, you can dial in a station like NDXE as easily as dialling a push-button phone, and once we sign on we expect many millions of people to be tuning in.

'Here in the States, millions of short wave sets are sold, but that's just the tip of the iceberg. In many countries, short wave radio is the only game in town. We want to reach that diverse audience with programs that are available nowhere else.'

QSL cards from NDXE will be available, but its card will be the world's first 3-D holographic QSL. It was designed in conjunction with Mr Ed Weitzen, Chairman of the International Bank Note Company of New York, and will be available as one of a series of cards.

NDXE's transmitters and studios will be located in Opelika, with sales offices in Atlanta and New York City. The projected sign on date is 4 July 1986, coinciding with the rededication of the Statue of Liberty, and Norman is hoping President Reagan will throw the first switch.

Norman welcomes any enquiries and suggestions regarding NDXE. Write to: *NDXE Global Radio Headquarters, PO Box 569, Opelika, AL 36801, USA.*

CIRKIT SPRING CATALOGUE

Cirkit has now made available a 6m transverter kit which enables constructors to utilise this newly allocated frequency with their existing HF rigs. The kit, designed by G3WPO, is just one of the new introductions in Cirkit's bumper 144 page spring catalogue, which will shortly be obtainable from leading bookstalls or by post from the company's Broxbourne headquarters at the cover price of £1.15.

Covering components, equipment and information for the home constructor, the new issue features a special section with pin-outs of linear ICs, plus an enlarged section on computer communication peripherals for the Amstrad. These include modems, text dump, the RS232 interface, parallel/centronics interface and ROM card.

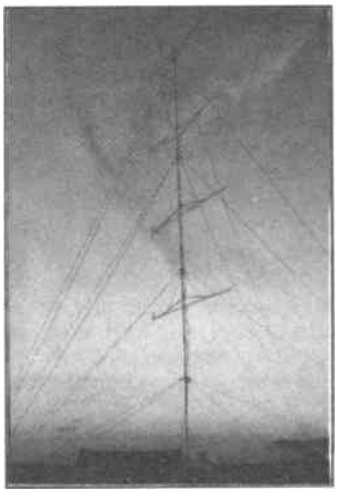
Providing virtually everything required by the electronic constructor, the catalogue also includes an expanded range of PCB drafting materials.

Originators and co-sponsors of the Young Electronic Designer Awards Scheme for full-time students in the United Kingdom, Cirkit has set up a special educational desk with its own telephone number (0992 445736) to service the individual requirements of schools, colleges, polytechnics and universities.

By contacting Cirkit, science and technology departments can receive a complimentary copy of the catalogue, and regular updates on all the latest introductions and special offers available.

For further information contact: *Cirkit Distribution, Park Lane, Broxbourne, Herts EN10 7NQ. Tel: (0992) 444111.*

PICTURE QSLs



If you want your QSL cards to make an impression, you may be interested in the services offered by the Thought Factory.

Using a photograph of your choice, the Thought Factory will print 250 colour QSL cards, with up to 50 words reverse printed in black, for £29.50, or you can have 500 cards for £42.00.

Anyone requiring further information, or sample cards, should contact: *Thought Factory, Unit 8, Hastings Road Industrial Development, Leicester. Tel: (0533) 765302.*

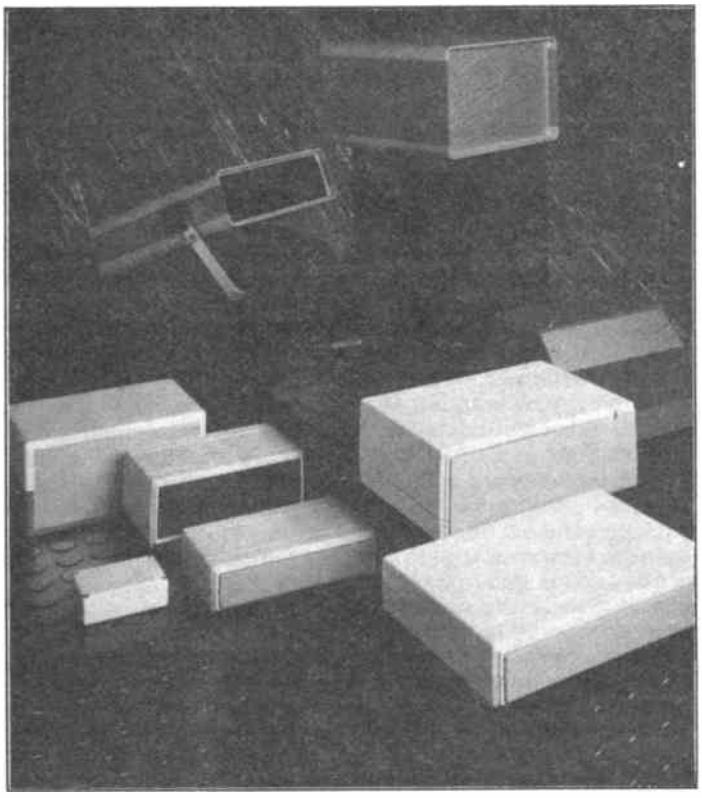
PLASTIC CASES

Apollo plastic cases are now available in light and mid grey colour combinations, and feature stronger case mouldings. These small cases, for portable or desk-top instrumentation applications, come in a range of six sizes for small single PCB applications and circuits with several boards.

The cases feature a particularly easy means of mounting boards. You simply drill four small holes in the board and insert the four plastic mounting clips provided. These clips accept a self-adhesive pad which allows them to be mounted onto the case in any position or orientation; a pre-marked grid moulded into the case is available for regular orientation if desired. Alternatively, the cases accept a stick-on pad with a self-tapping boss for more secure board mounting. PCB guides are also available.

The front and rear panels can be clipped on in a choice of positions, allowing you to conceal or display connections or controls as desired. Two colour schemes are now offered: combinations of either seafoam and chocolate or light and mid grey.

For further information contact: *BICC-Vero Electronics, Unit 5, Industrial Estate, Flanders Road, Hedge End, Southampton SO3 3LG. Tel: (04892) 5824.*



50MHz: The first weekend . . . . G3OSS reports . . .

At 2330GMT on 31 January, several dozen of the 50MHz special licencees came on to the band to have their last chat with high power before being joined by all those A licencees who were to come on at 0001GMT on 1 February. At midnight we all turned off our linears, and waited to see what would happen. One minute later, as far as London was concerned, the band seemed to go crazy, and never before in the UK had a new band been attacked with such enthusiasm by so many. I stayed up until 0130 having as many QSOs as I could, and am delighted to report that I could only work a fraction of the stations who appeared.

More response

At least two or three times more stations came on the band over the weekend than most of us had envisaged, and most were running no more than 30W ERP. Many were using makeshift aerials, one station (G2YS) using his 10MHz dipole to form five half waves. Many others used all types of normal HF beams in an attempt to be heard, and everyone seemed surprised at the reasonable signal strengths within a 50 mile radius. Conditions were actually quite poor, and the low power made DX contacts extremely difficult, so many stations resorted to CW and managed to work well beyond the normal extended groundwave distance of around 100 miles for the power used.

GB3RS came on right at the beginning, operated by John Nelson G4FRX, and Dave Evans G3OUF (General Manager of the RSGB) was also heard as an enthusiastic newcomer to the band. On the telephone to me on Monday he stated: 'Initial indications are that 50MHz is going to be a most useful and exciting band; it will inevitably reduce the pressure on the already overcrowded 144MHz band.'

We look forward to the review of the initial operating conditions which the DTI have promised after 12 months of operation. Quite a number of stations were using very low power, and I just scraped a QSO with G4OIG near Northampton, who was running 1W into a dipole, another station achieving several contacts with only 500mW into a beam. There were quite a few stations with outstanding signals who evidently had extremely good QTHs: G3BDQ, Hastings, and G2AIH, Epsom, having many good extended groundwave contacts.

New regulations

What is very clear about the new regulations is the advisability of having as much gain as possible in the antenna, allowing you to receive very weak signals more easily. There will not be any difference in the transmitted signal strength if you run 100W ERP from any antenna at a given height. However, it should be remembered that this power into a dipole will be heard by far more stations, but a dipole on receive will bring in much more band noise, including interference, than a beam.

It was obvious, studying the signal strengths, that the height of the antenna became a very major factor in getting one's signal out, but many stations were complaining bitterly that they were getting more interference from thermostats, etc than they had noted on any other band.

The RSGB are to be warmly congratulated for persuading the DTI to give us this band, and it is clear that their hard work over many years has paid off handsomely. We must all beware of one fact, though: we must not desert 70MHz, and it becomes all the more important now to encourage operation on both 50 and 70MHz to stimulate more interest in both bands, which are so very useful. Every station who came on felt that getting going on 50MHz was not only worthwhile, but a very pleasant surprise in view of the above average activity.

CLUB NEWS

Golden year

1986 marks the 50th anniversary of the Cannock Chase Amateur Radio Society. The society was started in 1936 and one of the notable events in its history was the organisation of the Worked All Britain Award scheme in 1969 (see *DX Diary* in the September issue of *Amateur Radio).*

With this in mind the society will be running a special event station on all bands from 5 to 13 April with the callsign GB4WAB.

Special QSL cards will be available to all contacts, and a specially designed award can be obtained by working the special event station and any one member of CCARS during 1986. The award will cost £1.50 including postage and packing, and all the profits from the scheme will go to the present WAB committee for distribution to the organisations sponsored by them.

Skeds can be arranged through the contest manager, Brian G0BXN, on (0543) 77558 or Alan G1AZO, on (0543) 79160, both QTHr.

Other special event stations promoting the society and Cannock Chase will be run throughout the year, the details of which will be announced at a later date.

For further information about CCARS contact: *B Robinson, 68 Langholm Drive, Heath Hayes, Cannock, Staffs WS12 5EZ. Tel: (0543) 74521.*

Memorial trophy

Members of the old South London Mobile Club recently commissioned a trophy in memory of their last Chairman, George Darling G3PGA.

The club had its origins in the earliest days of amateur radio but, although recently disbanded, its past members throughout the UK still keep in touch with each other.

The commissioned trophy was presented to the Wimbledon and District Amateur Radio Society to be awarded to the club member making the greatest contribution to amateur radio each year.

Celebrate on the air

Amateur radio enthusiasts are being invited to call up a special event station during 1986, to discuss the 100th anniversary of the birth of the motor car.

The idea is that of Shrewsbury Mercedes-Benz dealer Chris Hughes, a long standing 'ham radio' enthusiast. He persuaded Mercedes-Benz (UK) Ltd to sponsor production of the QSL contact cards and volunteered, together with three of his friends, to man the special event station.

Chris Hughes can be contacted at 6 Woodpecker Close, Sundorne Meadows, Shrewsbury, and his personal callsign is G0DOW. However, for the special event station he has been granted GB4DBZ, the last three letters of which neatly recall the names of Daimler and Benz – arguably the 'fathers' of the motor car.

He is being assisted by G4XBI (Diane), G0ALV (Clem) and G0BIJ (Eric). It is anticipated that the operation will be on all HF bands, 2 metres and 70cms, using RTTY, SSTV, FSTV and CW on all modes. They plan to be 'on the air' from 1 March for 28 days, and from 1 June for a similar period.

The centenary of the car is being celebrated all around the world, and considerable interest in this station is expected from overseas.

Memorial lecture

The Verulam Amateur Radio Club meets at the RAF Association Headquarters, New Kent Road, off Marlborough Road, St Albans, on the second and fourth Tuesdays in each month.

On Tuesday 25 March, at 7.30 for 8.00pm, the club will be holding its annual 'G3PAO Memorial Lecture' which is held each year in memory of their founder member and former Chairman, George Slaughter. This year the lecture will be delivered by Peter Chadwick G3RZP, and called 'Intermodulation, Phase Noise and Dynamic Range'. All visitors will be welcome.

For further information contact: *Hilary Claytonsmith G4JKS, 115 Marshalswick Lane, St Albans, Hertfordshire. Tel: (0923) 59318.*

Round-the-world trip

As a result of a contact on 30 September 1985 with HG4SEA/MM, Robert Senft G0AMP received the following info from Charlie HA4KYN:

On 25 September 1985 two radio amateurs from Hungary, Jozsi and Nandi, operating under the callsign

St George's Day award

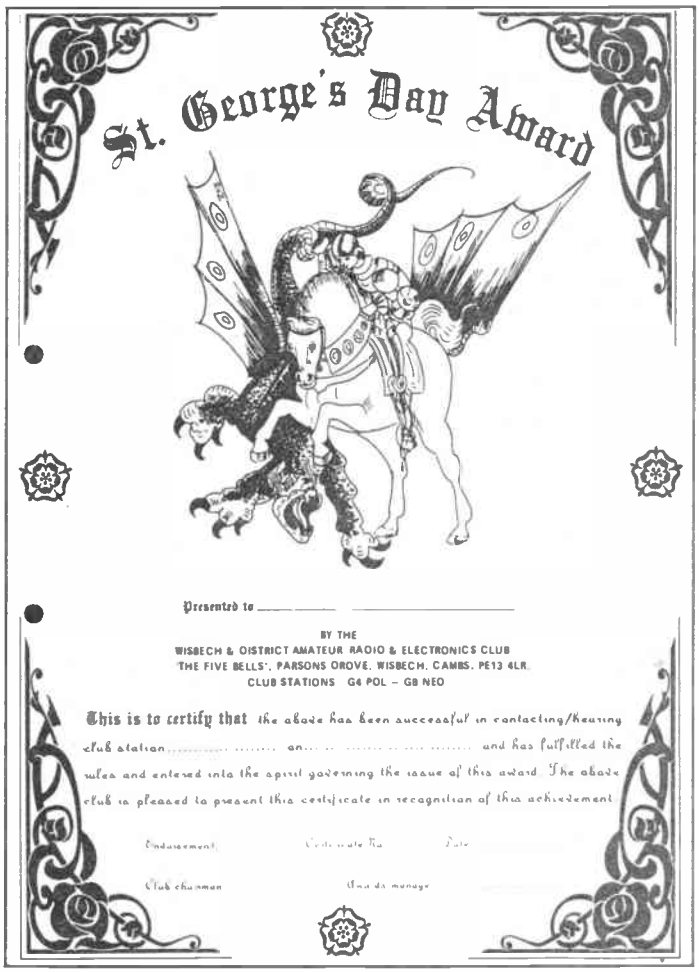
Once again this year, Wisbech and District Amateur Radio and Electronics Club are organising special event stations to celebrate the above. The three stations will be GB0SGD, GB4SGD and GB6SGD. They hope to be active on most days between the 20 April until the 17 May. To qualify, all QSOs must take place between these two dates.

Details of the award are as follows: applications for HF need to QSO with either GB0SGD or GB4SGD plus the following: applications from all G prefix calls need to QSO with 8 other stations from England; applications from EU need to QSO with 5 other stations from England; applications from the rest of the world need to QSO with 3 other stations from England.

Applications on VHF need to QSO with any of the 3 stations plus the following: applications from all G prefix calls need to QSO with any 8 English counties; applications from EU need any other 5 English stations. On VHF all QSOs must be simplex only, no repeaters to be used.

Applications will also be welcomed from all SWLs on the same basis.

The cost of the award, which is printed two colours on a white background, is as follows: all G prefix applications £1.50; EU entries, 6 IRCs, rest of the world, 8 IRCs or $3 US. Applications for the award via: *G4KHF, 'Leon', Lutton Gowts, Long Sutton, Spalding, Lincs PE12 9LQ.*



HG4SEA/MM, set off on a two to three year round-the-world boat trip from the port of Optia in YU.

The trip followed six years of preparation and planning, during which time they learned how to navigate, took the Hungarian equivalent of the RAE and learned German and English.

Meanwhile frantic fund-raising was taking place, and in 1981 a Balaton 31 type yacht body was purchased from the Balatonfured shipyard. The rest of the boat, the *St Jupat*, was designed and built by themselves, finally being completed in December 1984.

Among the main sponsors were Videoton Electronik, Kofem and Peky, the latter providing Meka 7800 type VHF navigation equipment.

The station on board comprises a Yaesu FT7B, a Hustler rig. Yaesu mobile antennas and a home-brew ATU from the Hungarian equivalent of the RSGB, the MHSZ Videoton Radio Club.

Jozsi and Nandi plan to visit ZB2,EA9, EA8, ZD8, ZD7 and ZD9, then travel around the Cape of Good Hope to FB8W, FB8Z and VKland, where they will stay for a few months until the cyclone season is over.

The journey will then continue to ZL, Polynesia, where they hope to collect ethnographical items, then they will travel around Cape Horn to LU, PY, the Caribbean, across the Atlantic to EA8 and via Gibralta to the Adriatic Sea.

Contacts will be attempted on Mondays, Wednesdays and Fridays on 14.262MHz and 21.255MHz at 12.00UT. Net controls are HG1S, HG1W, HA4KYN, HG5A, HG6V, GH7B and GH9R. QSL information should be sent to HA5NP. Other possible frequencies include 3.675, 7.075, 14.265 and 28.505MHz.

Charlie HA4XH, the secretary of MHSZ, would appreciate information regarding contacts made with HG4SEA/MM and the *St Jupat's* whereabouts. His address is: *PO Box 13, Szekesfehervar 8007, Hungary.*

Constructional contest

The Sutton and Cheam Radio Society is having a 'Constructional Contest' on 21 March. This is an annual event and the society encourages mass participation. Don't hide your light under a black box and all that!

The society meets on the third Friday of each month at 7.30pm in the Downs Lawn Tennis Club, Holland Avenue, Cheam, Surrey.

Further details can be had from: *Alan Keech G4BOX, 26 St Albans Rd, Cheam, Surrey.*

Components fair

The Pontefract and District Amateur Radio Society is holding a components fair on Sunday 16 March, from 11am to 4.30pm, at the Carleton Community Centre, Pontefract.

The event is based on the mobile radio rally but the difference is that it is aimed at the home constructor and the do it yourself enthusiast.

Traders are invited to sell components, surplus equipment, instruments and antennas only. New black box type equipment is not allowed.

For further information about this and the society's other activities contact: *Colin Mills G0AAO, 27 Pendennis Avenue, South Elmsall, Nr Pontefract. Tel: (0977) 43101.*

144MHz contest

The Barking Radio and Electronics Society's annual 144MHz contest is being held on Sunday 6 April from 13.00 to 17.00 GMT.

A full copy of the rules is available to prospective entrants, on receipt of an sae, from: *M G Toms, 32 Wellington Road, Rayleigh, Essex.*

Hamster news

The Cheshunt and District Amateur Radio Club has sent us its newsletter, *Hamster,* which gives details of its meetings for the coming months.

This month there will be a talk on HF propagation and short wave aerials by Chris Griggs on the 2nd, and a junk sale on the 19th.

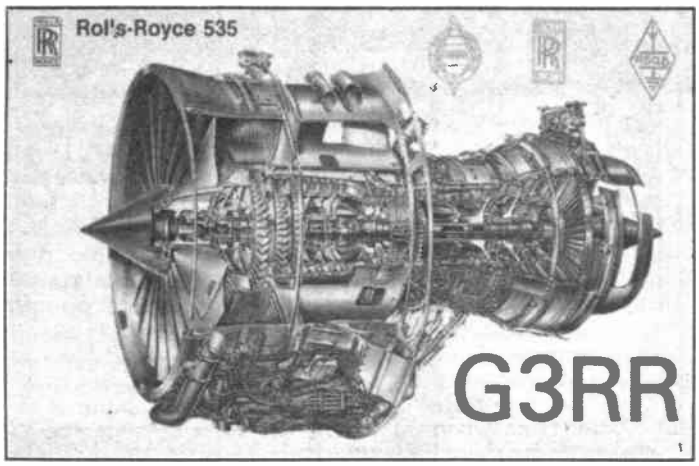
If you want more information about the club, listen in to the club net most evenings between 2000 and 2100 (local time) on the 2 metre band at 144.535MHz FM. Or you could be more conventional and write to or telephone the new joint secretaries: *Mr J and Mrs T A Watkins (G4VMR and G4VSL), c/o 51 High Street, Ware, Herts SG12 9BE. Tel: (0920) 84250 (evenings).*

Edgware net

The Edgware & District Radio Society meets on the second and fourth Thursdays of each month at 8.00pm at the Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware.

The society has a net on 1.875MHz at 22.00hrs (clock) and transmits slow Morse on 1.875 and 144.175MHz from 20.30 to 22.00 at 4 – 14 words per minute on Mondays, and from 19.30 to 21.00hrs on the first and third Thursdays of each month at 8 – 16wpm.

For further information contact: *John Cobley G4RMD, 4 Briars Close, Hatfield, Herts. Tel: Hatfield 64342.*



Rolls Royce ARC

The Rolls Royce Amateur Radio Club G3RR meets on the first Wednesday of each month at 8.00pm in the Rolls Royce Sports and Social Club, Barnoldswick, Colne, Lancashire. March's meeting will be a construction contest.

Every Monday night at 7.30pm there is a Morse class, on Tuesday afternoons a retired members' meeting, on Fridays at 8.00pm Morse transmissions on behalf of the RSGB, and on Sunday morning at 11.30am there is a natter net.

If you would like to find out more about the club's activities, contact: *L Logan G4ILG, 19 Fenton Avenue, Barnoldswick, Colne, Lancashire BB8 6HB. Tel: (0282) 812288.*

Mini rally

The Wythall Radio Club is holding a mini rally on 9 March at Wythall House, Silver Street, Wythall, South Birmingham.

The admission price of 50p will give you talk-in, a large free car park, an indoor venue housing trade stands, components and junk, bring-and-buy, club stands, bar and refreshments and will include you in the prize draw!

If you want further information, contact: *M A Pugh, 37 Forest Way, Hollywood, Birmingham B47 5JS.*

Lagan Valley

The Lagan Valley Amateur Radio Society meets at the Rathvarna Teachers Centre, Pond Park Road, Lisburn, County Antrim, on the second Monday of each month.

On Friday 14 March at 7.30pm the society is holding its annual hamfest at the Grove Activity Centre, Knockmore, Lisburn, with talk-in on S22.

Visitors are welcome to all meetings and anyone interested in finding out more about the society should contact: *W J Jackson G14TCS, 21 Carnreagh, Hillsborough, Co Down BT26 6LJ.*

Morse workshop

There will be a one day Morse workshop on Saturday 1 March at 9.30am in the Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham, Kent (nearest BR station, Clockhouse). Tea and coffee will be provided. The fee is £6.

Postal enrolments and all enquiries should be sent to: *Bromley Adult Education Service, Aylesbury Rd, Bromley, Kent. Tel: 01-464 5745.*

Equipment disposal

The Cray Valley Radio Society meets on the first and third Thursdays of each month at the Admiral Seymour Hall, Admiral Seymour Road, Eltham, London SE9, at 7.30pm.

In March the first meeting, on the 6th, will be devoted to a discussion on equipment disposal, and the second meeting, on the 20th, will be a general natter night.

For further information about the society contact: *B Rowe, 19 Madeira Park, Tunbridge Wells, Kent TN2 5SX.*

New home

Solihull Amateur Radio Society has recently changed its meeting place to the Shirley Centre, Stratford Road, Shirley, Solihull.

Meetings are held on the third Thursday of each month at 7.30pm.

Club nets are held on Fridays at 9.00pm on 1.960MHz AM, using G3GEI, and also on Sundays at 9.00pm on 145.350MHz S14 FM, using G8ZLJ. Both frequencies are ±QRM.

For further information about the society's activities please telephone the secretary, Paul Gaskin G8AYY, on (021 783) 2996.

Amateur TV

The British Amateur Television Club (BATC) is holding the usual contests this year, beginning with the 'April Fools Fiesta' on 1 April. This will be on 70cm fast scan from 0001 to 2359Z.

For details, entry forms and log sheets, send an sae to: *BATC Contest Manager, Mr M Wooding G6IQM, 3 Perkins Grove, Rugby, Warks CV21 4HU. Tel: (0788) 74494.*

The BATC publishes a hefty volume for its members which provides compulsive reading for TV amateurs.

If you are interested in this exciting hobby, or would like to find out more about the club, write to: *'Greenhurst', Pinewood Road, High Wycombe. Tel: (0494) 28899.*

Feedback

The Bury Radio Society has sent us its journal, 'Feedback', which is full of useful and interesting articles.

The society meets every Tuesday evening at 8.00pm in the clubroom at the Mosses Youth and Community Centre, Cecil Street, Bury.

For further information contact: *C J Ashworth, 16 Wheelton Close, Bury BL8 2HZ. Tel: (061) 761 5018.*

Wimbledon

The Wimbledon and District Amateur Radio Society meets on the second and last Fridays of each month at the St John's Ambulance HQ, 124 Kingston Road, Wimbledon, London SW19

On 14 March they are having a surplus equipment sale and this, like all other meetings, begins at 8.00pm.

For more details contact: *George Cripps, WDARS Secretary. Tel: 01-540 2180.*

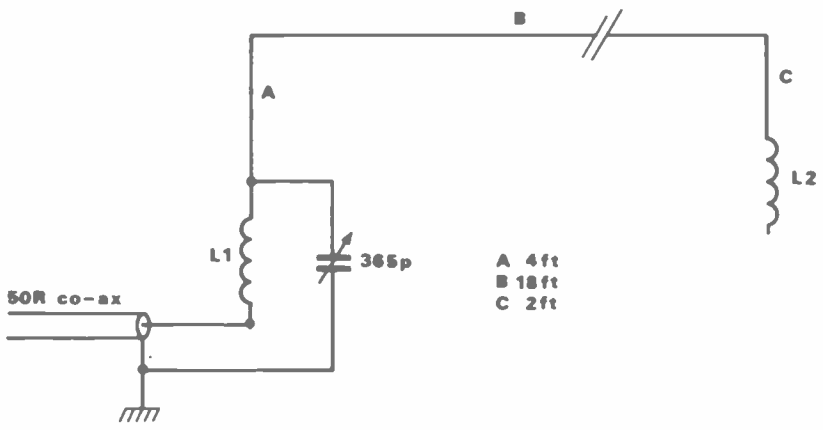
WARS

The Worksop Amateur Radio Society will show a video called 'Secret Listeners' on 11 March, and there will be a darts and dominoes night with the Worksop branch of the British Sub Aqua Club on the 25th.

If you would like to find out more about WARS, contact: *The Hon Secretary, Mrs C S Gee, 100 Plantation Hill, Worksop, Notts. Tel: 486614.*

OOPS!

In last month's magazine the diagram on page 46 of the 'Apartment 80' antenna article was drawn incorrectly. This has been corrected and re-printed below. Please accept our apologies for the mistake and our thanks to those who pointed it out.



L·E·T·T·E·R·S

IMPERIAL METRIC?

In the February issue of *Amateur Radio*, under the heading 'Old Fashioned', there was a letter from Philip Lane, Dyfed which covered the question of using imperial and metric systems of measurement. He also suggested that *Amateur Radio* and *Radio & Electronics World* should lead a crusade to straighten out the whole glorious mess. I have a good deal of sympathy with what Philip Lane says.

However, before *AR* and *R&EW* go ahead with their usual enthusiasm to sort out the imperial/metric measurement jungle, perhaps they should consider the following thoughts from this ancient person, who can quite happily work in imperial or metric:

1. Just after reading his letter I went to the local hardware shop to try and buy some plastic pipe to form the basis of an experimental helical antenna. The assistant pointed out with knowledgeable interest that I should buy a length of *standard* ¾in dia plastic waste pipe which had a diameter of ⅞in when measured! I asked for a 6 foot long length. All very imperial!

'Sorry Sir', said he, 'we sell it by the metre – you will have to buy 2 metres.' All very metric!

'Ah!' says I. 'Why does the standard ¾in waste pipe have a diameter of ⅞in and is sold by the metre length?'

'Sir', says he, very patiently and kindly, 'because we are in the European Common Market.' And so I learned, at this ripe old age, that as we are in the EEC we buy waste pipe in *imperial* diameters and *metric* lengths!

When I took out a handful of coins to pay for the piping, some of the 10p coins were stamped 'two shillings' and the 5p coins stamped 'one shilling'.

Now this, of course, should have left me completely (and unusually) speechless – so imagine my delight, a little later, when I was looking at the 12.30 BBC1 news...

A very well-known pro-European politician was being interviewed. He went to great length (like this letter?) to pontificate that 'the British must realise that the UK is part of Europe'. He then concluded by saying 'I am flying to Europe later today!'

2. I think that it is generally agreed that the *ARRL Antenna Book* is our amateur radio antenna Bible. Imagine a scene in 10,000 years time when archaeologists arrive in their rocket ships from the outer parts of the Universe. They have immediate luck and excavate the 1986 vintage amateur radio station G9JOE.

They discover a virgin copy of last year's *ARRL Antenna Book*. This is immediately scanned and reprinted on their instant computer translator, and this is what they will find: a 40 metre dipole is approx 66 feet long. 66 feet is equal to 20 metres length. The readout then concludes: 'from this we can assume that 40 metres is equal to 20 metres'!

So, *Amateur Radio* and *Radio & Electronics World*, think carefully before starting a metric/imperial crusade!

Keep up the good work.

Richard Marris G2BZQ, Slough

SUCCESS STORY

I would just like to write and thank you for the series of articles that you printed in 1985, entitled *Back to Basics*.

I became interested in the RAE in January 1985 and sent off a subscription for *Amateur Radio* plus an order for the November and December 1984 back issues. After reading these first three issues I decided it would be a waste of time and let things slide.

We then went to the Isle of Man on holiday in June and visited a friend who lives in Colby who awakened my interest – he has a B licence.

He persuaded me to 'have a go' so, this being more of a challenge, I came home and got out all my issues of *Amateur Radio* and started to swot. I went along to the local Radio Club three times, but I then developed eye trouble and couldn't drive (after 52 years) the 9 miles to the club.

In October I lost the sight in my right eye completely and had only 50% vision in my left one. I bought the RSGB book, *Preparing for the RAE*, and with this and your articles I studied hard. I went to the Leicester Radio Exhibition and bought a Trio R2000 and struggled home with it by bus. I also made three trips to the Riverside Technical College to make sure I was booked in for the December RAE which, due to the problems within the Liverpool council, was only confirmed 1 week before the exam!

My son-in-law took me the 18 miles to the technical college for the exam, and then I waited. Not too hopeful, with no classes attended.

This morning's post brought me the results: 01 Lic conditions & transmit interference – Pass!
02 Op practice, procedures & theory – Credit!

I am overjoyed, especially when I tell you that in a couple of months I will be 70!

I am now practising for the Morse test. All on half an eye and *Amateur Radio!*

E A Kent, Merseyside.

DRIVEL, PURE UNADULTERATED DRIVEL

I wish that I could put my sentiments a little stronger, but I guess I had better stay within the realms of decency. Not wishing to be such a crass bore as our friend and novelist, Mr Bolton (see February issue), I will not itemise as he has.

Let me first explain that I am a CB user, and have been for much longer than I would care to admit in court, so I have not got a particularly one-sided view of the world.

It befalls me, and my ilk, to look after and repair many CB radios, and in general the people I am dealing with are Mr and Mrs Average who, for one reason or another, wish to use a method of short range communication. Then there is the frustrated ham.

This is the same man who brings to me (and my like) a 500 watt linear, a multimode rig which covers from 25.850 to 28.110, and an ATU that he paid £8.25 for, saying, 'I'm not sure but I fink me matcher's blown up'.

The above type is the CB user who will manage a passable job of getting up hams' facial bits every time, with their pedantic rantings.

Oh, and one last thought, has it ever occurred to any one that all of the comments in the vein of Mr Bolton's invariably come from people who either a) are ex-radio ops, or b) have only experienced CB since November '81.

John Smith G4VEL, Norfolk

RIS QUIBBLE

With reference to Mr Bolton's letter (February issue), I would like to pass comment on the RIS and their activities.

I have been active on the HF bands since 13 April '85 and on 15 April '85 I had a complaint of a breakthrough on a neighbour's mains medium wave radio receiver. I tried to cure this problem with ferrite rings and rods, with no success, so I told the person concerned to fill in the appropriate form.

On 15 May '85 the RIS arrived and carried out tests while I was on the air. They told me that the problem could be solved and they would call back at a later date.

Anyway, the days went by and there was no sign of the RIS people. Tempers got shorter, words were exchanged.

I wrote the RIS a letter, and another, and they sent me a post card telling me to be patient while they busily made the equipment to cure the problem.

Well, I am no wizard when it comes to electronics, but I would have thought the components were readily available.

Coming back to Mr Bolton's letter, perhaps the RIS *are* busy spending my licence fee chasing the wallies off the air – but who am I to say how they spend money? I only pay £12 every year!

I would be interested to hear from anyone having any communication (or absence of it!) with the RIS as I haven't seen them since 15 May.

Fred Fenwick G0AOJ, Humberside

DX DIARY

News for HF operators compiled by Don Field G3XTT

1986 seems to have got off to a flying start, at least as far as the DXer is concerned. Looking back over what was heard and worked in January, it's hard to believe that we are in the doldrums of the sunspot cycle. Within the first few weeks of the year at least one G operator had worked 39 of the 40 zones towards the *CQ Magazine* anniversary award, Kermadec Island had been worked in the UK on 80 metres, and VU2GDG was putting in regular appearances on 160 metres SSB. Only 10 metres seemed immune to DX activity.

10m satellite frequencies

Appearances can, of course, be deceptive. Although there have been few recent ionospheric openings on 10 metres, there is another kind of DX to be found on the band. This is by way of the downlink frequencies of the various Russian satellites. Satellites RS9 and RS10 were due to be launched in February, so to bring readers up to date the table shows the frequencies concerned.

Even if you are not a satellite user, please keep these frequencies clear for those who are. Of course, for the most part these satellites use 2 metres for the uplink, but there are indications that there will soon be at least one satellite with a 21/28MHz transponder, putting it very much into the realms of the HF enthusiast. Fortunately many current HF rigs permit split operation with the transmit frequency on a different band to the receive frequency, so such a satellite could prove to be quite an attraction. Unfortunately, data from Russia regarding these satellites is sparse, so it's largely a case of keeping your ear to the grapevine.

Beacons

In an earlier column I discussed and listed the various 10 metre beacons. The future of the 28MHz beacon band has now been discussed by the IARU Administrative Council. They are hoping to abolish the present chain of beacons and replace it with one based on time-sharing principles, similar to that operating on 14100kHz. There would be several (possibly closely-spaced) channels in use, one for a world-wide beacon chain and others for regional chains. The reason for taking this step is to reduce the amount of the 28MHz band occupied by beacons from 100kHz to 10kHz, thus releasing some valuable frequency space for other purposes.

Disadvantages

The IARU proposal does, however, have disadvantages. These are:
Having to wait for up to 10 minutes to see whether a particular beacon is audible.
Being unable to monitor a particular propagation path continuously.
The need for narrow receive filters to separate beacons only 1kHz apart.
The problems of maintaining unsupervised beacons in remote locations to the necessary tolerances of frequency and time.
The cost of new equipment for all existing beacons.
Not being able to pass detailed information (propagation data and other telemetry) in the short time-slots.

Before the proposals become too far advanced, Martin Atherton G3ZAY, Chairman of the RSGB HF Committee, is inviting comments. If you feel strongly either for or against the new proposals, then write to him at Box 146, Cambridge.

Band reports

Just to give you some idea of what was about during January, let me try to summarise. Top Band was awash with DX, partly because of contests held towards the end of the month. CW DX included 9M2AX, P29PR, 4U1UN, ZS5LB, ZL3GQ, YU3KI/5N0, KH0BKX, OA4ZV, VE3ICR/VP2M, VK6HD, VS6DO, UA1OT (Franz Josef Land), JW0A, W1BIH/PJ2, YV2IF, VP2EC, HK1AMW, JT0APE, J37AE, VP2VA, 4X4VE, FM5WD, W6s and 7s. SSB produced VU2GDG, 4U1UN, CE8ABF, HH7PV, TG9NX, UA1OT, ZF2JB, VP9BO, JY4MB, CO2CB, and 5T5CJ.

On 80 metres the list is just as impressive. On CW JT0APE, PZ1AP and VU2TTC were contacted, while on SSB S90AS, P4/KQ2M, TJ1AF, VK9LM, 8R1RPN, H44IA, HH2MC, J87BZ, ZD7CW, 3D2DM, 4S7NMR, TA1E, AP2SQ, TU2CJ, KH0AC, KL7NT, VR6JR, ZL8OY, 5V7AS, OX3JF, JG1FVZ/5N0, P29JS and SU1HK were worked. In addition several USSR stations in zone 19 put in an appearance, much to the delight of those chasing the 5BWAZ award.

As for the higher bands, 40 metres has been producing much the same sort of DX as 80, while on 20 metres the New Year saw some impressive openings to the Pacific and South-East Asia. 15 metre DX was confined mainly to Africa and South America.

News

K4LTA, N4FKC, WA8FSX, N4MMV, NF5Z, K0OSN, N4KOV, W5PWG and N6LHN were due to be in Grenada until 5 March. Look for them signing their own calls /J3.

VR6JR is now back in the UK. During his stay on Pitcairn Island he made about 12,000 contacts. If you heard his excellent signals on 80 metres you may be surprised to know that he was using a dipole at only 30ft. VR6IC, Irma Christian, should now be active from Pitcairn, mainly on CW.

Egypt

G4RWJ/SU is in Egypt but, at the time of writing, had a broken rig! He hopes to be operational by mid-February.

NK7K was due to be active as A35WZ until 4 March. QSL via NE7W.

Aruba

P4/PA0FM is currently active (often on 14170kHz from 1930Z) and should be there until the end of April. P4DO, a resident, is also quite active, particularly on 20 metres in the evenings, although he has also been heard on 80 metres SSB. Still no news of whether this one will count as a new country (see last month's column).

Sao Tome

Yet another station appeared from Sao Tome in January, this time S90AS. The operator was Salvatore IT9AZS, a doctor working in various African countries. He was worked on 80, 40, 20 and 15 metres with an unconfirmed report on 160. From there he went on to Togo as 5V7AS, and should then have operated from Benin (TY) before returning home. QSLs go to his home call.

Awards

An award will be issued to commemorate the 10th Asian Games to be held in Seoul, from 20 September to 5 October. There will be two classes of award for confirmed contacts during the period 1 January to 5 October 1986 as follows:

Class HL: Issued for confirmed contacts with 10 HL stations, including at least one HL1 (Seoul).

Class DX: Issued for confirmed contacts with 10 countries participating in the games, including one HL station. The award is also available to listeners.

The special station HL86AG will be operational during the games and QSL cards from that station will count for 5 HL stations, or for 5 countries towards the two classes of award. All applications (with 10 IRCs) go to the Korean ARL, CPO Box 162, Seoul 100, Korea.

Contests

Several major international contests take place during March. Last month I mentioned the ARRL SSB contest on 1/2 March – the RSGB Commonwealth Contest takes place the following weekend. This is usually a very pleasant contest for the CW enthusiast, not too frenetic but with some interesting DX to be worked.

The big one on the 15/16 March is the Bermuda Contest; I can help with full details of the rules if required. The event runs for 48 hours and involves working (mainly) North American stations, but with multipliers gained by working the various Bermuda parishes on each of the five bands. The great incentive is that the leading UK station each year wins a free holiday in Bermuda. The rules insist, though, that you operate from your own station, so it's no good borrowing a friend's antenna farm for the weekend.

The CQ WPX SSB Contest runs for 48 hours on 29/30 March. Contest exchange consists of a signal report and a serial number. On 10,15 and 20 metres one point is scored for each contact with one's own continent (contacts with your own country do not score), and three points for contacts with other continents.

On the LF bands the scores are twice these. The final score is the sum of QSO points multiplied by the total number of prefixes worked, regardless of band. As usual I can help out with log and cover sheets, etc on receipt of an sae.

Two as one

The two islands of San Andres and Providencia count as a single country for DXCC. HK0BKX and HK0HEU are regularly active on all bands (see the earlier report of 160 metre activity) and there have been operations from time to time by visiting amateurs.

What is less well-known is that these islands were first colonised by 90 Englishmen in May 1631, and Old Providence, as it was then called, became the fourth English colony in the Carribean. The Providence company had been founded just a year earlier, in 1630, and given the right not only to colonise but to fit and arm ships and, if attacked, to retaliate.

The company directors were all puritans and their main aim was to establish a model puritan colony. They chose Providence, a volcanic island, as their main base rather than San Andres, a coral island, because it had a safe natural harbour.

The colony was not a success, a fact attributed by some historians to the climate, which was too pleasant and not conducive to the puritan mentality. The island soon became a major centre for piracy and the slave trade which led to the colony's downfall in 1641 when the Spanish admiral Francisco Diaz de Pimienta, fed up with the attacks on his ships, invaded and took control of the island.

After this the islands were settled by planters, woodcutters and Negro slaves from Jamaica.

They were awarded to Spain in 1786 and became part of Colombia in 1822. Curiously, through all this chequered history, the population has remained English speaking.

The islands, which are located 440 miles North West of Colombia and 110 miles from the coast of Nicaragua, cover 17 square miles and have a total (declining) population of about 30,000. The main industry nowadays is tourism, although San Andres produces coconuts, copra and oranges.

DXpeditions

A couple of months ago I invited comments on the pros and cons of DXpedition operations.

Goff Curtis, who as a listener usually writes in to Trevor, comments in favour. To him DX operations provide an element of excitement on the bands, in comparison with the tedium of most QSOs.

On the other hand, he says, too few DX operators make a determined effort to control their frequency. Goff believes, from his own listening, that much of the bad behaviour in pile-ups could be prevented if DX operators were stricter in their approach.

Goff cites examples of DX stations who he has heard taking this approach with excellent results.

That wraps things up for another month. Keep the news and comments coming. My address once again is 105 Shiplake Bottom, Peppard Common, Henley on Thames, Oxon RG9 5HJ.

USSR satellite frequencies in the 28MHz band

Frequency (kHz)	Satellite number	Usage
Existing		
29331	RS5	Robot telemetry & code store downlink
29341	RS7	Robot telemetry & code store downlink
29350	RS5/7	Command downlink transponder channel
29400	RS1	Telemetry downlink (only when satellite in sunlight)
29410	RS5	Downlink transponder (LF edge)
29450	RS5	Downlink transponder (HF edge)
29451	RS5	Main telemetry beacon
29460	RS7	Downlink transponder (LF edge)
29500	RS7	Downlink transponder (HF edge)
29501	RS7	Main telemetry beacon
Immediate future		
29320	RS9	Robot telemetry downlink
29360	RS9	Downlink transponder (LF edge)
29400	RS9	Downlink transponder (HF edge)
29402	RS9	Main telemetry beacon
29457	RS10	Robot telemetry downlink
29460	RS10	Downlink transponder (LF edge)
29500	RS10	Downlink transponder (HF edge)
29503	RS10	Main telemetry beacon

Notes

All frequencies are ± doppler shift.

Beacons run continuously. Until 5 April the RS5 transponder will operate Tuesdays and Saturdays, and RS7 on Wednesdays, Fridays and Sundays. From then until late June both transponders will operate continuously.

RIG OF THE YEAR

Angus McKenzie G3OSS takes the pick of the crop of the rigs brought out in 1985

In looking back over the rigs delivered to me in 1985 and reviewed in this magazine, it has struck me that quite a few of them are probably the best available products in their field. Consequently, I thought it might be useful to write up a résumé of the best rigs of the year and choose one particular rig which I feel is worthy of the title of 'top rig of the year'.

I was very surprised to see fewer imported rigs in the second half of the year, and it stuck me that Japanese manufacturers are at last heeding the advice given to them by so many dealers around the world: they should first design a rig to work properly, have good ergonomics and then keep it available for a longer period before introducing a new model.

Advancing technology

We seem to be in an age in which technology is advancing very fast; so many of last year's rigs have shown significant improvements over those of the year before. Notwithstanding all the excellent new products mentioned in this résumé, I still feel that there is a very great need for more basic rigs, especially at HF, which only combine the facilities that are really needed with superb technical performance. One must ask the question 'Do you really need 99 memories, searching, complex scanning etc etc?' I suggest that a really up to date version of the Trio TS130 mobile HF transceiver, including 160m and a better receiver front-end, would sell extremely well if the production line was planned to continue for many years. This could keep the cost down and allow many to purchase the set instead of buying a secondhand cattle truck.

Almost all rigs now employ synthesiser VFOs, and there are many who regret this. It is probably inevitable, though, since it is a lot cheaper now to design a synthesiser local oscillator using off-the-shelf chips than it is to design a complete analogue VFO system. What is very obvious is that one or two manufacturers have not as yet discovered how to design their synthesiser circuits without producing quite a lot of phase noise around the injection frequency. Matters are getting better, though, and both Icom and Trio seem to be coping very well in this area.

Most HF and VHF front-ends are reasonably good now, but they nearly all employ bandpass filters instead of tuned peaking circuits. RF input intercept points are a lot better now than they used to be, but the odd manufacturer has still had problem areas in gain optimisation at RF and the various IFs. Many older rigs had too much front-end gain and this is the worst situation, but what can be almost as bad is excessive first IF gain, especially when the roofing filters are too wide.

Some two years ago, I discussed the various ways of getting on to the 2m band and explained that a simple and older multimode rig was good for starters, but the next step up was to use an HF rig and an average transverter. The receive sensitivity performance could be improved by adding a masthead pre-amp, but one would have to suffer the consequences of considerably degraded RF intermodulation because of the extra gain, so up to around nine months ago the best system was a multimode 2m transceiver fitted with a muTek front-end, which gave greatly increased dynamic range. Now, however, the situation completely reverses, and I have no doubt at all that the best commercial installation is the new muTek 2m transverter combined with the HF rigs recommended in this article.

Top rig of the year

Although I have been on 2m SSB for over 20 years, I have never been anywhere near satisfied with any of the transverters that I have used with various HF rigs. This is because the system intercept point had fallen far short of what is clearly needed in a large city. Typical British designed or imported transverters themselves had an input intercept point at −20dBm, and many models had so much gain that the overload problems were sometimes in the HF transceiver, the system having a combined intercept point as bad as perhaps −35dBm. I have had so many arguments with importers and manufacturers about this over the years who were not prepared to believe that both in and out of band signals were as strong as they actually are. Now I have the evidence showing the astonishing strengths of signals between 140 and 150MHz (*Figure 1*). I therefore had to wait until last summer before I could see the real potential of 2m in Greater London, for it was then that I received my own muTek 2m transverter, having reviewed a prototype in the October 1985 issue of *Amateur Radio*.

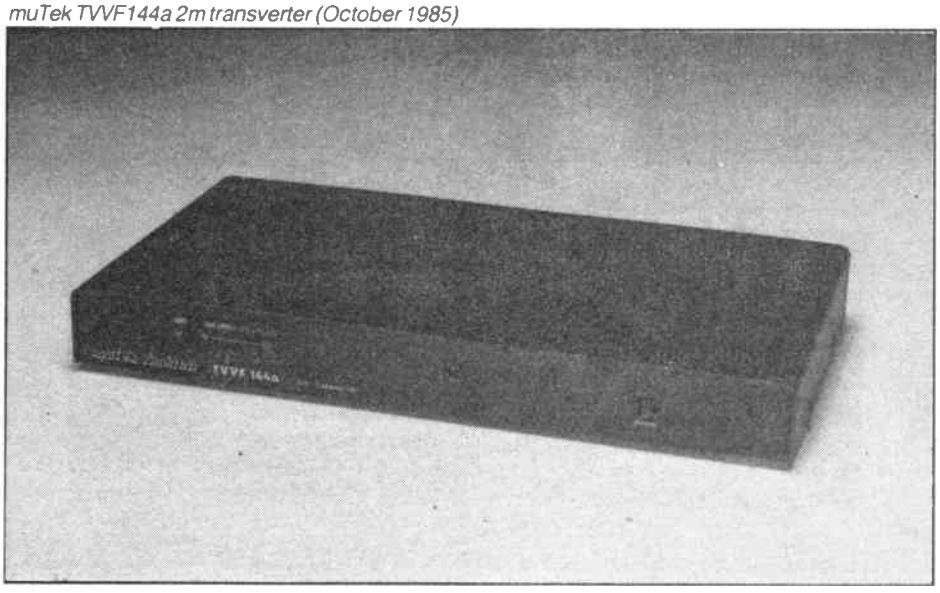
Not satisfactory

The prototype review sample did not have the ALC circuits working satisfactorily, as Trio HF transceivers require a higher negative cut-off voltage than do most other makes. The sample that I purchased two months later, however, had more than enough cut-off voltage, and works superbly well with my TS940S. Not only is the transverter's noise figure as good as a rig with a muTek front-end, but the RF intercept point is excellent; indeed some 23dB better at +3dBm than older Microwave Modules transverters, and around 16dB better than their new model.

Although the nominal receive gain is just over 20dB, some HF transceivers are so sensitive that even this lower than usual gain is unnecessary, and muTek provide an internal preset to cut the gain down to as low as 8dB if required. Stability is superb and I have never detected any spurious Rx products.

Not only have all the measurements been excellent on both Rx and Tx, but having carefully set up the Tx input sensitivity, the internal ALC loop and

muTek TVVF144a 2m transverter (October 1985)



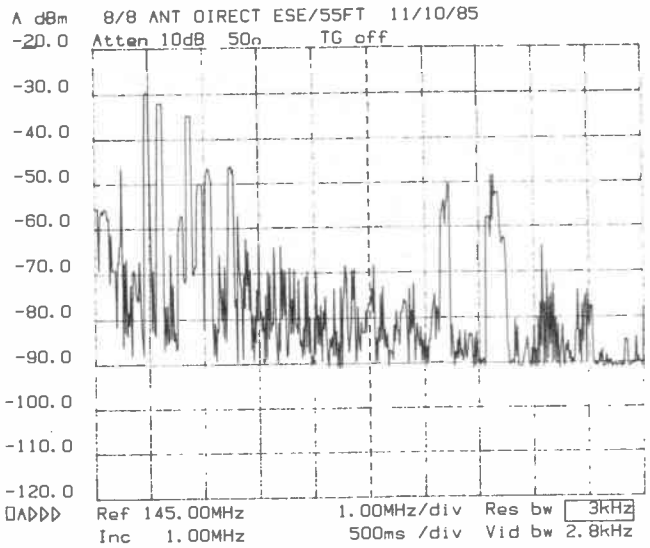


Fig 1 *Showing strength of signals between 140 and 150MHz on typical British transverters*

external ALC drive back to the TS940S driver has worked so well that stations have particularly commented on the high quality of the transmissions, and the very narrow band occupancy.

The transverter has separate 28MHz input and output sockets, but the input drive socket can be wired up internally for common transceive operation in which a separate Rx output is not required. 10W PEP output is available on SSB and CW, and the rig copes excellently with FM with a long duty cycle.

In the review I showed how good the two-tone intermod performance is. The multi-pin power socket includes 13V dc interconnections, PTT, ALC return and a pin which can give 13V dc for energising external relays, or a short on Tx line (see original review, *Amateur Radio*, October 1985).The product is superbly well made, and my use of it, with the TS940S, has allowed me to hear very weak stations that are not covered up by low level intermodulation products and mush resulting from the scrambled mixture of so many out of band PMR and other stations. Band noise seems to have decreased appreciably, but the RF sensitivity most certainly has not.

I regularly switch in a muTek masthead GaAsFET pre-amp with a separate control unit when I am working late at night, and I can only just hear the system sensitivity improvement thus given, which is proof enough that the receiver is excellent.

It is over 20 years since SSB began to become popular on the band, but I suggest that this is the first really hot rig which brings true DX performance to an operator who does not want to build his own gear. As I have no criticisms at all, and this is somewhat rare, I feel it only fair to award this rig my highest accolade for 1985. I most strongly recommend that you look at this transverter, in combination with either the TS940S or IC735, if you want to see 2m performance transformed, especially if you are in an area in which there are many strong signals about. My heartiest congratulations to muTek for a superb product.

HF equipment

When I looked at the first prototype Trio TS940S to come into the UK about a year ago, I was rather excited about it and considered that all its features seemed well in advance of any opposition. Because its performance was so outstanding in so many areas (including an excellent RF front-end, good IF filters, excellent audio quality (except for AM) and a very good Tx performance), I delved deeply into some of the trickier areas and found just two parameters which had to be criticised. The local oscillator phase noise on two separate samples tested was a few dB inferior to that of the TS930, and the quality of AM was adequate rather than excellent.

The problem with AM was that the distortion was rather high, although this is all too common with Japanese rigs. John Thorpe of Lowe Electronics agreed to look into both the problem areas, and soon found a way of making a dramatic improvement of 12dB to the reciprocal mixing performance, bringing it up to that of the best synthesiser rigs available, and also improved AM distortion so that even at peak modulation it was well below 1% instead of around 12%.

I agreed to purchase one, provided that I could switch the AM between the normal wide bandwidth and the 6kHz optional filter, rather than only one of these choices, with the alternative position being the SSB filter, as originally intended by Trio. When the modified rig arrived I was delighted with it, as I still am some nine months later. There are very few rigs indeed that I do not have slight regrets about after such a period, but this is most certainly one of them, although two little niggling problems have cropped up, both of which seem to have now been rectified.

Strange flux

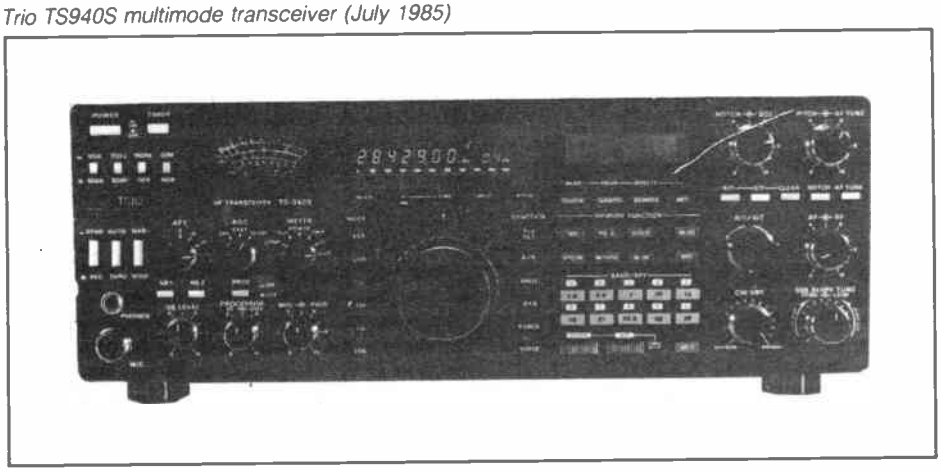
The first was due to slight intermittencies in the interstage multi-pin plugs and sockets, caused by a rather strange flux used in early samples by Trio, whilst the second problem was an occasional complete cessation of output from one of the local oscillator circuits, which muted the receiver either momentarily or until I poked it about inside.

I have been able to interface the TS940S successfully with Amtor, with a high quality record and play back cassette tape recorder, and even with my professional studio audio equipment for a bit of fun, and have not had any interfacing problems. I have made very full use of many of the remote control features and all the transverter drive functions, and I use the rig now for the LF and HF bands as well as all other bands from 50MHz up to 2.3GHz with appropriate external transverters.

There is not much that I can add to the July 1985 review, other than the fact that many amateurs have contacted me after they have bought the rig and have stated that they are delighted with its performance and quality. Most of them have requested the Lowe Electronics modifications, which cost only around £40 more than the cost of the extra AM filter, so I most strongly recommend you to have these in. Lowe Electronics are not prepared to put these into Kenwood rather than Trio samples, however.

The fact that the automatic ATU option covers down to the 160m band is most useful, and I find that it usually tunes up within a few seconds. The rig's ability to give very good performance on all modes, including FM, is a great advantage, and the filter bandwidths are far better optimised, particularly on FM, as

Trio TS940S multimode transceiver (July 1985)



compared with most other transceivers. The most useful more esoteric functions are the RF front-end attenuator switching in 10dB steps down to –10dB (superb for use with transverters), the memory and VFO facilities which allow calling frequencies and beacons to be appropriately stored in four groups of 10 memories, and the remarkable, and most convenient, IF selectivity switching – separate for CW and SSB. As I am blind, I also find the speech frequency readout system a boon, although the one on the IC751 is also quite good.

Finest HF transceiver

Having tried around 40 HF rigs over the years, I have no doubt in my own mind that the Trio TS940S, with Lowe modifications, is the finest amateur radio HF transceiver that I have ever used, so I must clearly recommend it as my favourite HF main station transceiver.

There is of course one snag: its price ticket of around £1700 basic, plus Lowe modifications at £98 etc. One must be fair, though, for if we compare this with the seven-times inflation since 1962, and the average wage increase of twelve times in the same period, one can see that one's pocket is not really being hurt any more than by a KW200A when it came out over 20 years ago, but what a difference in performance!

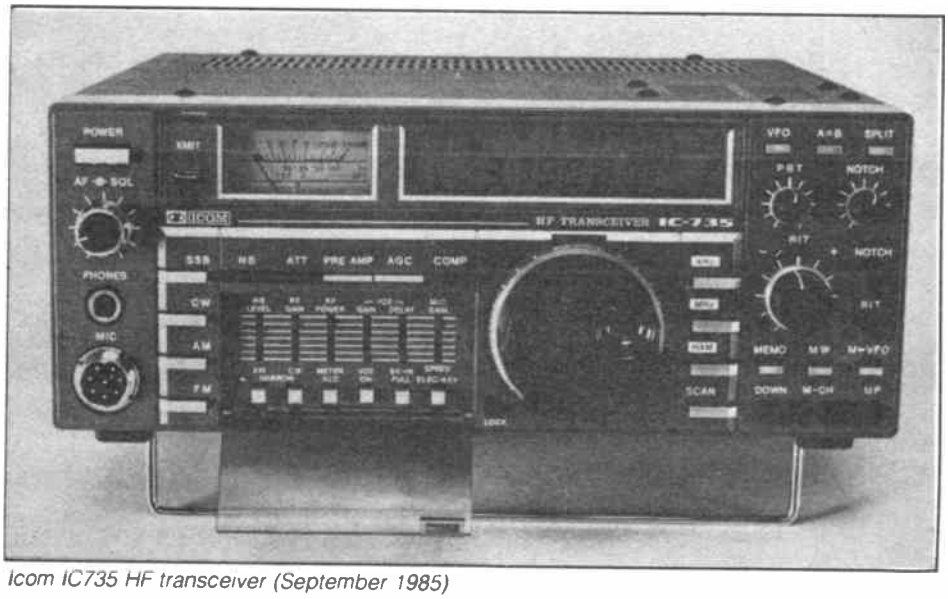
This begs the question that whilst many consider rigs to be very expensive today, they have not actually been any cheaper in the past if one considers inflation and average earnings. A very good rig has always been a big hole in the pocket, and often necessitated a visit to the bank manager.

If you want a really good HF mobile rig which will also give a far above average performance as a main station, it is definitely worth your while to look at the Icom IC735 transceiver. This model is amazingly compact and yet offers so many good facilities (*Amateur Radio* September 1985).

Most unhappy

When I reviewed the IC745, in another magazine, I stated that I was most unhappy with the gain optimisation and that the second mixer was being overdriven when more than one signal passed through the first IF within the passband of the roofing filter. The same situation, but to a lesser degree, applied to the IC751, but the IC735 is quite a lot better, and sounds cleaner for it, especially on the LF bands. It includes general coverage reception from 100kHz to 30MHz, and AM, FM, SSB, CW and AFSK modes are incorporated. Although the rig is similarly styled to its predecessors, it is somewhat smaller and easier to use. It offers excellent interfacing, including the capability of driving transverters (30mV into 50 ohms), and a computer interface is also available.

I warmly recommend this rig and many of my friends have bought one and been very happy. The IC735 thus deserves its place as one of the best rigs of 1985.



Icom IC735 HF transceiver (September 1985)

Although the Trio TS940S has an excellent optional auto ATU, the matching range is limited to around 3.5:1. Consequently you may like to consider a comprehensive manual ATU, especially if you buy a rig such as the IC735 which requires the load to be well within 2:1.

I was very impressed with the Cap Co SPC300 ATU, reviewed in the January 1986 issue, which includes a roller coaster inductor in its circuitry. It can not only match an amazingly wide range of resistive and reactive impedances, but its steep high-pass filter action allows it to reject even the top end of medium wave very successfully when you are on the 1.8MHz band, thus removing a lot of interference which causes problems to many solid-state rigs on Rx. Latest versions of the SPC300 performed very satisfactorily from 1.8 to 30MHz, but on an early sample I noted rather a high through-loss at 1.8MHz. It seems that you can load your transmitter up into almost anything and the SPC300 performs admirably, even into an anglepoise lamp!

I recommend this fascinating ATU if you like experimenting with strange LF and HF antennas of weird impedances! The company also makes very good 1:1 and 4:1 baluns, which seem to work rather better than some of the alternatives, especially at LF. The SPC300 is now supplied with a wrap around, shatterproof PVC outer casing to obviate any circulating current problems which had shown up in earlier versions. The internal cabling has been re-routed to reduce losses further.

For further information on the Cap Co products contact Tony Johnston G4OGP (tel: (0695) 27948), who will be more than pleased to help you.

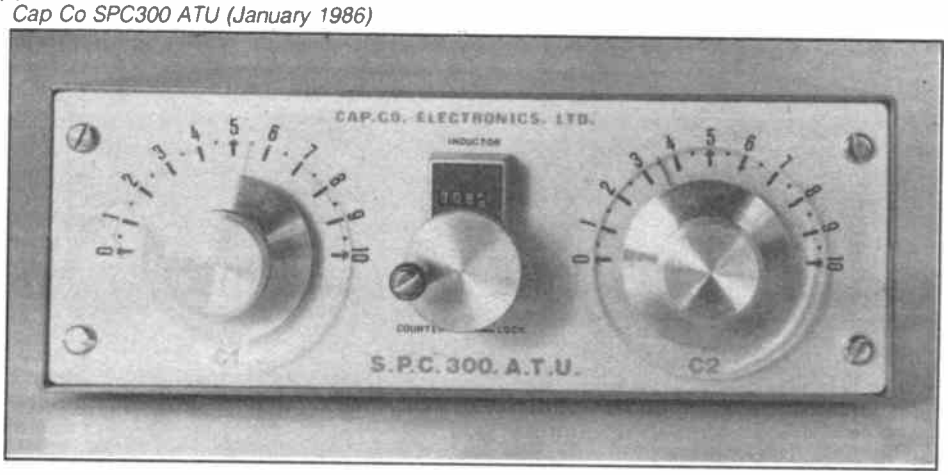
VHF and UHF equipment

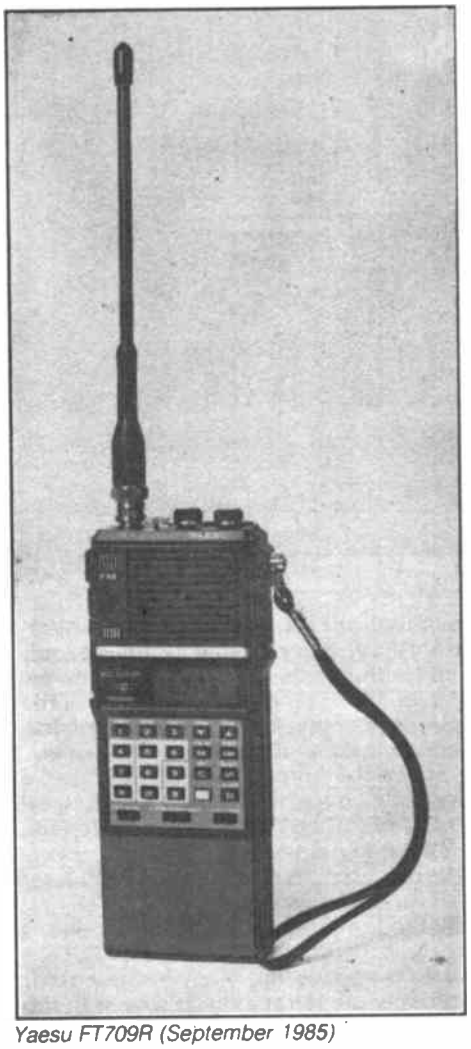
Although the top rig of the year award has been given to muTek for their superb new 2m transverter, many of their other products made for 2m are almost in the same category. Chris Bartram's designs in his masthead pre-amplifiers are quite frankly a lesson to almost all his competition, and I can recommend every single one of them as being the best performers within their price brackets.

muTek's 50MHz transverter, in the 144MHz IF version, was reviewed in the April 1985 issue, and I was very complimentary about it. Its performance was clearly ahead of that of any dedicated 50MHz rig, and although I have not, at the time of writing, tried the 28MHz version, I feel it can be safely assumed that it should perform as well as the 144/28MHz model.

Chris Bartram has offered to supply

Cap Co SPC300 ATU (January 1986)





Yaesu FT709R (September 1985)

one for me to review very shortly, and it would seem that both his transverters offer the best way of getting on to the band, especially as mobile, portable and alternative premises operation is forbidden for the time being. News has come from Microwave Modules, however, that they will also be introducing a new 50MHz transverter in 144 and 28MHz IF versions in the next month or two, and this should be specified at 20W PEP output, just about right to meet the current DTI ERP specifications.

Of the 2m band hand-helds that I have looked at, I can strongly recommend the Trio TH21E with its various accessories if you want an inconspicuous rig. I used one of these in the States for some three weeks last September, and was quite astonished with its excellent performance. Of the larger handy-talkies, my favourite is undoubtedly the Yaesu FT209RH, which I prefer to the IC02E as the latter has ergonomics problems.

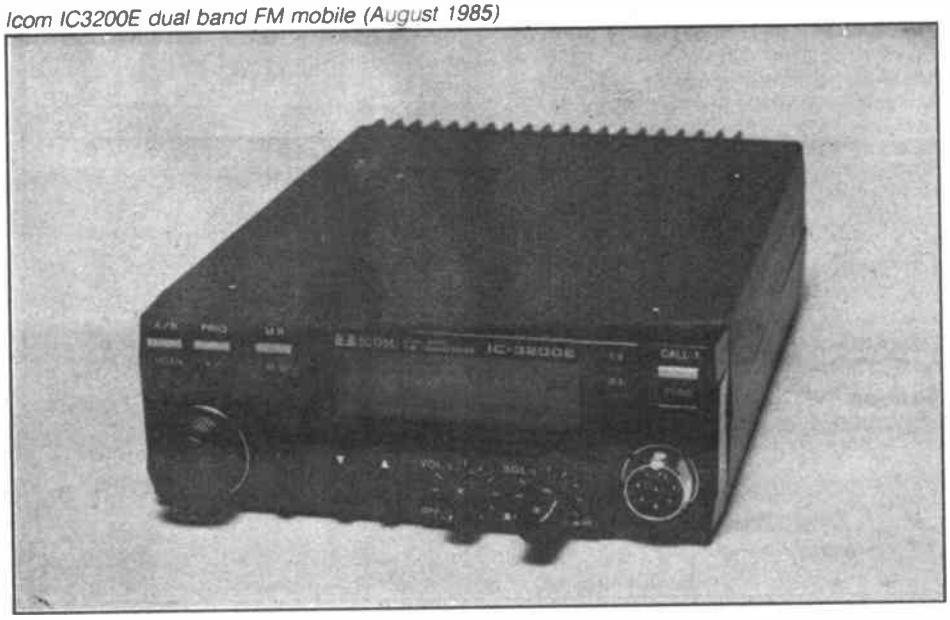
For the 70cm band, I have no hesitation in recommending the Yaesu FT709R (September 1985) which is a very good performer indeed, particularly if you use a collinear whip with it instead of the rather small one supplied. Like its 2m companion, it has a useful battery saving circuit which allows the batteries to last many times longer if you leave it in the squelch mode with the economy circuits switched on.

Advanced multimodes

About 15 months ago the new Trio TS711E for 2m came out, and was followed shortly afterwards by the TS811E for 70cm (reviewed in May 1985). I recommend both of these advanced multimodes highly, and I far prefer their ergonomics and facilities to the Icom equivalents. Early samples did seem to have a slight hum problem on Tx when the rig was being used on 240V ac, but later samples seem to have had this fault remedied. If you want a multimode base station rig which can also be used mobile or portable, then these rigs seem to be the best choice, although I do prefer to recommend the muTek 2m transverter with an HF rig for optimum performance on that band.

The audio quality of both the 711 and 811 is far better than that of the opposition, and Trio's VFO clutch system is extremely convenient, allowing you to have smooth click steps on FM for 12.5kHz channelling, whilst preserving a very good VFO continuous rotation action for CW and SSB. Memory insertion into the 32 memories and transferance to VFO is very simple, and both rigs include the new Trio digital coded squelch (DCS) system. Both the 2m and 70cm models are very similar and could fairly be described as amongst the best rigs of the year.

Icom IC3200E dual band FM mobile (August 1985)



FM mobiles

There are now three dual band FM mobiles available, and after considerable head scratching I feel the top recommendation should go to the Icom IC3200. It is competitively priced and copes with 12.5kHz channelling, which unfortunately is missed out on the Trio TW4000A, otherwise my personal favourite. The IC3200 has just a single output covering both bands, as it is designed for a dual band antenna. It was reviewed favourably in the August 1985 issue.

I have had a long think about the Yaesu FT2700, and as good as this is I am just slightly concerned that it seemed to overheat. One friend who bought one finds that his 2m PA module sinks in power output rather quickly, reducing to around 5W instead of 25W.

One or two other purchasers have also had slight problems with overheating, but perhaps by now Yaesu will have rectified the problem, which existed in early samples.

The Yaesu FT270 2m mobile is available in two versions, the cheaper one giving 25W out, whilst the more expensive one gives 45W output for an extra £50. I reviewed the 45W version in June 1985 and gave it a recommendation, although its selectivity was not quite good enough for 12.5kHz channelling in extreme cases. 45W is a useful amount of power to have in a mobile rig, and the fan kept it reasonably cool.

Excellent facilities are included and the price was reduced a few months ago, allowing it to become more competitive. This is one of the rigs with a power output which should allow you to get into any repeater that you can hear.

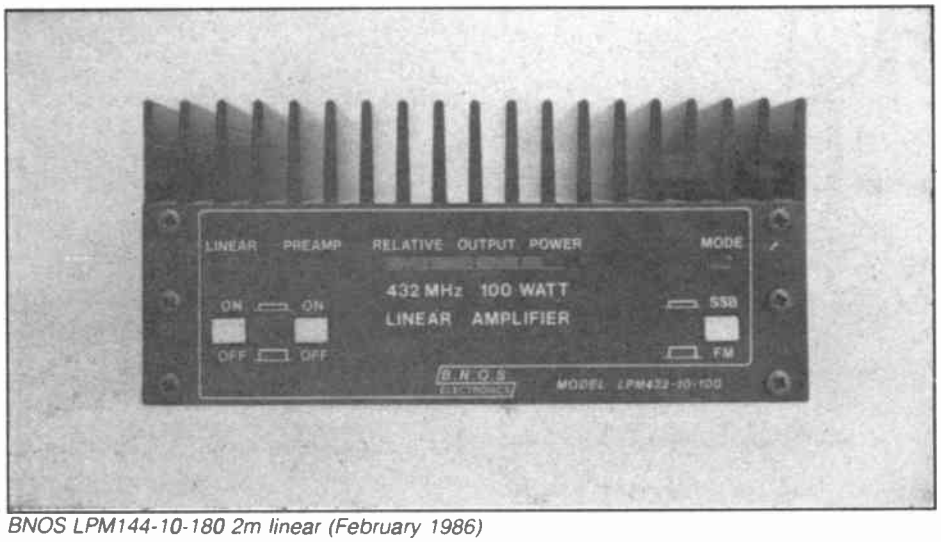
VHF/UHF linears

In 1985 I looked at many BNOS products for the first time and was most impressed with the performance of the transmitter sections. I reviewed the 2m 180W model, which required 3W drive, in the April 1985 issue. The LPM144-3-180 worked extremely well when driven by my carefully aligned FT290, and one highly critical station thought, at the time, that I was using a good valve linear because of the lack of spreading! BNOS's 2m linears are available in many different versions, allowing for drive powers of 3W, 10W or 25W. In my experience they seem to be better than any other solid-state 2m linear that I have yet tested. One very good point is that the input drive requirement is virtually as specified by the manufacturer, so you are not likely to over-drive them as easily

as some other makes which seem to require only half the nominal drive power, at most, to achieve the rated outputs!

You can buy the BNOS linears either with or without power output LED indicators and switchable Rx pre-amps. The through-loss on the versions with pre-amps is not too great, so there is not much to choose between versions here. However, BNOS seem to have a slight problem in their latest 70cm models reviewed in the October 1985 and February 1986 issues; in models including switchable pre-amps the through-loss is a little high and there is a mismatching problem into the pre-amp on Rx.

The main Tx in/out relays are of good quality, but on economic grounds BNOS have so far used bypass pre-amp relays which seem to create the mismatching problem. Consequently, I can only give a strong recommendation to the 70cm models which exclude the pre-amp facility, and also incidentally the power LEDs. These models are very competitively priced and gave a good linear performance on Tx, and were again well within specifications for the required drive levels. The new 100W linear is my personal favourite and is available in 3, 10 and 25W input drive versions.



BNOS LPM144-10-180 2m linear (February 1986)

23 and 13cm equipment

The 23cm band has become far more popular in the last few years, originally because of the introduction of the Microwave Modules transverter and more recently because of the superb performance of the SSB Products models. In the February 1986 issue of *Amateur Radio* I gave a favourable review to the Icom IC1271 multimode 23cm transceiver, and although it is expensive I think it will become fairly popular and be a very simple way of getting on to the band. Its power output of above 10W is a very sensible power both for barefoot operation and to drive linears.

It is styled very similarly to the IC271/471 series and, while the audio quality leaves just a little to be desired, it worked well from the RF point of view. It is the only 23cm dedicated multimode rig at present available, and it is not only quite brave of Icom to introduce it, but it is well worthy of being considered as one of the year's most interesting rigs. It has quite good interfacing, but I suggest you look at the slight reservations mentioned in the review.

It can be fitted with an internal mains PSU, thus allowing it to operate either as a home base rig or a mobile one. I recommend it particularly for portable contest use, the receiver being surprisingly sensitive and fitted with a circuit which provides 13V dc on the antenna socket to power a masthead pre-amp, such as the SSB Products model or one shortly to be introduced by Icom.

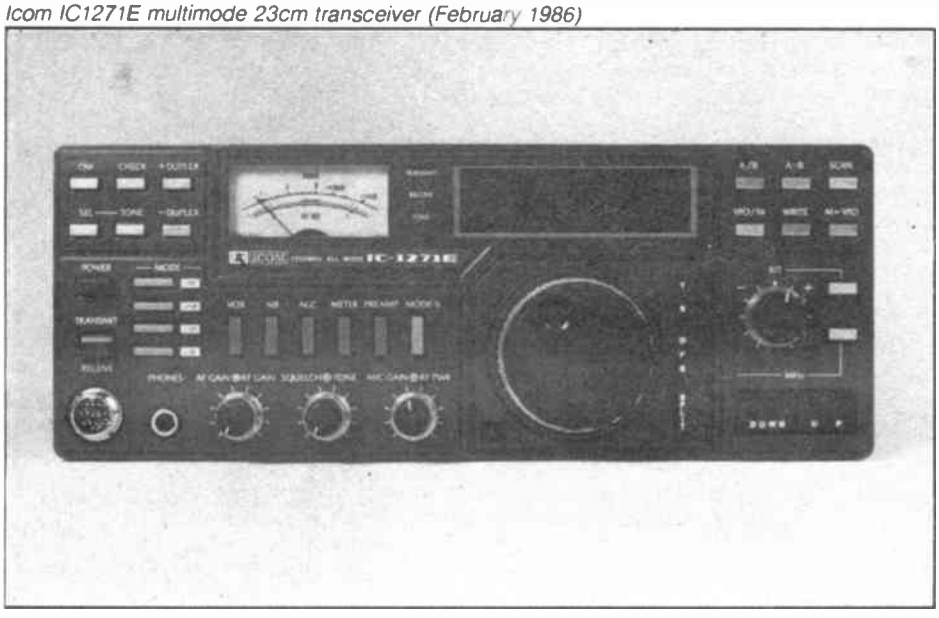
In the January 1985 issue I reviewed the SSB Products 13cm transverter system, which has an IF at 144MHz. The system is supplied as three separate modules: local oscillator, Tx and Rx converters. The local oscillator has two outputs, and interconnects with both the Tx and Rx modules. The Tx module requires between 10mW and 1W drive and can give around 600mW output, whilst the Rx converter has a GaAsFET front-end and mixer with adequate overall gain and noise figure. The system works off 13V dc, and you can buy a booster amplifier which was originally rated to give up to 4W output, but I have never been able to achieve more than a reliable 3W of power.

In the March 1985 issue I reviewed the EME 13cm valve linear, and after much aggro attempting to find the best valve for it, I have ended up with a Siemens 2C39BA, obtained from Piper Communications, which gives around 30W RF output for 3W drive. After the early traumas, which included components blowing up in the linear, the problem components were replaced and the new valve put in, followed by a very reliable performance. The input and output circuitry has remained stable now for around nine months and has never required retuning in this time. It is well worth investigating 13cms as it is a most fascinating band, and whilst I use a 1.2m dish, G3JVL can now supply a quad loop yagi for the band. Last August I fitted an SSB Products GaAsFET masthead pre-amp installation, which has improved the performance on Rx quite considerably, especially after we took great care in trimming the input circuits for an optimum subjective noise figure by beaming the dish onto the most useful new beacon, GB3NWK on 2320.850MHz. Very many thanks for this, incidentally, to G4GLN, the beacon keeper.

Worth Investigating

If you seem to have a good site, judging by your 23cm results, then you should find 13cm well worth investigating as it is a fascinating band with phenomenal DX potential. The band is by no means a 'line of site' job, for last summer I managed to work two Swedish stations on SSB at remarkably good signal strengths. I find that the propagation on 13cms is only an S-point or two below that of 23, although my dish is some 20ft below my 23cm antennas.

Icom IC1271E multimode 23cm transceiver (February 1986)



Surrey Electronics modified FRG8800 (December 1985)

Receivers

Although I have looked at quite a number of receivers in the last few years, there only seems to be one at a fairly modest price which I would describe as reasonable for HF. The Yaesu FRG8800 was reviewed in the April 1985 issue, and proved to have a far superior performance in most areas when compared with anything on the market that I have checked at the same, or a lower, price. The front-end sensitivity was good and the audio quality quite satisfactory, although AM had slightly more distortion than I would like to accept. The ergonomics were extremely good and far superior to those of the earlier FRG7700. You can also buy a VHF adaptor for it, which worked quite well.

HF receiver

If you need a receiver for HF, then the Yaesu FRG8800 is worth looking at, although the TS940S, just as a receiver, is in a totally different class and far superior. I am somewhat surprised that Trio has as yet not announced a receive only version of the TS940, which I am convinced would sell extremely well.

If you want really good audio quality and also considerable improvements in the general technical performance, then I strongly recommend the Surrey Electronics modified version of the FRG8800, which I reviewed very favourably in last December's issue. The audio quality is good enough for rebroadcasting and I consider it is well worth paying the extra for all the modifications. You can obtain further details from Trevor Brook of Surrey Electronics. Tel: (0483) 275997.

AOR AR2002 scanning receiver (January 1986)

VHF/UHF scanners

I have studied the VHF/UHF scanner market and, until the new Icom IC7000 becomes available, the best choice seems to be the AOR2002 (reviewed in the January 1986 issue). This little receiver includes AM and both narrow and wide-band FM, covering 25 to 550MHz and 800 to 1300MHz. The AOR2002 has a far superior keypad to the older 2001 and also includes a tuning knob which greatly helps when you are manually sweeping up and down a band.

It is worth-while putting on record here that amongst the poorest rigs reviewed in the year was the Yaesu FRG9600 which, apart from anything else, seems to be desperately in need of a deaf aid around 433MHz!

You will notice that I have left out quite a few rigs because I have had to have some moan or another about them in the reviews. I am in no doubt that in a year's reviewing I always seem to get the odd rig which explodes, catches fire or bites the dust in some way, and the explosion of the year was very definitely that of the Dressler D70; as a result of this the manufacturer has now fixed his PCB appropriately.

What I do find very tragic, though, is the odd slip that I hear about when someone blows up a new piece of equipment because of 'finger trouble'. One amateur purchased a muTek 2m transverter, connected it to his Yaesu HF rig and forgot to disable the PA. His first transmission through the unit produced an ominous smell when the main RF output of the HF transceiver fed 100W into the 28MHz output socket of the transverter.

It really is so important to read instructions first, and I feel that manufacturers should always provide a special page right at the beginning of the handbook, headed in large letters 'urgent instructions for those who do not normally read them'!

An interesting year

I feel that 1985 has been a most interesting year and already I am hearing of some very fascinating new rigs arriving this year, which I hope to review as they come along. Yaesu, Icom and Trio are all working like beavers to introduce high tec into their new models, which include base station and mobile HF rigs, various linears, new portables, and both new VHF and UHF rigs.

Several British manufacturers have new items forthcoming and many of these sound quite exciting. I look forward to reviewing them all in *Amateur Radio* in the future.

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

Well, here we are again! At the time of writing (January) the winter has not lived up to the threats and is resembling the 1985 'summer'; plenty of rain and high winds, but no heavy snow so far.

What has been heavy is the mailbag, as always, and I really must thank you all for your many letters. It is sometimes a bit awkward trying to get replies out by return, but you can be sure that I will reply to *all* letters and answer your enquiries even if the occasional SAE does go missing (hint, hint).

I am still trying to sort out the problem with the RTTY program, and until it is resolved I will reserve comments. Sorry about that, but I will not review anything that I have problems with until I'm sure it's not my problem but the product's.

Short wave listeners never cease to amaze me! While amateurs are complaining about the lack of DX on the bands, the listeners are busy logging stations in the most exotic areas. I realise that some amateurs would claim that it's easy to *hear* them, but there used to be an advertising slogan in the days of the 'Joystick' antenna that if you could hear them you could work them. As the antenna was of a very limited type, I would have thought that with modern equipment, antennas and computers, the slogan would be easier to fulfill.

Backlog

Before getting on to the *Amateur Radio* Prefix Awards, I must apologise to those who have claimed awards for 'two-way contacts'. When the scheme was introduced, I intended it for listeners and the award was designed as such. However, claims came in from licensed amateurs (and we were pleased to receive them too!), but the awards were not revamped to take account of this. However, I am redesigning the certificate and, by the time you read this, the new awards should be ready for issue. Once again, my apologies, especially to those who have worked extremely hard to get the awards.

The problem does not arise with the Gold awards as these are individually engraved, but I have to get these done in groups to keep the cost down so please be patient. Those who have had their Gold awards have been delighted with them.

Claims

So to the claims in hand. Many of our readers were obviously intent on getting the Gold by the end of 1985 and I congratulate you all on your excellent efforts.

Don Robertson GM3JDR, from Auckengill, Scotland, waded in with his claim for the Gold and the first claim for two way contacts with 1000 prefixes! No mean effort, this, and with callsigns like A4ZXG, A92EM, BV0AU, CX3AW, HH2WW, KP4BZ, TU2FI, VP9C, 3V8AL, 5B4OG and 6Y5FS, it is obvious that the station set-up of FT101ZD and that 280ft rhombic is working 'fine business'. Bands from 160m to 15m were used over the eleven months it took to get the submitted 1013 contacts and a lot of 'midnight oil' was burned. A superb effort proving that, even under bad conditions, if you have something to aim for the DX is there to be had. Well done Don!

Another licensed amateur, Nigel Marston G0ASM, from Sunderland, claims the Bronze award with a log of 264 stations contacted including A71AD, AP2MQ, AH2BA, D44BS, KL7IRT, DU7WY, HL1CG and sundry others for the award.

Nigel raised a couple of questions about the prefixes and these are explained later in this issue.

A first claim for the Gold comes from Eddie Gauci 9H1/15357. Eddie has been a listener for some years and I often see his name appearing in the listener sections of various publications. It's nice to welcome Eddie to our ranks and his claim of 1010 prefixes came on the tail of his claim for the 'Jamboree Award', so he has a nice parcel on the way to Malta!

I nearly slipped up with Eddie's claim because he headed it as a 'Bronze' claim, but as I was going through the list I noticed the change of heading and realised that he'd hit me with a 'triple header' for Bronze, Silver and Gold in one fell swoop. Should have read his letter first, I suppose ... silly me! Eddie has also gained the Certificate of Merit in the Cray Valley Contest!

Listener's Exchange

John Robley G3TLG, Tonbridge, gets in his claim for Silver with a list of 505 stations worked on CW only! John's set-up is the Heathkit SB400/SB300 with a G5RV at thirty feet. Using all bands, he included A4XZG, CX7CO, JJ1MLQ/MM, P29JS, VP2VCW, YT3X, 3D6AK, 9J2BO and many other nice catches amongst the crowd. Welcome to the gang, John!

Dave Howes BRS87894, from Rochester, sent in a neatly produced list in alphabetical order in book form to claim his Silver award. A71AD, AA3OG, HG4SEA, PY7PY, VK8DN/MM, XO1AW, 5B4MM and 9J2JM were amongst the total of nearly 700, so it looks as though a Gold is within Dave's grasp.

In his letter Dave stated that he is only too pleased to be of assistance to beginners and has added his name to the 'Listeners' Exchange' list.

Go for Gold

Yet another Gold claim! This time from Philip Davies of Market Drayton who sent in a very nicely detailed list including details of his band scores. Prefixes included A71AD, BY4AA, C6AMU, CX1TE, FG5LD/FS (Fr Isle of St Martin, Guadeloupe), J5WAD (QSL via UA4PW!), J87BZ, P29JS, VK9NM/P (Lord Howe Island), VQ9DG (Chagos), YB8QD, and many other very nice catches. Philip's band scores are; 160m-86, 80m-377, 40m-373, 20m-879, 15m-336 and 10m-63. Excellent by any standard and on the way for a single band 'Gold' for twenty too!

Philip comments that the Americans have really loused up the prefix plans with few clues now as to the locations of particular prefixes.

Antenna kit

Finally for this month, yet another licensed reader: Eric Collins G4ZME, from Canterbury, who submitted 461 two-way contacts for 1985 ... so close, Eric! Never mind, you can still claim for the Silver and Gold as 'all time' figures.

Remember, the Prefix Awards are on-going and not an annual contest. If you do make the Gold within twelve months it's damned good going but it's not essential.

Eric made good use of the contests to bring his score up. These are very useful and despite the persistent '5-9' reports, they are good for judging your reception capabilities under heavy noise levels. I use them often when testing QRP as the contestants are really listening hard for the weaker signals, in case they are exotic calls ... nice to get a 59 from the West Coast of USA on 2 watts ... even if the report is bullshine, at least the signal got there!

News from CM Howes Communications (139 Highview, Meopham, Kent DA13 0UT) in their CTU25 antenna tuning unit kit. Retailing at only £17.10, covering 1.8 to 30MHz, and suitable for QRP operating as well as receiving, this represents excellent value and is a good way to start home construction as there's not much you can do wrong. Even if you are not a wizard with the soldering iron, you can still finish up with a very useful piece of equipment without breaking the bank. The unit has a dual variable capacitor 'T' network suitable for coaxial or end-fed antennas and will prove invaluable to most listeners using random length wires.

The kit comes complete, except for the case, so can be built as a free standing unit or

put inside an overall case with a receiver, such as the DcRx, to make a nice compact system that's easily portable. Very highly recommended!

Patch box

A nice letter arrived from Guy Dean of Ringwood. Guy uses the Trio R2000 for general coverage reception. Prior to this, he used an R820 linked to the Datong UC/1 converter which worked very well. Unfortunately, Datong no longer make the UC/1 but Guy recommends it to anyone who has an amateur bands receiver . . . try the next rally bring-and-buy if you want one!

Still using the R820 and the R2000, Guy links his various antennas to them using two three way antenna switches in tandem. He also uses the VC10 converter and GPV5 antenna for VHF coverage.

Guy's letter reminded me of the unit I picked up at Longleat last year. This was a Rediffusion patch box which consisted of eight co-ax sockets in two banks of four, with input and output access through the steel casing. A set of four patch leads was included in the very reasonable price of £2.00, which enabled permutations of any one of four inputs to any one of four outputs. A very useful experimenters' antenna link for a silly price!

A letter from Elmer Liddicoat, St Austell, mentions that, despite a heavy workload, he is over the 900 prefixes now and still hard at it when time permits (seems like we all suffer from the same problem, Elmer). Not satisfied with just listening to the chat on the bands, Elmer has been giving the dots and dashes a bashing and has gained the RNARS Certificates for reception at 15 and 20wpm. Well done, matey!

AR awards

Also there was a query regarding awards. The RSGB produce a book, *Amateur Radio Awards*, which gives details of awards currently available world-wide (from the RSGB, £3.50 inc p&p).

I have received quite a number of Information Exchange slips, and I thank all who have sent them in. Details are being transferred to the files and all participants will receive a list soon.

As regular readers know, the *Amateur Radio* Prefix Awards are presented to listeners for logging 250, 500 or 1000 prefixes. The first two awards are certificates donated by the magazine and the Gold award is an engraved plaque donated by yours truly. However, there is still some confusion over the prefix, mainly amongst newcomers to the hobby.

To clarify the situation, the United Kingdom has G2, G3, G4, G5, G6, G8, G0. We also have G12, GW2, GM2, GD2, GJ2,/3/4/6/8/0 and so on plus the GB special calls and the EI calls from Eire.

Each of these counts as a separate prefix for the awards. Similarly, the Soviet Union has UA, UB, UC, etc, followed by a number. These are also separate prefixes.

Amateurs welcome

Some countries or states have callsigns beginning with a number, such as Israel with 4X4, 4X6 and 4Z4, which are also counted separately.

There is a list of prefixes available which is updated regularly and is available from Geoff Watts, 62 Belmore Road, Norwich NR7 0PU. Price £1.00 inc p&p.

Claims are also welcome from licensed amateurs and all awards are available with endorsements for single band working or single mode.

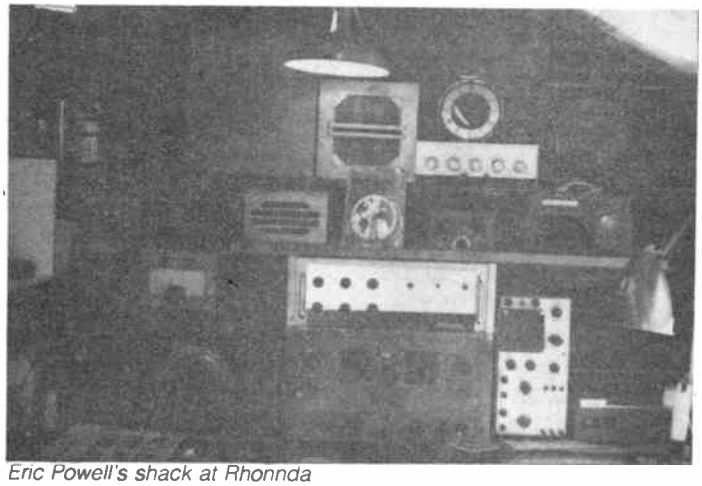
QSL cards are not required, but if you want the list returned a suitable SAE must be sent with the claim, which should consist of a verified list of the stations worked/heard including date and frequencies. Log photostats are acceptable. Over a hundred claims were processed in 1985!

QRP Award

Once you have gained the Gold award, you can aim even higher. In 1986 I am offering a further award for worked/heard 2000 prefixes and also a special award for worked/heard 250 QRP stations.

The QRP Award is available in two separate guises: heard 250 QRP, worked one-way QRP and a worked two-way QRP. These are for *stations* as opposed to prefixes.

The QRP claims *must* be accompanied by QSL cards, but as there are plenty of G-QRP Club members in the UK this should not present any difficulties. The cards will be returned with the trophy.



Eric Powell's shack at Rhonnda

This month's featured listener is Eric Powell of Penygraig in the Rhondda. Having started in the hobby of short wave listening at 14 years of age through reading a 1923 wireless book presented to him by an aunt, Eric joined the local radio club to get more information and increase his knowledge of radio. After building various sets, he finally set up his station with ex-service receivers such as the American BC779B and the RAF1155.

Now 54, Eric is frequently ribbed by the lads in the club for being the oldest SWL member, but this doesn't deter him and he enjoys it as much today as he did in the pre-black box years.

The station aerial is the old faithful half G5RV fed to the receivers via an ATU, and many pleasant hours are spent in the shack hunting the rare ones.

I'm sure you'll have many more years of happy listening too, pal!

QSL cards

QSL cards: are they necessary or a waste of time? A question often asked and the cause of many an argument at clubs world-wide.

The QSL card has been regarded as the final courtesy of a contact with another station or a thank you to the SWL sending in a report. Unfortunately, there are those who simply collect cards for the sake of it . . . nothing wrong with that in itself, but it does reduce the QSL card to the level of the cigarette cards we used to collect years ago, or the button badges some youngsters collect today.

The idea behind the QSL card is to *confirm* the details of a contact with useful technical information that may be appreciated by the other chap. For instance, as far as the listener is concerned: what equipment you are using to receive the signals; what the conditions were like generally; if there were any other stations in the same area with better signals . . . if so why? Was the audio distorted in any way? Were there any other points worthy of note?

Listen and learn!

There are dozens of standard designs of QSL card. Personally, I design my own and put in the details as required, but it's a matter of what you can afford.

As a basic list of necessities, you should have date, time, frequency, report, equipment used, details of the transmission (including any interference, faults etc), comparison with other transmissions, overall conditions and any other details you may consider be of interest to the station.

QSL cards sent via the bureau go through a tortuous path to reach a station and it can take two years to receive a reply.

Listen to the transmitting station! It's of no use to send a report to a station direct if he uses a QSL manager. His manager handles all the cards and the station often has none, so yours will finish up in the bin!

If you must send QSLs direct, make sure you enclose sufficient IRCs to cover the return postage *and* an envelope: in some countries envelopes are expensive.

Well, that's it for this month. Next time I hope to have more news for you on a contest, but in the mean time hope you have a good month listening.

AmRad 10GHz system

by Glen Ross G8MWR

10,400 + 50 = 1500!

This statement gives a realistic answer to the question 'What can I do on 10GHz and how much is it going to cost me?' The present world record using only 15 milliwatts of FM stands at nearly 1500kms, and you can build equipment of this capability complete with an aerial for around £50. Finding suitable sites could be a problem however!

In this series of articles I will be describing how to build this gear, and how to get the best out of it. If you are wondering how much activity there is on the band an indication may be the fact that the Microwave Society, which is only interested in the bands above 10GHz, has over 800 members!

Overview

Before describing the gear and how to build it, let us first have a look at the band, the equipment you are going to need and all the other bits of information required to make the active microwave operator.

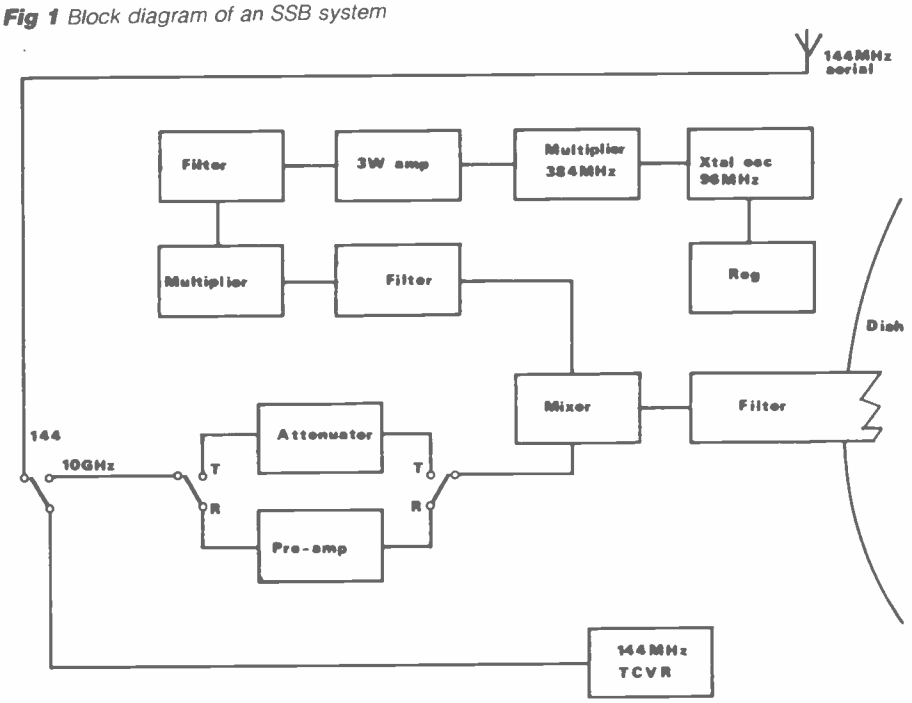
The people who operate at these frequencies are enthusiasts and I'm sure you wouldn't want to stand out as the only 'wally' on the band.

You may believe from reading some of the material that is available that you are going to need to get involved with a machine shop and tolerances of 1/10,000th of an inch. The thought of setting up dish headings to a fraction of a degree is a bit off-putting – and what about all the high technology test gear that you are going to need to set the whole thing up once you have built it? All these things may have been a problem a few years ago, but now . . .microwaves are simple!

Allocations

Internationally microwaves start at 1000MHz (1GHz), and go up to the highest frequency allocated to any service – nearly 250GHz. For our equipment we are going to settle at 10GHz, which is far and away the most popular amateur microwave band. This is due to several reasons: firstly, because the bits are easy to get; secondly, because there is plenty of surplus gear to modify for the band; and thirdly because the finished equipment is small enough to be easily transportable.

Fig 1 *Block diagram of an SSB system*



The modes

All the modes that you can use on the lower bands are available on 10GHz, but the most common by far is FM. This is not the type used on two metres, but is similar to the wide-band type used by the BBC, commonly using a deviation of 300kHz. It can be generated with extreme ease and in fact a basic system need only contain ten components; I have in fact seen one very simple transmitter which used only three.

The basic power is generated using a gunn diode, costing around £2, which runs on nine volts or so at a current of about 100 milliamps. This will produce perhaps ten milliwatts of RF; it doesn't sound like much, but when used with a two foot dish, with a gain of about 30dB, the effective radiated power is some 10 watts. Add to that a similar gain at the receiving end and you can work out that the total gain gives you the same effect as running 10 kilowatts to dipoles at each end. Now you really are in business.

SSB

This is a different kettle of fish altogether, as a look at the block diagram in *Figure 1* will show. The system is in fact a linear transverter, and the unit most commonly used is a design by Mike Walters G3JVL. The idea is to generate a crystal controlled signal at 96MHz, then multiply it to 384MHz and raise the power to about two or three watts. This is then filtered and applied to a snap varactor where it is multiplied by a factor of 29 times to give the final injection frequency, then filtered and applied to the mixer.

On transmit, a small amount of 144MHz RF is coupled in and the final signal, at a level of about half a milliwatt, is produced and filtered before being sent to the aerial. On receive, the incoming signal is mixed and then passed through a low-noise pre-amp to the driver transceiver, which is typically something like an FT290.

The main problem with this system is that the local oscillator has to be multiplied up to 108 times, so a change of only one hertz at 96MHz gives a shift of over 100 hertz at the mixer. This is the equivalent of turning the FT290 tuning one click. Trying to get this stability is difficult enough at home under controlled conditions. To acheive it on a windy hilltop is another matter, but it can be done.

If you do the sums to find the advantage to be gained from using SSB rather than FM, and allow for the narrower bandwidth etc, you will find that, power for power, SSB has an advantage of about 16dB. This represents a great improvement, but the extra complexity means that such a system is not for the newcomer to the band.

The results

Once you have got your system running, what sort of results can you expect to get? Using WBFM the range to be expected is optical. Due to the bending which takes place you do not have to be able to see the other end of the path, and normally optical means

optical plus about one third. The exact amount of enhancement will depend on the weather and other conditions, but with an optical range it does mean that there must be no obstruction in the path.

Microwaves behave much like light, and large hills throw large radio shadows so that, in effect, if you are operating from a site around 250 metres high you would not get terribly excited about working paths of more than 100kms. Finding longer paths to work is all part of the fun, and never give up on a path simply because it has not worked in the past; today may be the day when the enhancement is in your favour. *Figures 2* and *3* show examples of paths that will and will not work.

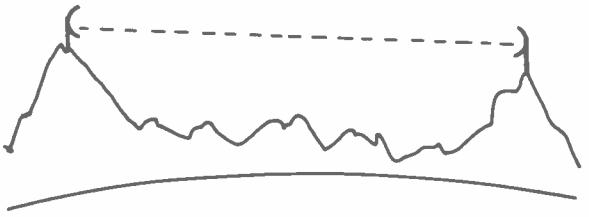


Fig 2 *A line of sight path. The actual distance would be 'optical' plus about one third*

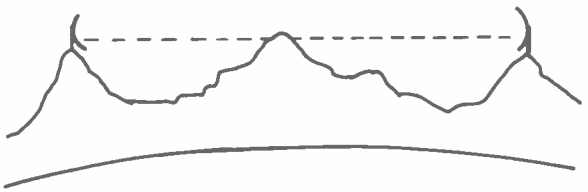


Fig 3 *The path would not be as workable using FM, but may well be using SSB*

Using SSB

This is really something special; you remember that 16dB advantage we found earlier? This means we can now work with signals some 35 times weaker than is possible with FM. Although you may not get any direct signal, due to obstructions, there is enough signal via scattering effects for the path to be workable. This means that we can now talk in terms of working obstructed paths of more than 200kms. If you really go to town and push your output up to around the 10 watt mark, as can be done, you will not only shoot the birds out of the sky but they will be cooked by the time they hit the ground.

Safety

This brings us to the safety aspect of microwave operating. At the power levels that most people use, say around 10 or 15 milliwatts, there is no health hazard; even if you stand right in front of the dish. However, your eyes are very susceptible to radiation damage and, once such damage is sustained, it is irreversible. For this reason NEVER look directly into the waveguide. You may think the equipment is switched off, but you can never be sure!

Operating

Due to the width of the band (500MHz) and the tight beam angles, there is not a lot of point in just going out and hopefully calling CQ, although it has been known to get results. The better method by far is to make use, at least at first, of the cumulative contests which are held every month during the summer. At least that way you know there are going to be people there to talk to.

To make life easy, two metres is used to provide initial contact; the frequencies normally used are around 144.175 and 144.330MHz. By calling on these frequencies you will get an answer and can then find out where the other operator is, enabling you to set up your aerial bearings and transfer operation to 10GHz. Most 10GHz contacts mean a chat of around half an hour or so (anything but rubber stamp), the first ten minutes of which is usually taken up by trying to explain why you had your aerial pointing the wrong way!

Talkback

The requirements for talkback vary considerably. If you are into working long marginal paths then you may need 20 watts and an eight element beam. For paths up to 150kms or so between good sites the friendly FT290 and an HB9CV will do a good job. Do not use more power than you really need; apart from being in breach of the regulations you will also cause havoc to operators on nearby hills. Please switch the noise blanker off; it is surprising how much crud can be generated by strong signals in your own receiver, and they are usually blamed on the other fellow.

Information

Having got your contact on two metres, you will then exchange details of where you are located and the frequency you are going to use on 10GHz. This is normally centred around 10.4GHz but, due to continental activity, there is also some activity around 10.1GHz, mainly in the south east. You will also need to know the National Grid reference for the site you are using, and this can be obtained from the Ordnance Survey map of the area. The location of the site with reference to some well-known town is also useful in helping to locate it, and is usually required as part of a contest exchange.

Protection

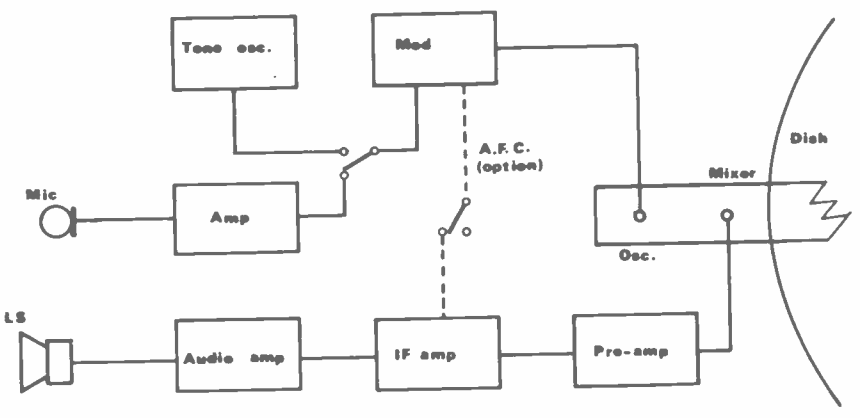
Remember that you are going to be operating from some exposed sites and the British weather has a nasty habit of making rapid changes. Even when it is a warm day at sea level, it can be rather chilly at 1000 feet.

Take a warm and waterproof coat, some food and a flask of hot soup, tea or coffee. If you get into serious trouble put a call through the local repeater and let people know where you are and what the problem is.

Next month

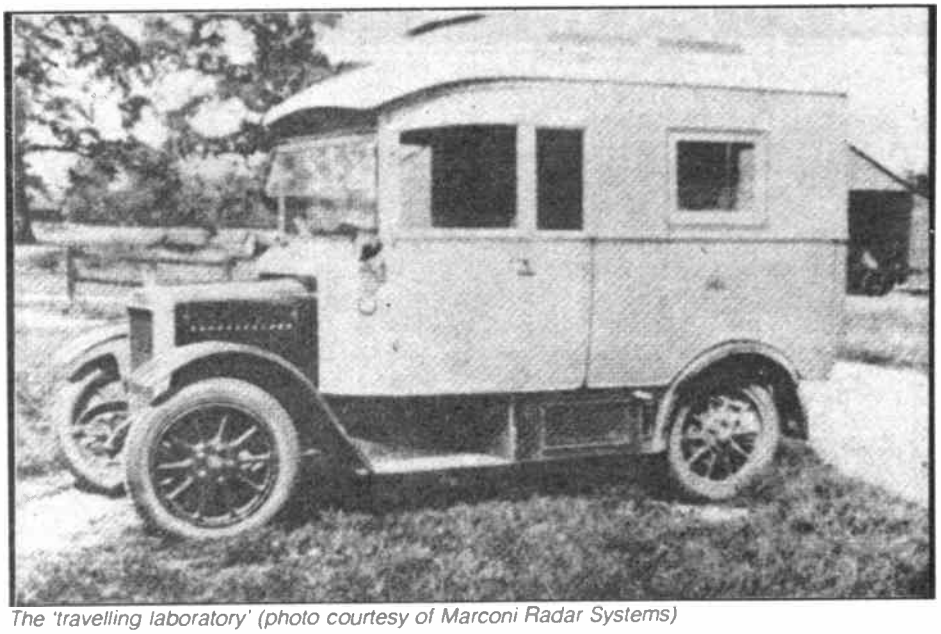
In next month's article I shall describe the transmit part of the equipment. PCBs for the whole project will be available, as will a supply of all the microwave parts that you are likely to need. There will also be a complete tune-up service for completed units in case you get into problems.

Fig 4 *Block diagram of wide band FM transceiver*



THE S
O
BRITISH

by Brian Ke



The 'travelling laboratory' (photo courtesy of Marconi Radar Systems)

If you ask any schoolboy, or even many adults, they will tell you that radar was a British invention and that it was largely because the Allies had it and the Axis powers did not that the Allies were successful in the 1939-45 conflict.

The truth is that neither statement is correct, for the history of radar goes back long before the turn of the century, and at the outbreak of war no less than eight countries were developing radar and several had equipment operational in the hands of the military.

The word RADAR is an acronym for 'Radio Aids to Directing (some people say Detecting) And Ranging', thus any apparatus which is intended to meet these aims may legitimately be called radar, whether it is a CW pulse, monostatic or bistatic system.

The beginnings

Perhaps the first suggestion of radar principles may be attributed to Thomas Edison in the United States, for in May 1885 he filed a patent which described a radio system for the prevention of collision at sea.

About the same time similar suggestions were being made by Professor Branley in the United Kingdom and by Nikolas Tesla in the United States.

In 1904, a German engineer, Christian Hulsmeyer, obtained a patent for a 'Telemobiloscope' which is believed by many to have been the first workable radar system. Furthermore, the operational frequency of this is thought to have been in the order of 600MHz, although historical records are rather unclear.

Spark transmitters

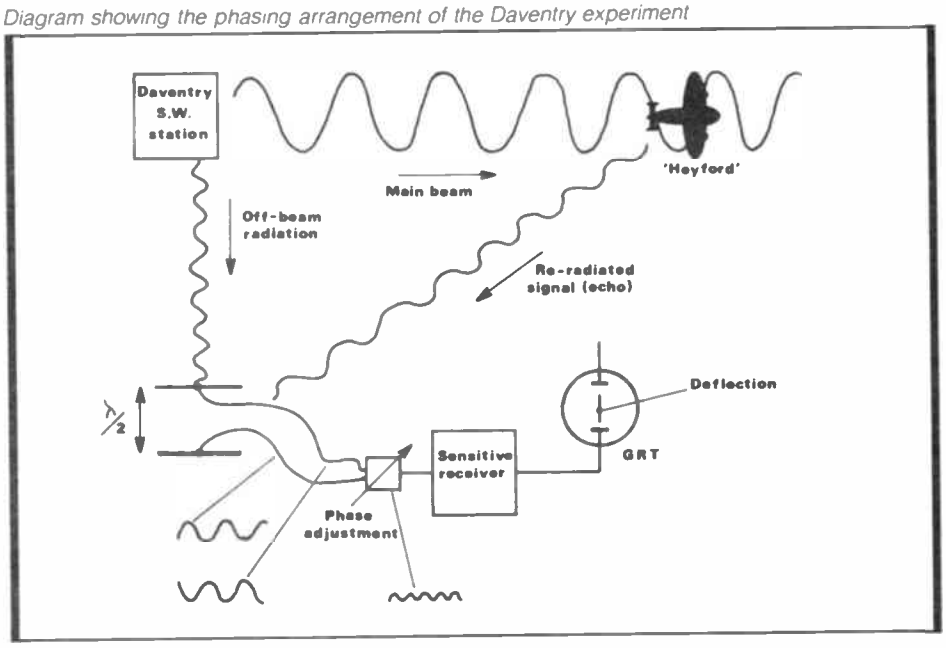
Some twelve years later another German, Hans Dominik, working for Siemens and Halske, experimented with a system using a spark transmitter in an effort to detect enemy targets at night.

Significantly, the next development of note was a speech by that greatest of radio experimenters, Guglielmo Marconi, to the American Institute of Electrical Engineers and the American Institute of Radio Engineers in 1922. In this, Marconi gave a comprehensive survey of the state of the science of radio engineering and also gave a clear formulation of radio detection of objects – which was all the more remarkable in view of his experimental demonstrations some eleven years later.

By the mid 1920s the principles of the reflection of radio waves were well known from observations by Albert Hoyt Taylor and Leo Clifford Young in the United States, as well as the ionospheric work of Appleton and Barnett in the United Kingdom and Breit and Tuve in the USA. The work of the latter team was particularly notable, for their techniques constituted the basis for all future pulse radar systems.

During the period from 1928 to 1934, experimenters in no less than eight countries (Italy, France, United Kingdom, USA, Holland, Germany, Japan and USSR) independently derived the principles of radar and, by the time that hostilities commenced in 1939, brought development to operational standard, although only two countries, United Kingdom and Germany, had manufactured sufficient quantities of equipment to form a significant system.

Diagram showing the phasing arrangement of the Daventry experiment



The British development

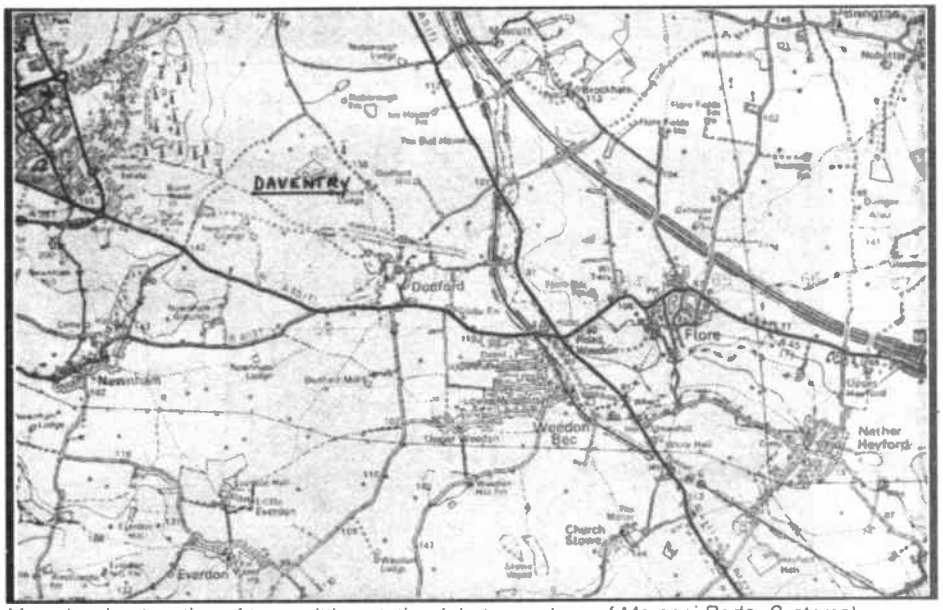
Compared with several other countries, the United Kingdom was rather slow off the mark and the reasons for the instigation of the development were unusual to say the least.

In the early 1930s wild stories were circulating within the British popular press regarding the existence of a 'Death Ray'. Although this concept seemed far fetched, such was the publicity of the idea that the then Director of Research at the Air Ministry, Dr H Wimperis, felt that it was necessary to assess the feasibility of the proposal. He therefore approached Robert Watson-Watt, who at that time was leading a team of scientists at the Radio Research station at Slough.

The task of assessing the 'Death Ray' proposal was delegated to Arnold Wilkins, of whom Watson-Watt asked the question 'How much RF power

TORY
OF
RADAR

ndal G3GDU



Map showing location of transmitting station (photo courtesy of Marconi Radar Systems)

should be radiated to raise the temperature of eight pints of water from 95 to 105 degrees F at a distance of 5km and a height of 1km?' Wilkins soon realised that energy considerations alone made such a ray impractical.

However, in response to a request for any other suggestions which might assist the Air Ministry, Wilkins recalled hearing that an aircraft flying in the path of an early experimental VHF radio link had caused severe signal strength fluctuations and suggested that this effect might well form the basis of an aircraft detection system.

Watson-Watt considered this suggestion and in late 1934 presented a paper to the Air Ministry which contained proposals for the use of pulse techniques (which had already been used for ionospheric research) for the measurement of range, bearing and height in addition to a system which could differentiate friendly aircraft from the enemy (IFF).

As a consequence of these suggestions, the Air Ministry requested a demonstration to determine the feasibility of the project. This resulted in one of the most famous demonstrations in the history of radio – the classic 'Daventry Experiment'.

The Daventry Experiment

The standard RAF heavy bomber of the mid 1930s was the Heyford. This was a large biplane with a wing-span of 75ft. It was believed that if such an aircraft were irradiated with a signal of 50 metres wavelength, the wings would act as a half wave dipole and consequently give an excellent signal return.

On the 25 February 1935, Arnold Wilkins and a driver took a small Morris commercial van, euphemistically called 'The mobile laboratory', which was equipped with a very sensitive receiver and a cathode ray oscillograph, to a field near Weedon, a few miles from the BBC's short wave transmitting station at Daventry.

Two aerials were set up and the receiver was tuned to the BBC's 49 metre transmission using the 'Y' plates of the oscillograph as a signal strength indicator.

The phasing of the two aerials was then adjusted for minimum signal strength of the broadcast transmission and then slightly offset to give a small residual deflection.

The Committee

The following morning they were joined by Robert Watson-Watt and A P Rowe, secretary to the 'Committee for the Scientific Survey for Air Defence'.

In the meantime, a Heyford bomber, piloted by Flt Lt Blucke, had taken off from Farnborough and was approaching at 6,000 ft on a course which would take it between the transmitting station and the observers in the mobile laboratory.

As the aircraft approached, the observers on the ground measured severe fluctuations in the received signal strength, which did not subside until the aircraft was nealy eight miles away. The effect of aircraft flutter is now well known, but in 1935 as part of a controlled test it was undeniable proof that an aircraft could be detected by radio.

As the experiment drew to its successful conclusion, it is reported that Watson-Watt said to Arnold Wilkins, 'Great Britain has once more become an island'.

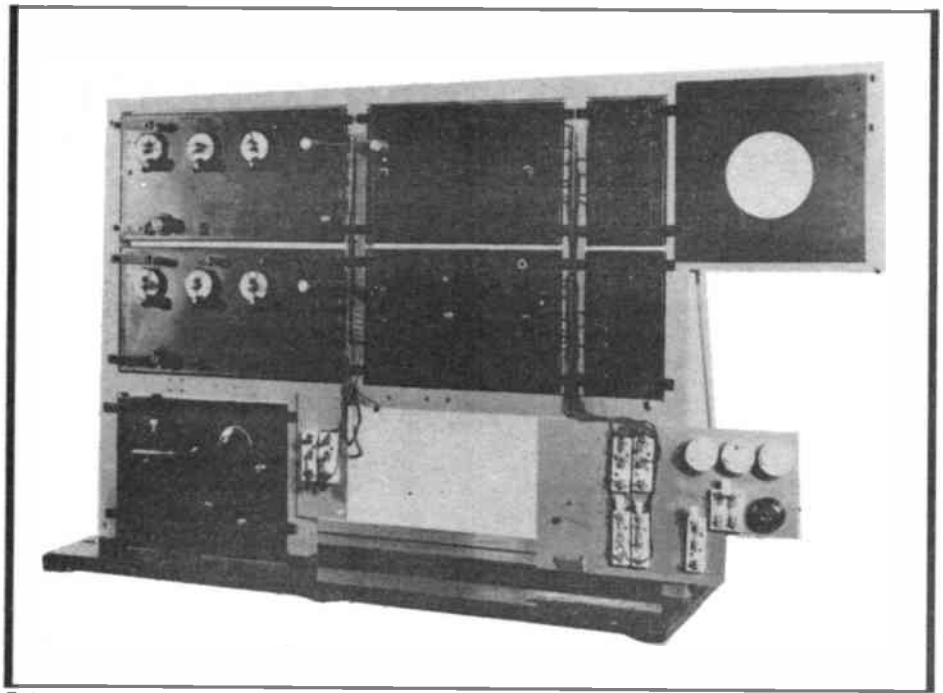
When the success of the experiment was known, it was immediately classified *Most Secret* and £10,000 was allocated to set up an experimental station at Orfordness which, within an incredibly short time, designed, installed and tested equipment using pulse techniques capable of detecting aircraft up to a range of 40 miles.

Chain Home

The experiments at Orfordness had initially used a frequency of about 6MHz, but interference from commercial radio transmissions soon necessitated the use of higher and higher frequencies, until finally the use of channels between 20 and 30MHz were selected for the operational equipment.

The general principle of operation was that a high power pulse of RF energy

The 'Heyford' heavy bomber (photo courtesy of Marconi Radar Systems)



Robert Watson's original receiver used in the Daventry experiments

'floodlighted' the search area, and the signal reflected from the target was timed (to assess range) and the bearing determined, the combination giving the position of the aircraft.

The detection and ranging of the target aircraft had been achieved comparatively early in the development, but determining the bearing and height proved considerably more difficult.

The first of these problems was overcome by the use of two dipoles, mounted at right angles, whose feeders were connected to a goniometer. Thus, by rotating the goniometer, a point could be found where the signals were equal and of opposite phase and thus cancelled out; this point corresponding to the bearing of the target aircraft.

This method proved to be extremely accurate but exhibited two serious disadvantages: it was impossible to determine whether a received signal was in front or behind the array (ie sense) and due to the height (240ft) of the aerial, there was a deep null in the vertical radiation pattern at an elevation of 5.2 degrees, which would cause the station to be blind at this elevation.

Pin-pointing the target

The first of these problems was overcome quite simply by fitting a reflector element to each dipole which could be switched in or out, consequently giving an indication of whether the target was in front or behind the station, while to fill the gap in the radiation pattern a further set of dipoles was fitted at 95 feet, which gave a main cable centred on 5.2 degrees.

In similar fashion there was a null in the vertical cover of the transmission array which was overcome by fitting a lower 'gap-filler' antenna.

With two different vertical radiation patterns now available, it was possible to assess the height of the target by comparing the relative strength of signal returns from the two arrays. This was achieved by fitting a further goniometer between the Y dipoles of the upper and lower arrays and adjusting for minimum signal strength as before. Unfortunately, due to the curvature of the earth and local site irregularities, this could not be calibrated directly, so the received data was transferred to the 'fruit machine' (an early electro-mechanical computer) which calculated the height of the target.

Problem solved

With these problems solved, ten million pounds were allocated to install a series of CH radar stations along the east and southern coasts of England with utmost priority. By the outbreak of war in September 1939, nineteen CH stations were operational, stretching from Ventnor, Isle of Wight to Netherbutton in Orkney.

Excellent as the CH radar equipment was, nevertheless, due to the slight inaccuracies present in every system, it was possible for conflicting plot information to be passed to fighter command squadrons. Aware of this possibility, the 'Filter Room' system was developed. In this, the target plots from all the CH stations in a sector were passed by telephone to a central filter room where all were plotted on a large map table. Here, based on experience, fighter controllers could decide which plots were valid and deploy their fighter squadrons to maximum effect.

It was the realisation of a working operational radar network by 1939, in secret and totally integrated with fighter control, which was the unique British achievement. Only a year later, the CH chain proved crucial to the nation's survival in the Battle of Britain.

By the end of the war over fifty CH stations had been installed around the coast of Britain and this equipment remained as the country's first line of radar defence for many years, the last stations not being withdrawn until the 1950s – in fact it was in 1952 when, as a young airman, the author first visited and learned the principles of operation of this classic radar.

The Biggin Hill experiment

The Daventry experiment has frequently been described in books and featured on radio and television programmes. However, another much less publicised experiment also took place. This was less glamorous than the Daventry experiment, but without it the work of the radar pioneers would have been to no avail.

Prior to the development of radar, ground control methods for fighter aircraft were restricted to visual observation and the use of signal lights, ground markers and signal flares. By 1935, with the projected performance of the new generation of fighter aircraft, such as the Hurricane and the Spitfire, it was evident that such methods would be useless.

At that time, civil aviation was developing techniques of air traffic control using CW radio communication which necessitated a specialist radio operator. Such methods were obviously unsuitable for single seat fighter aircraft and it was therefore decided, as an experiment, to install radio telephony equipment in the Gloster Gauntlet fighter aircraft of 32 Squadron, which were located at Biggin Hill.

Between 1936 and 1937, these aircraft carried out a long series of mock interceptions, controlled by radio telephony from the ground using filtered plots from the south-east coast CH stations. During this time the principles of Ground Controlled Interception (GCI), which were used throughout the war, were established.

This was the Biggin Hill experiment.

Chain Home Low (CHL)

As good as CH proved to be, it had several serious deficiencies: it could not detect aircraft at low levels until within a few miles of the station, by which time it was often too late to organise effective interception; it only looked out to sea and thus could not control inland interceptions; it was not sufficiently accurate to guide an intercepting aircraft into attacking position on a hostile aircraft at night; and the cumbersome filter system was really too slow for modern air combat.

These problems had been recognised from the earliest trials, but it was not until the middle of 1939 that the technology became available which could overcome these difficulties.

The answer came in the development of the metric radar equipment, CHL, which operated on a frequency of about 200MHz and which I shall describe next month.

CALCULATING GREY LINE PATHS

by D.J Reynolds G3ZPF

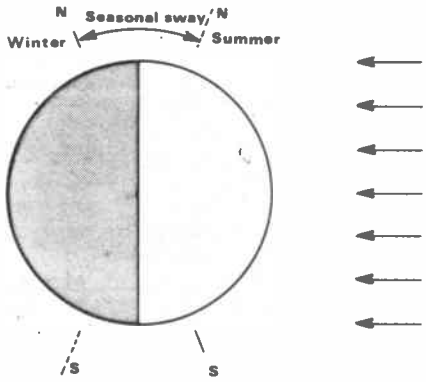


Fig 1 *Border of daylight and darkness*

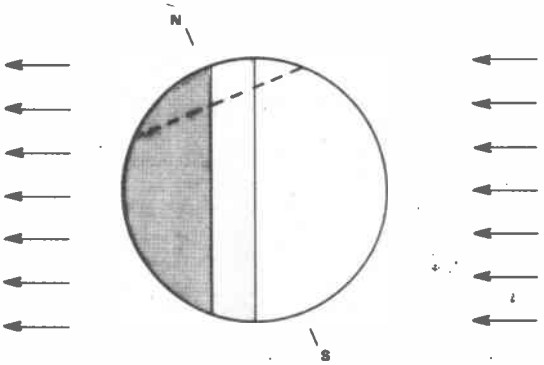


Fig 2 *Latitude of UK in October*

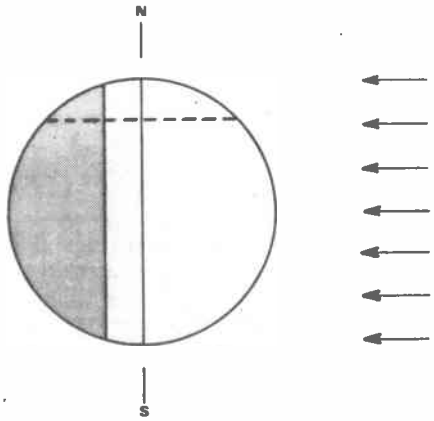


Fig 3 *Latitude of UK in April*

What is a grey line?

While the term will be quite familiar to established amateurs, a number of those who have recently entered the hobby may not have come across it before. It seems prudent therefore to give a brief explanation of its significance to DX working at LF, before moving onto the mechanics of determining the time of the event and the production of overlays for those without microcomputers.

Figure 1 shows in simplified form how the border of daylight and darkness follows a great circle around the Earth. The precise position will vary throughout the year as the attitude of the Earth changes with respect to the sun. The rotational axis of the Earth swings back and forth through an angle of roughly 24 degrees each side of the vertical, and it is this 'wobble' which causes the seasons of the year.

When the northern hemisphere is 'leaning' away from the sun we have our winter because the sun is lower in the sky and the heating effect of its rays are diminished. Conversely, when the northern hemisphere is tilted towards the sun we have our summer and the southern hemisphere has its winter. Equatorial regions have little or no seasonal variations since the Earth tilts about its centre and the sun will always be high in the sky around the equator.

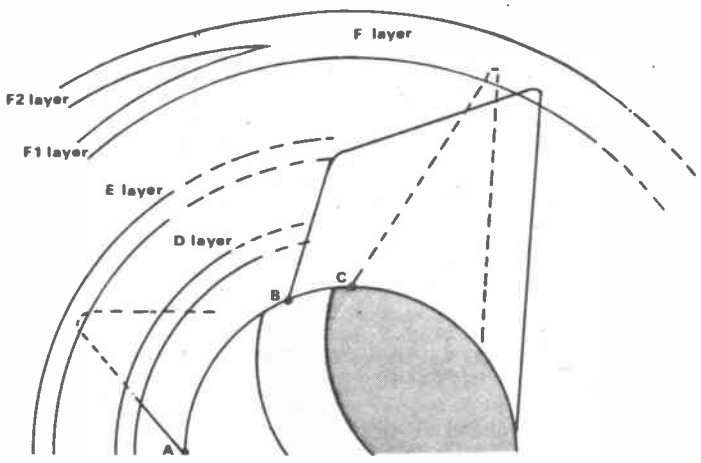
Midnight sun

Many readers will have seen variants of *Figure 1* in a number of books, but even allowing for the fact that it is diagrammatic there is one glaring inaccuracy. The transition from daylight to darkness is shown as a single line, but in reality this change does not take place instantly and there is a region of semi-darkness in between the day and night areas *(Figure 2)*. In Arctic and Antarctic regions the sun never quite sets in the summer, nor fully rises in the winter, and readers will undoubtedly be familiar with references to the 'land of the midnight sun'.

The dotted line in *Figure 2* and *Figure 3* represents the latitude of the UK with *Figure 2* being for October and *Figure 3* being for April, around the time of the equinox (when the Earth is 'vertical'). It is quite easy to see how much shorter the days are going to be in October while the Earth's northern hemisphere is tilted away from the sun, and that since the rotational path of the UK crosses the twilight band at an angle it will take slightly longer to get dark.

The combination of the sun being lower in the sky, plus longer periods of darkness giving greater heat losses, heralds the onset of winter weather. The band of twilight is often referred to as the 'grey line' in the amateur technical press, and enhanced propagation conditions can occur for a QTH in twilight especially if the other station in the QSO is also in twilight.

Fig 4 *Showing three locations in daylight, twilight and darkness*



Propagation enhancement

Most, if not all, readers will be familiar with the various layers in the ionosphere and their respective effects on RF. To visualise how twilight conditions can enhance propagation, consider *Figure 4*, which shows three locations in daylight, twilight, and darkness respectively. Station A will only be able to communicate at groundwave distances at LF since any skywave radiation will be severely attenuated, if not totally absorbed, by the D layer. Any signal that does get past the D layer will be reflected by the E layer, only to be attenuated yet further by another passage through the D layer. Under daylight conditions at LF, any signal that does finally get back to the surface will be well below the threshold of amateur equipment.

Since the D layer is relatively low in the atmosphere it dissipates almost instantly

when no longer in sunlight, but the E layer, at a height of about 70 miles, takes rather longer. The station at C will have increased range over the station at A because skywave reflections can take place from the F layer, once the D and E layers have dissipated. The F layer will be at about 175 miles during the night, having combined from the F1 and F2 layers (140 and 200 miles up) as darkness fell, where it dissipates slowly throughout the night. As it dissipates, so the MUF will be lowered.

Now consider the station at B whose skywave strikes the partly dissipated E layer. Although there will be insufficient energy to divert the RF enough to return it to earth, it will be turned to a lower angle whereupon it will continue upwards to the F layer. When it reaches the F layer it will then be returned to the Earth at a greatly enhanced range, especially if the station at the other end of the QSO is in twilight with the E layer lowering the angle of his skywave too. When both stations are in twilight, the signal travels in twilight for the whole of its path.

Since real aerials are unable to focus RF into a single line, especially at LF, some amount of RF will leave the grey line path at an angle, and enter either daylight or darkness *(Figure 5)*. In daylight the D layer will be present, and so LF signals will suffer severe attenuation on their downward path. HF signals would pass through, however, so do not think that grey line DXing is exclusively an LF affair. RF which passes into darkness enters a domain where the F layer is dissipating and lowering the MUF. HF signals will be lost to space, although LF signals will be reflected and return to Earth.

Curved paths

Since the twilight zone will lie along a great circle, it follows that signals should arrive on the 'normal' beam heading, always assuming that you are lucky enough to have a beam at LF. However, there have been a number of reported instances where this has not been the case, and to explain why requires a reappraisal of the terms in which simple RAE theory depicts the various layers of the ionosphere.

The D, E, and F layers are generally depicted as RF mirrors which reflect the skywave back to earth, but in fact they are 'clouds' of charged particles which *refract* the skywave downwards. Even though the net result is often the same, it is significant to note the difference between the gradual turning of an RF wave within the depth of the layers and the reflection of light from a mirror's surface.

Once the layers can be thought of as clouds, it takes only one further step of the imagination to realise that they will obviously be very unstable regions for RF, and that any 'swirling about' of particles as they split and recombine could well curve a signal off a straight line path. The fact that ionised layers do 'move' about will be well known to VHF types who have exploited sporadic-E propagation.

Sunrise and sunset times

Although the mechanics of RF propagation contain a large number of variables and uncertainties, the chances of DX contacts will obviously increase if it is possible to find the sunrise and sunset times for any point on the Earth for any date. Even if the said times are known, there will be some areas that cannot be contacted via a grey line path since the 'wobble' of the earth is only about 24 degrees. If it was 45 degress then sooner or later any two points on the earth would have twilight conditions simultaneously, but then our winters would be very bleak indeed.

The calculation of sunrise and sunset times has occupied amateurs for decades and several mechanical aids have been produced during that time. Although these are very useful for general purposes, their accuracy is slightly limited by the fact that they take no account of the slight annual fluctuations in sunrise and sunset times but work purely on the variations within a 'typical' year.

Taking full account of annual variations can give accuracies to within a minute or so, but this requires the use of some high powered mathematics. In recent years the advent of the home computer has meant that these greater accuracies can be achieved, and this is of particular importance in the case of G to ZL paths, where 160m openings can be of literally just a few minutes' duration.

Enter the micro

I first got to grips with the determination of sunrise and sunset times a few years ago after buying an Apple 2 micro. This resulted in an article in *Short Wave Magazine* (October 1982) giving a program listing together with conversion notes for other machines, and the formulae that it was based upon. The algorithm was a simple one, and was little more accurate than mechanical aids, but it proved quite useful and the notes within the article enabled several amateurs to convert the program for their own machines.

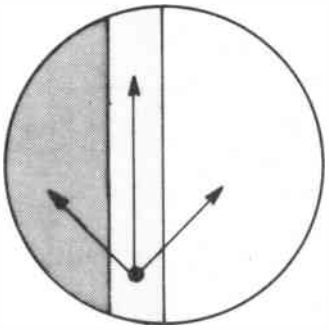


Fig 5 *Angled grey line path*

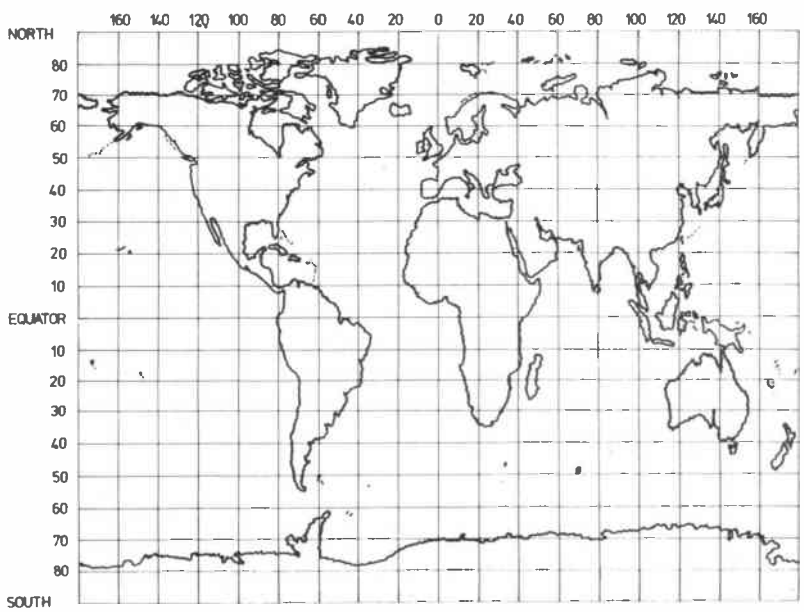
Following the publication of the article I was contacted by G4FKH who had entered the program on his work's mainframe. Since the Cobol language on that machine had no trig functions available it meant him typing in the entire set of log tables . . . such dedication.

In a series of letters Gwyn drew my attention to NAO technical note 46, which is issued by the Royal Greenwich Observatory. Written by Dr B Yallop it contains a collection of formulae intended for use by navigators with hand-held calculators.

Among other things it shows how to find sunrise and sunset times to accuracies of a minute or so, and the step by step approach adopted by Dr Yallop means that the maths is easy for the amateur to understand.

Owners of Texas T199 calculators may wish to note that the publication contains listings for their machines, and that the postal address is: Royal Greenwich Observatory, Herstmonceux Castle, Hailsham, East Sussex BN27 1RP.

Fig 6 *Typical world map*



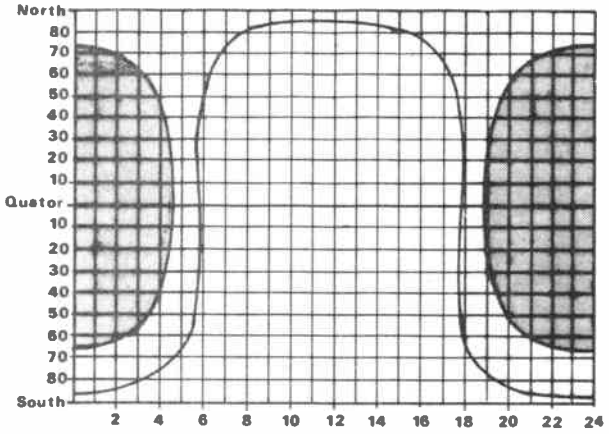


Fig 7 *World map overlay made for October*

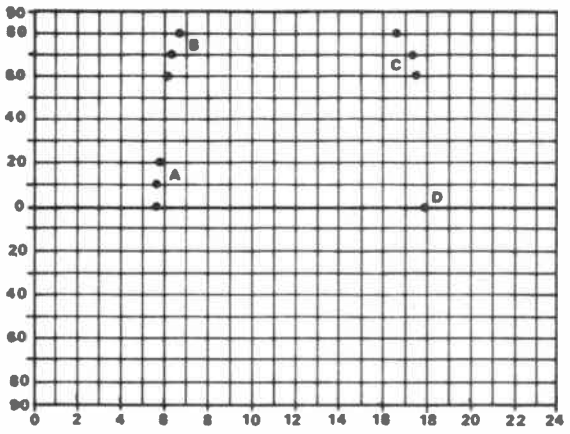


Fig 8 *Rectangle grid marked in degrees of Long and Lat*

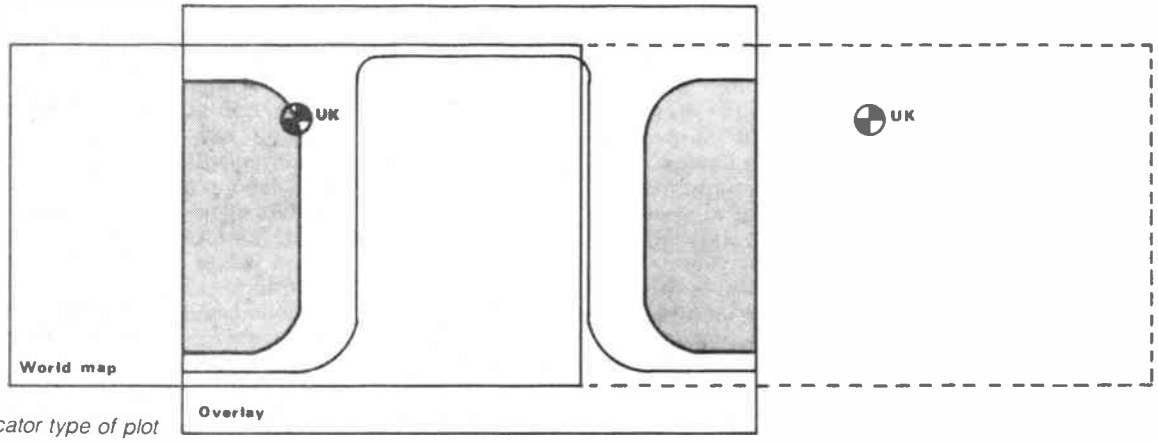


Fig 9 *Mercator type of plot*

Twilight zone width

Although the route to greater accuracy had now been found, the times of sunrise and sunset were still quoted as a single figure.

The determination of the width of the twilight zone, and the maths behind it, were still baffling me when Gwyn wrote again to mention an article in the April 1984 issue of *Astronomy* magazine. This article contained a program which went further than simply finding sunrise and sunset times, and also found Civil, Nautical and Astronomical dawn/dusk. The latter is defined as 'the instant when the sky first glows a little lighter in the East', which was exactly what I had been trying to find.

The listing was quite straightforward, and written in a way which could easily be used on any micro with the Basic language. It certainly ran first time on my BBC machine, and while it did not have the facility to identify long and short paths directly (as with my own program) it was interesting to compare the values output by each.

For those without computers

So far this is all pretty academic for readers without access to a micro, but it occurred to me that the results could be expressed in tabular form so as to be of use to a wider audience. Further thinking indicated that such tables could be used to construct a set of overlays to suit whatever size map the reader had to hand. Two sets of outputs have been put together, one for the general case for use with a world map, and the other for those brave souls who go DXing on 160m and require greater accuracy for those G to ZL contacts.

Figure 6 shows a typical world map, with *Figure 7* showing an overlay made for it from the October table of values. The only real requirement is that the overlay is on the same axes as the map, but after presenting these notes as a lecture at a local club it became clear that the construction of an overlay from the table values was not as obvious a process as I had imagined, to a significant number of those present.

Consider *Figure 8*, which is a rectangle of the same size as the map to be used. Mark on the degrees of latitude from the map but divide the horizontal axis into 24 rather than degrees longitude. Now look at *Figure 1*, which shows the values for October. Starting at zero latitude, and plotting the sunrise/set curve, the time shown is 0546 which can be entered as point 'A' in *Figure 8*. Work upwards in latitude, plotting each point as you go, until arriving at point 'B' whereupon you start down the sunset column, ending up at 'D'.

Hopefully it will now be clear how to construct an overlay, with the same process being repeated for each month. Obviously (famous last word) overlays will need drawing on transparent material, and this can be obtained from

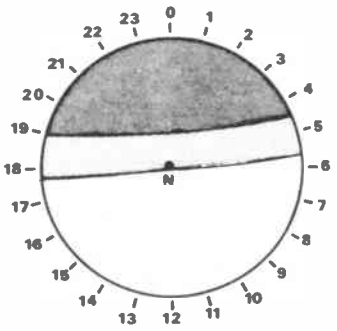


Fig 10 *Plot of northern hemisphere*

drawing office suppliers in the form of draughting paper. To the uninitiated, this looks like a high quality grease-proof paper, and is very easy to see through.

For the ambitious reader the shaded areas can be done with 'Letratone' which comes in a variety of shades, and is what I used for the artwork of this article. In *Figure 7* the darker areas represent complete darkness and the lighter areas twilight.

One slight snag with the mercator type of plot is illustrated in *Figure 9*, where the entire length of the overlay cannot be viewed in one go as it overhangs the map edge. Although sliding the overlay across to the other side soon reveals this, the minor inconvenience can be overcome completely by duplicating the world map alongside, as shown. For the sake of clarity (and my sanity) I have not

GREY LINES

OCTOBER

Latitude	Dawn	Rise	Set	Dusk
+90	—	—	—	—
80	—	0649	1645	—
70	0239	0618	1719	2057
60	0346	0607	1731	1952
50	0413	0601	1737	1925
40	0427	0557	1741	1911
30	0434	0554	1745	1904
20	0438	0551	1748	1901
+10	0439	0549	1750	1900
0	0437	0546	1753	1902
−10	0434	0544	1755	1905
20	0427	0541	1758	1912
30	0417	0538	1802	1922
40	0401	0534	1806	1938
50	0335	0528	1812	2005
60	0244	0519	1821	2057
70	—	0501	1840	—
80	—	0409	1935	—
−90	—	—	—	—

NOVEMBER

Latitude	Dawn	Rise	Set	Dusk
+90	—	—	—	—
80	0420	—	—	1903
70	0454	0833	1451	1835
60	0501	0724	1602	1825
50	0500	0651	1636	1826
40	0458	0630	1657	1829
30	0453	0614	1712	1834
20	0447	0602	1725	1840
+10	0439	0551	1736	1848
0	0429	0540	1747	1858
−10	0417	0530	1758	1911
20	0400	0518	1809	1927
30	0338	0505	1823	1949
40	0306	0448	1840	2023
50	0208	0425	1903	2121
60	—	0348	1940	—
70	—	0225	2105	—
80	—	—	—	—
−90	—	—	—	—

DECEMBER

Latitude	Dawn	Rise	Set	Dusk
+90	–	–	–	–
80	0714	–	–	1622
70	0619	–	–	1718
60	0556	0836	1502	1742
50	0540	0737	1601	1758
40	0527	0703	1635	1812
30	0514	0639	1700	1824
20	0501	0619	1720	1837
+10	0447	0602	1737	1851
0	0431	0546	1753	1907
−10	0413	0529	1809	1926
20	0349	0512	1827	1950
30	0317	0451	1848	2022
40	0227	0425	1914	2112
50	0001	0348	1951	2343
60	–	0242	2057	–
70	–	–	–	–
80	–	–	–	–
−90	–	–	–	–

JANUARY

Latitude	Dawn	Rise	Set	Dusk
+90	–	–	–	–
80	0757	–	–	1611
70	0646	–	–	1722
60	0618	0903	1505	1749
50	0600	0759	1609	1808
40	0545	0722	1645	1823
30	0531	0656	1711	1837
20	0517	0635	1732	1851
+10	0502	0617	1750	1905
0	0445	0600	1807	1922
−10	0425	0453	1825	1942
20	0400	0524	1843	2007
30	0326	0502	1905	2041
40	0233	0435	1932	2134
50	–	0355	2012	–
60	–	0243	2124	–
70	–	–	–	–
80	–	–	–	–
−90	–	–	–	–

FEBRUARY

Latitude	Dawn	Rise	Set	Dusk
+90	–	–	–	–
80	0559	–	–	1842
70	0552	0948	1442	1837
60	0548	0815	1614	1840
50	0543	0734	1654	1845
40	0536	0709	1719	1852
30	0529	0651	1739	1859
20	0520	0636	1752	1907
+10	0510	0623	1805	1917
0	0458	0610	1817	1929
−10	0444	0558	1830	1944
20	0425	0544	1843	2002
30	0400	0528	1859	2027
40	0322	0509	1918	2105
50	0211	0441	1945	2215
60	–	0356	2030	–
70	–	0200	2223	–
80	–	–	–	–
−90	–	–	–	–

MARCH

Latitude	Dawn	Rise	Set	Dusk
+90	–	–	–	–
80	–	0904	1526	–
70	0402	0729	1658	2026
60	0441	0700	1727	1946
50	0457	0644	1742	1929
40	0504	0634	1751	1921
30	0507	0627	1759	1918
20	0507	0620	1805	1918
+10	0504	0615	1811	1921
0	0500	0609	1816	1925
−10	0453	0604	1821	1932
20	0443	0558	1827	1942
30	0429	0551	1834	1956
40	0407	0542	1842	2017
50	0332	0530	1854	2052
60	0216	0511	1912	2206
70	–	0435	1948	–
80	–	0219	2157	–
−90	–	–	–	–

Fig 11 *Map of the UK with specific QTHs marked*

Fig 12 *Map of ZL with specific QTHs marked*

SOUTH EAST ENGLAND 51 North 0 West

Month	Dawn	Rise	Set	Dusk
Oct	0411	0601	1737	1927
Nov	0501	0653	1633	1825
Dec	0542	0742	1556	1757
Jan	0601	0803	1604	1806
Feb	0543	0737	1651	1845
Mar	0456	0646	1740	1930

SOUTH EAST ENGLAND 50.5 North 5 West

Month	Dawn	Rise	Set	Dusk
Oct	0431	0621	1757	1947
Nov	0521	0713	1654	1845
Dec	0602	0801	1617	1817
Jan	0621	0823	1625	1826
Feb	0603	0757	1711	1905
Mar	0516	0705	1801	1950

NORTHERN IRELAND 55 North 8 West

Month	Dawn	Rise	Set	Dusk
Oct	0434	0636	1806	2008
Nov	0533	0737	1653	1857
Dec	0620	0834	1608	1822
Jan	0640	0857	1614	1831
Feb	0617	0824	1709	1915
Mar	0522	0723	1807	2008

NORTHERN SCOTLAND 58 North 4 West

Month	Dawn	Rise	Set	Dusk
Oct	0409	0621	1748	2001
Nov	0517	0731	1627	1841
Dec	0609	0837	1533	1801
Jan	0630	0902	1538	1809
Feb	0603	0821	1640	1857
Mar	0501	0712	1746	1957

MIDLANDS 52.5 North 2 West

Month	Dawn	Rise	Set	Dusk
Oct	0415	0610	1744	1939
Nov	0509	0706	1636	1833
Dec	0552	0758	1556	1802
Jan	0613	0821	1603	1811
Feb	0552	0752	1653	1852
Mar	0502	0656	1746	1940

NEW ZEALAND (North Island) 36 South 174 East

Month	Dawn	Rise	Set	Dusk
Oct	1633	1800	0628	0755
Nov	1545	1720	0656	0831
Dec	1515	1701	0726	0912
Jan	1522	1710	0744	0933
Feb	1602	1741	0734	0912
Mar	1640	1809	0703	0832

NEW ZEALAND (South Island) 46 South 170 East

Month	Dawn	Rise	Set	Dusk
Oct	1628	1811	0649	0832
Nov	1517	1716	0732	0931
Dec	1415	1645	0813	1044
Jan	1413	1653	0834	1113
Feb	1525	1733	0814	1021
Mar	1627	1815	0730	0917

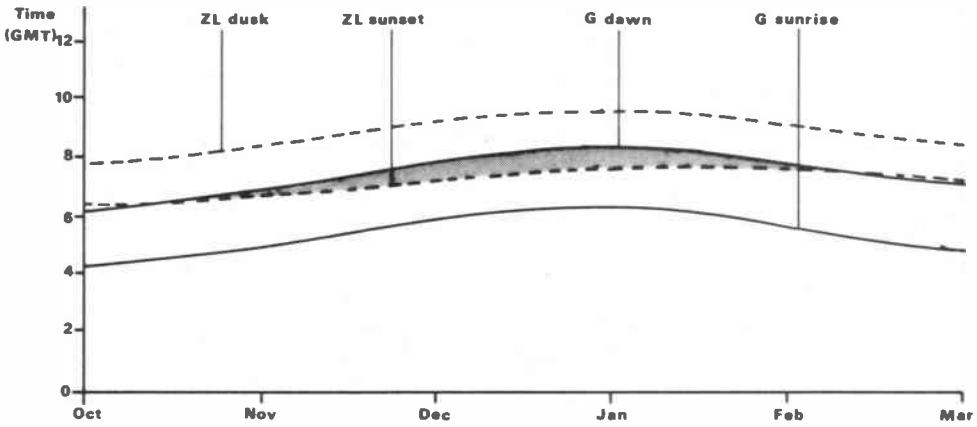


Fig 13 *Time comparison graph*

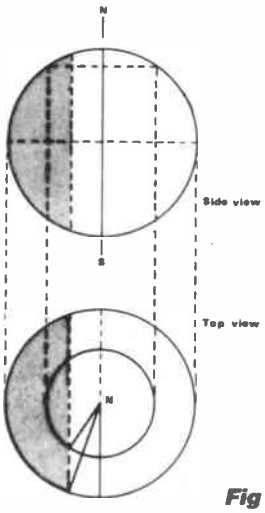


Fig 14

drawn in the map completely, but indicated the position of the UK on each map.

Mercator plots are not the only ones available, and most atlases contain polar plots of the northern and southern hemispheres. *Figure 10* shows a plot of the northern hemisphere with the values from the October table plotted on it. The overlay is rotated rather than slid across, as with the mercator projection, and the whole of the overlay is visible, albeit one hemisphere, so this may suit some readers more.

Great circle maps are a common article in many shacks, but there is a snag to using them. Anyone who has one will realise that the lines of longitude change shape around the map, due to the way that an entire sphere has been 'unwrapped' to give true bearings. This means that an overlay will only be valid at one position on the map and cannot be rotated around it as with a polar plot.

The G to ZL path

Dealing with the G to ZL path with accuracy, while making the tables useful over the whole of the UK is not simple, hopefully the method adopted will be of some use to all. *Figure 11* and *Figure 12* show maps of the UK and ZL with specific QTHs marked on each. Their locations were chosen so that each country is 'bracketed' to enable interpolation for any QTH on the map. Readers then compare times for their own QTH with those for ZL, either by simply studying the tables or by producing graphs of the type shown in *Figure 13*. Note the variation in times for QTHs at the extremities of the UK.

Checking criterion for paths

A short path exists when the station at the western end of the path has sunset at about the same time that the eastern station has sunrise. A long path exists when the station at the eastern end of the path has sunset around the same time that the western station has sunrise.

In conclusion

Hopefully the charts will be found useful, and readers will be able to construct overlays for maps in their shacks. It is certainly far easier than going through the maths each time, and does mean that those without access to a micro can make use of the enhancement of propagation. The months given do not give a complete year, but do cover the 'winter DX season' on the LF bands. The monthly outputs are for the first day of each month, and can be interpolated if required, but note that the monthly variations follow a roughly sinusoidal pattern, not a linear one. Overlays can be used for stations outside the UK, although they are more easily read over a world map centred on their own country. Stations within the UK can interpolate the times given to produce tables for their own QTH, but this will only be necessary for the G to ZL case, as the difference will be too small to be noticed on the world map.

The transition from day to night varies in duration across the world, which regular globe trotters will be aware of. This may appear to be at odds with the constant width shown for the twilight zone, and it confused me too at first. Looking at *Figure 14*, it will be seen that for a station at the equator to pass through the twilight zone requires a far smaller rotation of the earth than for one at a more northerly (or southerly) latitude, and this is why it gets dark very quickly in some countries.

Finally, my thanks to anyone who I pestered for information during the writing of this article, and especially to Gwyn (G4FKH) without whose help it would not have been possible.

COBRA CONVERSION

PART II

Roger Alban GW3SPA continues with the conversion of the Cobra multi-mode CB sets for the 10m amateur band

Alignment

Having built and modified the logic circuitry feeding the program lines to the PLL chip, it is worthwhile checking that you are obtaining the correct logic values before proceeding to the next stage of adjusting the tuning of the phase locked loop.

By far the easiest way to align the phase locked loop is to examine the dc output from the phase comparator. However, it is not possible to connect a dc voltmeter directly to the output of the phase comparator and take sensible readings as the dc output also contains a relatively high content of 10kHz derived from the two inputs of the phase comparator. It is therefore essential that the dc readings are taken from the output side of the low-pass filter. This may be found on the set PCB by first of all locating pin 7 on the PLL chip, the phase comparator output.

Table 5 *New frequency allocation*

CHANNEL	LOW	MID	HIGH
1	28.46	28.86	29.26
2	28.47	28.87	29.27
3	28.48	28.88	29.28
4	28.50	28.90	29.30
5	28.51	28.91	29.31
6	28.52	28.92	29.32
7	28.53	28.93	29.33
8	28.55	28.95	29.35
9	28.56	28.96	29.36
10	28.57	28.97	29.37
11	28.58	28.98	29.38
12	28.60	29.00	29.40
13	28.61	29.01	29.41
14	28.62	29.02	29.42
15	28.63	29.03	29.43
16	28.65	29.05	29.45
17	28.66	29.06	29.46
18	28.67	29.07	29.47
19	28.68	29.08	29.48
20	28.70	29.10	29.50
21	28.71	29.11	29.51
22	28.72	29.12	29.52
23	28.75	29.15	29.55
24	28.73	29.13	29.53
25	28.74	29.14	29.54
26	28.76	29.16	29.56
27	28.77	29.17	29.57
28	28.78	29.18	29.58
29	28.79	29.19	29.59
30	28.80	29.20	29.60
31	28.81	29.21	29.61
32	28.82	29.22	29.62
33	28.83	29.23	29.63
34	28.84	29.24	29.64
35	28.85	29.25	29.65
36	28.86	29.26	29.66
37	28.87	29.27	29.67
38	28.88	29.28	29.68
39	28.89	29.29	29.69
40	28.90	29.30	29.70

Output connection

The output is connected to an R-C network forming the low-pass filter feeding the capacitance diode in the VCO tuned circuit. The dc output can be taken from the middle of the low-pass filter by soldering a piece of wire to the printed circuit side of the PCB. The author found that a dc oscilloscope gave a reasonable indication of the output dc value, as well as showing if there is any instability existing within the PLL loop.

Having now checked that the correct logic levels are present on the PLL program lines, switch the set to channel 40 on the mid-band and adjust the VCO tuning coil core, L18 (found next to the 10.24MHz crystal), by unscrewing the core until a reading of 5.5 volts is obtained. The loop should now be locked.

A further check can be carried out by observing the dc voltage reading when changing from one band to another. Ensure that the dc voltage is varying in sympathy with the operating frequency selected. You may find that the tuning core of the VCO coil, L18, has to be adjusted so that it is nearly completely unscrewed from the coil former. If this is the case, then you will need to modify the number of turns on L18. The author desoldered L18 from the PCB and rewound the coil former with ten turns of 36swg wire; remember to replace the pot core when re-assembling the coil former.

Having completed this stage of the tuning exercise the loop should now be locked and the VCO should be operating on the correct frequencies.

Transmitter tuning

The next step is to adjust the tuning of the transmitter. Connect a 50 ohm dummy load and SWR meter to the aerial socket of the set. With the SWR meter switched to read forward power, key the transmitter and adjust L52 and L53 for maximum output power on channel 19 on the mid-band. L52 and L53 form a bandpass filter on the output side of the transmitter mixer.

Check the power levels on channel 1 on the low-band and channel 40 on the high-band to obtain, as far as possible, an even power output over the complete new operating frequency range of the set.

The author found that it was not necessary to adjust any of the tuning cores associated with the power amplifier stages as these stages of the transmitter appeared to be broadband.

Finally, with the use of the amateur station main receiver, check either side of the transmitter carrier frequency to ensure that a pure carrier is being transmitted on either the AM or FM mode. Check the frequency of the carrier, and if not correct, adjust L37 to obtain the correct transmit frequency.

Switch the set to the USB mode and again key the transmitter. With the aid of the main amateur station receiver, adjust L38 to obtain the correct operating frequency for USB. With the set in the LSB mode, key the transmitter and adjust L39 to obtain the correct operating frequency.

The set was designed so that the USB and LSB will be resolved on the same receiver operating frequency as for AM or FM.

Receiver tuning

Tune the set to channel 20 on the mid-band, inject a signal of 29.1MHz into the aerial socket and adjust the tuning cores of the receiver RF amplifier: L7, L8 and L9. Reduce the level of injected signal until it is just audible from the set's loudspeaker and again adjust the tuning cores of L7, L8, and L9 for maximum audio from the loudspeaker.

If you do not own or cannot obtain a suitable signal generator, the receiver front-end can be tuned from an off air signal generated by another amateur station. Remember from the previous discussion that the operating frequency generated by the channel change switch logic code does not necessarily change in 10kHz steps from one channel to the next.

Switch the set to the USB mode and, with the aid of the main amateur station transmitter, inject a USB signal into the set at a chosen operating frequency and adjust L33 until the signal is successfully resolved. Repeat the same tuning operation for LSB, but on this occasion adjust L34 to resolve the signal. The new operating frequency relationship with channel number is shown in *Table 5*.

The cost of the modification is approximately £1: the cost of using a few switching diodes and a small piece of Veroboard.

Simple crystal modification

If you should feel that modifying the binary adder to put the set on the ten metre amateur band is slightly complicated, a simpler method is to change the value of the 15MHz crystal. To calculate the new value of crystal frequency required we need to take another close look at the various operating frequencies within the set.

If we select channel 30 on the high-band, the unconverted set will be operating on a frequency of 28.205MHz and the VCO will be operating at a frequency of 10.695MHz below 28.205MHz, which is 17.51MHz. The value of F_{in} will be 17.51MHz minus 15.00MHz, which equals 2.51MHz. If the modified set is to operate on the FM portion of the ten metre amateur band, it is advisable to make channel 30 on the high-band correspond with the calling frequency of 29.6MHz. Therefore, the VCO will now be operating at a frequency of 18.505MHz.

For the loop to remain locked with the same binary values as for the unconverted set, it will be necessary for F_{in} to continue to operate on a frequency of 2.51MHz. Therefore, the value of the new down mixing crystal oscillator frequency will be 18.905MHz minus 2.51MHz, which gives a frequency value of 16.395MHz.

The resulting operation of the VCO and down mixer crystal oscillator for the mid-band and low-bands is shown in *Table 6*. It will be immediately seen that different values of crystal frequency will be required for the set to operate on the other frequency bands, as shown in *Table 5*.

However, all is not lost! If the 16.395MHz crystal is used on the other bands, then, besides giving the required operating frequencies on the high-band, it will give a slightly different group of operating frequencies on the other two bands. For example, the operating frequencies on the mid-band will be 50kHz below the frequencies shown in *Table 5*, and the low-band will be 100kHz lower in frequency.

This, in real terms, means that the top five channels of the mid-band will be lost, which is the frequency range between 29.25MHz and 29.30MHz. However, as a result of the American specification regarding frequency jumps between channels, the bottom end of the high-band starts at 29.6MHz. What appears at first to be a disadvantage turns into an advantage. The operating frequencies on the low-band will lose five channels near the top end between 28.81MHz and 28.85MHz, but will gain an extra ten channels at the lower frequency end. This will extend the frequency coverage of the set down to 28.36MHz. However, the main disadvantage of the odd frequency jumps between channel numbers still remains.

Memory board

If the problem of the odd frequency jumping between channels is to be solved then we either have to change the channel switch or insert some device between the channel switch and the program lines to the PLL chip to correct the binary code. A channel switch giving a group of 40 sequential binary codes is not always readily available, although such a switch does exist and can be found in the vast majority of British specified CB sets.

The alternative is to use a memory device. The existing binary values produced by the channel switch will become the address lines of the memory device. Each individual address location can hold a unique binary number which can be fed to the program lines of the PLL chip. It should therefore be possible, with the aid of a memory chip, to provide the correct binary codes to ensure that the operating frequencies of the set remain in step with the channel selected.

There are also other advantages in using a memory chip. The operating frequency range of the set can now be extended by adding to the address lines additional logic levels from the band switch. Therefore, it is possible to create a unique binary number for each channel, depending upon the band selected. Again, the binary values held within these unique addresses can be arranged so as to give a continuous frequency coverage in 10kHz steps over 120 channels. Other facilities, such as repeater shift, can be incorporated.

When using repeater shift it is necessary for the transmit frequency to be 100kHz below the receiver frequency. If a spare address line of the memory chip is put at logic level 1 then it should be on transmit when the repeater shift facility is required only, and at all other times held at logic level 0.

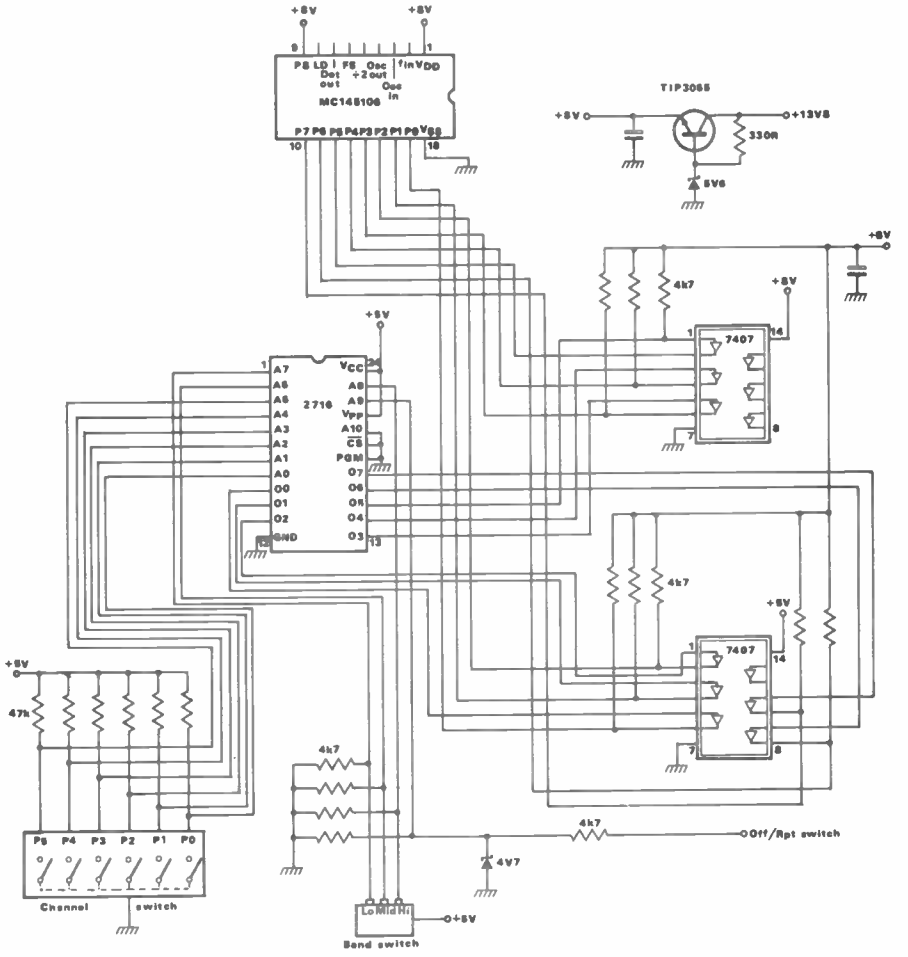
Another group of unique addresses will be produced under transmit conditions containing a binary value which will be fed to the program lines of the PLL chip to ensure that the transmit frequency is 100kHz below the receive frequency. The problem now encountered is which type of memory device should be used?

2716 EPROM

The memory device to be used must have the ability to hold its memory contents when the set is disconnected from the power supply. The memory device chosen for this application is an ultra-violet erasable programmable read only memory (EPROM).

Many commercial EPROMs require a number of different voltage levels, some in excess of 12 volts, for the device to operate. However, there is an EPROM that only requires a single five volt supply to be able to read its memory. This

Fig 7 *Circuit diagram of 2716 memory board*



2816 EPROM		BINARY ADD PINS ON MAIN PCB	
Connect pin number	Function	To pin number	Function
8	A_0	7 on ICa	A_0
7	A_1	5 on ICa	A_1
6	A_2	3 on ICa	A_2
5	A_3	1 on ICa	A_3
4	A_4	7 on ICb	A_4
3	A_5	5 on ICb	A_5

Table 6 *Address line interconnections*

EPROM is called the Intel 2716, which has been in circulation for many years. It operates on TTL logic levels, that is, logic level 1 being plus five volts and logic level 0 being zero volts. It draws an operating current of approximately 100mA, and therefore a separate stabilised voltage supply will be required to drive the 2716 from the 13.8V set supply.

We do, however, have a problem. The Motorola MC145106 PLL chip requires CMOS logic levels. The manufacturer's data sheet specifies that the minimum voltage value for logic level 1 must not be less than 0.7 times the value of the supply voltage. If the supply voltage is 8V, then the minimum acceptable value of voltage to obtain logic value 1 will be 5.6V.

The problem can be overcome by using a non-inverting open collector buffer. The device selected was the 7407 which contains 6 buffers on each chip. The integrated circuit is driven from the stabilised 5 volt supply and the open collectors are connected via 4.7kΩ resistors to the 8 volt supply. This will produce CMOS logic levels at the collector for each buffer which will be fed to the program lines of the PLL chip. The full circuit diagram of the memory board is shown in *Figure 7*.

The five volt stabilised supply is produced by a TIP3055 pass transistor and a 5.6 volt Zener diode. The pass transistor is mounted with a mica washer to the metal side chassis of the set, so that the metal case of the set acts as a heatsink.

Installation of the EPROM board

In the modified PLL circuit, the two binary adder integrated circuits will not be required and can therefore be desoldered and removed from the PCB of the set. The holes left in the PCB where the legs of the integrated circuits made contact with the PCB track will be used to pick up the required address and data program lines which will be connected to the EPROM.

The EPROM circuitry is constructed on a small piece of Veroboard, and the component layout, as used by the author is shown in *Figure 8*. It is recommended that the three integrated circuits should be mounted in IC holders which will prevent the ICs from being damaged by the build-up of static when the board is constructed. It will also give you the opportunity to carry out some voltage checks when the circuit has been constructed to ensure that all the wiring is correct.

The various interconnections between the memory board and the set were made with flat ribbon cable which makes a neat job of wiring and prevents the modification from resembling a bird's nest!

A few modifications should be undertaken on the PCB track of the set. The 47kΩ resistors, which were connected to the channel switch inputs of the binary adder integrated circuits, are also connected to the 8 volt supply of the set to produce CMOS logic levels. The EPROM modification will now require that these logic levels should be TTL logic levels to feed the address lines of the EPROM. It will therefore be necessary to reconnect these pull-up resistors to the 5 volt regulated supply.

To achieve this alteration, the PCB track of the set will need to be cut in a number of places. The isolated pieces of track remaining connected to these pull-up resistors will be attached together by soldering pieces of wire to the track side of the PCB and eventually connecting all the pull-up resistors shown in the memory board circuit diagram to the 5 volt supply.

In cutting the track of the PCB, part of the track which carries the 8 volt supply will become isolated and will need to be reconnected to the 8 volt supply by means of another wire strap soldered to the track side of the PCB.

Having completed the construction of the memory board, leave the integrated circuits disconnected until the interconnection wiring has been completed. It is also advisable to try to keep the interconnection wiring as short as possible, as large values of RF will be present within the set under transmit conditions.

To achieve this the author found the most suitable place to mount the memory board was directly behind the channel switch. The memory board was connected firmly to the inside metal chassis of the set using an L-shaped bracket fabricated out of thin aluminium sheet. A 6 core ribbon cable was soldered to the address lines on the memory board and the other end soldered into the holes which were left after removing the binary adder ICs. The interconnections for the address lines are shown in *Table 6*.

Location of channel switch

The exact location of the correct channel switch functions on the PCB is shown diagrammatically in *Figure 6*. To make a neat job of the soldering of the interconnection wires the author found it helpful to remove the screws holding the front panel of the set to the chassis and move the front panel forward slightly.

The EPROM data lines are connected to the program lines of the PLL chip by using 8 core ribbon cable soldered between the memory board and the holes left after removing the binary adder ICs. The correct interconnections for the data lines are shown in *Table 7*, and the correct location of the program lines are shown in *Figure 6*.

Pin 10 of the PLL chip is permanently connected to ground via a soldered strap to ensure that program line P_8 is always at logic level 0. If we are to retain the existing down mixer crystal and adjust it to operate on a frequency of 14.995MHz, as discussed earlier, the binary value on the program lines of the PLL chip will need to be increased to obtain the desired divide-by-N numbers for the set to operate on the FM portion of the amateur ten metre band. It will therefore be necessary to make program line P_8 permanently at logic level 1. This will entail desoldering the earthing link and connecting pin 10 to pin 1, which is the 8 volt supply feeding the PLL chip. This modification will add a binary value of 256 to the program line value.

The next stage of the modification concerns the band switch. The existing wiring of the band switch connects 8 volts to the diode matrix, as shown in *Figure 4*. The wiring will need to be altered, but before disconnecting any wires study the wires soldered to the back of the band switch as shown in *Figure 9*. Remove wire number 1, which links two terminals of the band switch, then remove wires 2, 3 and 4 from the switch, desoldering their other ends from the PCB of the set.

Table 7 *Data line connections*

2716 EPROM		BINARY ADDER PINS ON MAIN PCB	
Connect pin number	Function	To pin number	Function
9	O_0	10 on ICa	P_0
10	O_1	11 on ICa	P_1
11	O_2	12 on ICa	P_2
13	O_3	13 on ICa	P_3
14	O_4	10 on ICb	P_4
15	O_5	11 on ICb	P_5
16	O_6	12 on ICb	P_6
17	O_7	13 on ICb	P_7

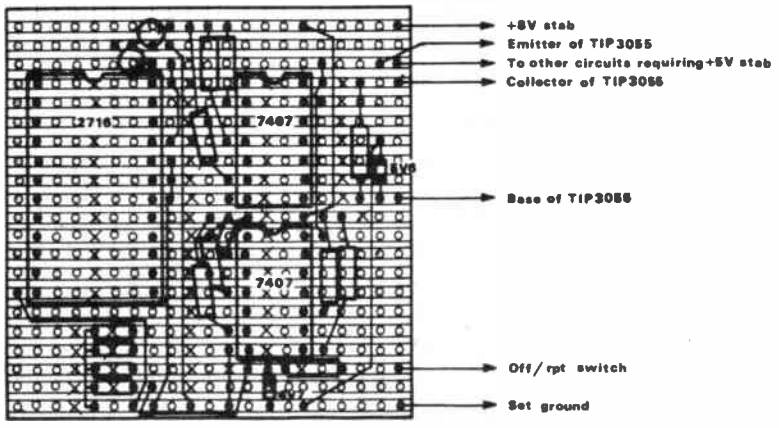


Fig 8 Circuit layout of EPROM board

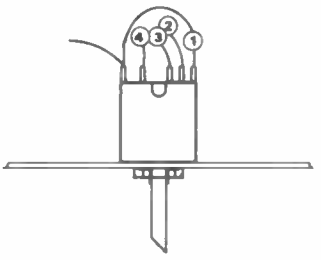


Fig 9 Wire connections to the backs of the band switch as viewed from the component side of the PCB

Connect terminal 1 of the switch to the 5 volt regulated supply and terminal 2 to pin 23, A_8 on the EPROM holder. Connect terminal 3 to pin 1, A_7 on the EPROM holder, and terminal 4 to pin 2, A_6 on the EPROM holder.

Repeater shift

The repeater shift facility is achieved by making address line A_9 logic level 1 during transmit. The logic level voltage is taken from the Tx/Rx circuitry of the set, which operates between zero and 8 volts. To convert these voltage levels to an acceptable TTL logic voltage it will be necessary to clamp the logic voltage which is fed to the address line A_9 by using a 4.7 volt Zener diode mounted on the memory board.

It will be necessary to be able to switch the repeater shift facility on and off, and ideally it would be convenient to have the repeater switch located on the front panel. Unfortunately, there is no room on the front panel to locate an additional switch, so one of the existing switches will have to be used to provide the repeater shift facility.

The most appropriate switch to use is the channel 9 switch. This is a switch which, on the unmodified set, places the set on the CB emergency channel 9, irrespective of the channel number selected by the channel switch. It also alters the seven segment display to illuminate channel number 9.

This facility will not be required on the modified set and can therefore be dispensed with. The front panel will need to be moved forward from the set to aid the removal of the channel 9 switch, and the three wires soldered to the terminals of the switch will need to be removed. It will be necessary to connect the two wires which are normally connected electrically when the switch is in the off position. You will find that the remaining wire is connected to the small PCB, forming part of the channel switch assembly. This wire can be disconnected from the channel switch PCB and can be discarded.

The address line A_9 of the EPROM pin 22 can now be connected with a small length of wire via a 4.7kΩ resistor to the centre contact of the switch. The normally open contact of the switch is now connected to the Tx/Rx logic circuitry of the transceiver. This can be found on the set PCB at a wire strap numbered JP47. The wire can either be soldered to the wire strap on the component side of the PCB, or soldered to the track side of the PCB directly beneath the wire strap.

The TIP3055 pass transistor is mounted on the inside of the case just behind the memory board, to keep all the connecting wires as short as possible. A wire is taken from the collector of the pass transistor and is attached to the 13.8 volt supply, feeding the set on the back of the on/off switch which is attached to the volume control. The 13.8 volt feed should be taken to the set side of the supply after the switch contact to ensure that the voltage supply feeding the memory board is removed when the switch is in the off position.

Voltage checks

The earth wire connected to the memory board is also connected to a large area of the set PCB earth track close to the PLL chip, and the 8 volt supply of the set is fed to the memory board by a short length of wire connected to pin 1 on the PLL chip. The interconnection wiring between the set and the memory board should now be complete.

Do not insert the three integrated circuits into the holders on the memory board until the following voltage checks have been carried out. Switch on the set and check that the 5 volt regulated supply is operating at the correct voltage by measuring the voltage on pins 21 and 24 on the EPROM. Also check to see if the 5 volts are present on pin 14 of the two 7407 ICs.

Now check the voltages on the address

CHANNEL	÷N	HEX		P_8	P_7	P_6	P_5	P_4	P_3	P_2	P_1	P_0
Low 1	282	1	A	1	0	0	0	1	1	0	1	0
Low 40	321	4	1	1	0	1	0	0	0	0	0	1
Mid 1	322	4	2	1	0	1	0	0	0	0	1	0
Mid 40	361	6	9	1	0	1	1	0	1	0	0	1
High 1	362	6	A	1	0	1	1	0	1	0	1	0
High 40	401	9	1	1	1	0	0	1	0	0	0	1

Table 8 Modified PLL program line logic codes

Table 9 New channel/frequency allocation for EPROM modification

CHANNEL	LOW	MID	HIGH
1	28.51	28.91	29.31
2	28.52	28.92	29.32
3	28.53	28.93	29.33
4	28.54	28.94	29.34
5	28.55	28.95	29.35
6	28.56	28.96	29.36
7	28.57	28.97	29.37
8	28.58	28.98	29.38
9	28.59	28.99	29.39
10	28.60	29.00	29.40
11	28.61	29.01	29.41
12	28.62	29.02	29.42
13	28.63	29.03	29.43
14	28.64	29.04	29.44
15	28.65	29.05	29.45
16	28.66	29.06	29.46
17	28.67	29.07	29.47
18	28.68	29.08	29.48
19	28.69	29.09	29.49
20	28.70	29.10	29.50
21	28.71	29.11	29.51
22	28.72	29.12	29.52
23	28.73	29.13	29.53
24	28.74	29.14	29.54
25	28.75	29.15	29.55
26	28.76	29.16	29.56
27	28.77	29.17	29.57
28	28.78	29.18	29.58
29	28.79	29.19	29.59
30	28.80	29.20	29.60
31	28.81	29.21	29.61
32	28.82	29.22	29.62
33	28.83	29.23	29.63
34	28.84	29.24	29.64
35	28.85	29.25	29.65
36	28.86	29.26	29.66
37	28.87	29.27	29.67
38	28.88	29.28	29.68
39	28.89	29.29	29.69
40	28.90	29.30	29.70

lines. The logic voltage on pin 8 of the EPROM, A_0, should be alternating between zero and 5 volts as the channel switch is rotated. Select a number of different channels and check that the logic levels on pin 8, A_0, through to pin 3, A_5, correspond with the channel switch codes shown in *Table 3*.

Check that when the band switch is in the low position, pin 2, A_6, is at logic level 1. On the mid-band, pin 1, A_7, should be at logic level 1 and on the high-band, pin 23, A_8, should be at logic level 1. With the repeater switch on, check that on transmit pin 22, A_9, is at logic level 1. At all other times pins 1, 2, 22 and 23 should be at logic level 0.

Having successfully completed these tests, switch off the set and insert the programmed 2716 EPROM and the two 7407 ICs into their holders on the memory board. Switch the set back on and examine the logic levels on the program lines feeding the PLL chip. The exact location of the program lines on the set PCB is shown in *Figure 6*. Remember here that the logic levels will be at CMOS values. With a multimeter or logic probe, check the logic levels on the program lines and compare them with the values given in *Table 8* for channels 1 and 40 on the low, mid and high-bands. If the set passes this test it is now ready for the various tuned circuits to be aligned.

The alignment procedure is similar to that already discussed for the binary adder modification. Care must be taken when aligning the VCO as the tuning core is directly beneath the memory board. For those of you without the facility to program your own EPROM, a programmed EPROM is available direct from the magazine at a price of £8.50 inclusive. This programmed EPROM will give the operating frequencies *(Table 9)*.

You will notice that the odd hops in frequency experienced as a result of the FCC specification have now disappeared and that the relationship between operating frequency and channel number is sequential in 10kHz steps.

THE OTHER MAN'S HOBBY

Jim Smith P29JS goes back in time to sample the activities of the original amateur radio enthusiast

Many will know of a simple analogy to the length of man's activity on Earth. Relative to the aeons of time, our stay is very short indeed. In the world of antiques, furniture, paintings, etc time is measured in hundreds of years. There are many signs of civilisation measured in thousands of years.

When we look at the world of radio then our limits are quickly defined. All those interested in electronics and communication will know of Marconi, Faraday and Fleming. Most will have an outline of how it all started, even if one's ideas have to change from time to time.

Daily innovations

One thing is certain, the sheer acceleration from these rudimentary beginnings of a few decades ago is spectacular. In today's world of electronics, changes happen almost day to day. No sooner does one buy this or that black box (all-singing, all-dancing, of course) than it becomes a superceded model. The changes in amateur radio equipment is a good example, where models come and go ad infinitum.

The radio enthusiasts of today have a lot going for them. ICs perform tasks which would have required hours of 'discrete component labour'. However, dare I suggest that the days of old were more fun. With a little bit of application and effort one could cheerfully find one's way through a typical superhet. With a bit of thought one could explain the stages of a typical 5 band amateur AM/CW transmitter.

With the advent of SSB in the early fifties things became a bit more difficult. One needed just a bit more expertise to come to grips with phase shift networks, sideband switching, crystal filters and the mechanical filter etc. Ideas on linear amplifiers were not always clear. Intermodulation distortion, overdriving and that dreaded word the decibel raised their heads.

My own ham radio hobby started in the late forties. In those days 'home brewing' was the way to go. For those of you not around at the time, the world was a gigantic surplus store. At the right place and the right time you could buy whatever you wanted. Guns, aircraft, tanks, ships etc. However, it was for the radio enthusiast that the lode of El Dorado was suddenly opened. Millions of radio valves, capacitors, resistors and other components were readily available. Thousands of complete transmitters, receivers, panels and units were just down the road or at the end of the mail system. The amateur ingenuity really thrived. There were thousands of words written on modifications to this or that unit.

The Dakota (apart from being the world-beater it was) had aboard a set of radio equipment which even today makes me feel alive. The Command Series of three matching transmitters and receivers was superb. They were engineering masterpieces along the traditions of Rolls Royce standards. At the time it seemed they would be around forever. Long after their heyday these units were being stripped for parts. There seemed to be no end to the uses for the bits and pieces.

However, just 30/40 years on one would find it hard to find these units complete. They are around but will be in a private collection, a museum etc. Most of them have gone, such is the way of our use and throw away society.

It was with this background that a visit to the States brought me in touch with Ralph W6SPQ. He is a radio amateur with a difference; he collects radio antiques. In comparison with the age of the Sphinx, a Rembrandt painting, etc our ideas of antiquity are ludicrous. Yet many of these earlier pre-war radio items are very hard to find.

Ralph's interest is in these old and rare items and in addition he is interested in their restoration. To refurbish an old radio takes time and dedication. At worst they will only be around 60 years old, in many cases much younger. A lost control knob must be replaced with exactly the right item.

It may take years of collecting and sorting to complete one particular job. As Ralph says, one develops an obsession and a memory which scans every junk box seen and looks at every junk radio brought in or sighted at some 'flea market'. Looking for what? Probably some knob, component board or component to complete project X.

Laws sent to try us

Among the laws usually governing such things, input of parts and units is faster than shelves can be built. When that law is overcome it will be that other law about wall space which will come into place. In any case there will be always a heap of unsorted items which of course is covered by another law.

Like all people with a real interest in their hobby, Ralph's enthusiasm is catching. Many of us have memories of these older radios. They seemed to be things of beauty and items of furniture, such as glorious cabinets in selected hardwood, carefully polished. Even as assembly line methods took over, veneered ply still looked pretty good. It seemed that they were built to last, as indeed they were. Of course nasty old technology came along and in due course they were replaced by something better. This time the something better was in plastic and so it goes.

The important thing was that these radios were the centre of the home. Just like television today, families gathered around to listen to the news, Henry Hall's guest night or some special comedy or drama series.

When looking inside one of these very early masterpieces it can be seen that 'the shortest distance between two points is a straight line' had not been thought of. Instead wires went from A to B in a series of immaculate right-angles. The wire used was substantial; it had to be since it was usually self-supporting. In the unfortunate instance where two

A collection of Ralph W6SPQ's radio antiques

wires had to cross each other this was done neatly at the regulation distance.

Lavish use was made of copper, brass screws and nuts, solid panels and baseboards. There is no doubt about it, love and care is there for all to see.

Even then there is a mystery about it all, even if you are a technical wizard. Only those who have experienced the magic of the crystal set will know what I mean, even if you cheated and used a germanium diode 'off the shelf' instead of the classic cat's whisker. Those first signals heard are never forgotten. Add the complexity of band switching, a bit of amplification and a bit of super-regen and the result is magic to be sure. Who remembers the first valve acquired and how much pocket money or wheeling and dealing was involved to get it?

'Pit of the stomach'

These days a fault on one's multimode Japanese transceiver results in a 'pit of the stomach feeling'. Take the lid off and it is a nightmare of small components, transistors and ICs. Life is no longer easy. No matter how enthusiastic you are, the technicalities of it all are hard to keep up with.

Let us think of Ralph and his wonderful collection of earlier radio and communication equipment. Consider the hours of dedication and effort to bring his collection to such a high standard. The hours of searching for that elusive part for that incomplete unit. Ralph has some amazing stories of lucky finds, such as radios still in unopened boxes from some old warehouse to be pulled down. However, the majority of it all is down to hard work and application.

I would like to thank Ralph for sharing with me some of his enthusiasm – he will leave a tremendous legacy to the kids of tomorrow. Let us hope they will get as much fun as we have had from this hobby of ours.

News and comment from Glen Ross G8MWR

Genesis

In the beginning there was rain, flood and gales, none of which helped to provide good conditions for the general release of the new 50MHz band. What was lacking in conditions was certainly made up for in the level of activity that suddenly appeared at midnight. For me it meant that the wheel had turned full circle; I heard British amateur stations close down at midnight on the day we lost the old 56MHz band to the television stations and I heard the first new calls when we regained it: real memory jerking stuff.

The permit holders were making the most of the high power available to them until midnight but it was noticeable that several who were known to be running around 100 watts on the permit did not seem to drop in strength after midnight, and some of them were just as strong the following morning. A bit naughty, don't you think?

Saturday (the 2nd) morning, the band was still in poor shape but there was regular activity, even if a little sparse. In fact you could find some activity at every turn around the band. One thing that was very noticeable was the large number of comments about the problems people were getting from thermostats; it certainly seems that interference from these devices seems to peak at around this frequency. Before you buy a rig check the noise blanker.

The RSGB station was heard; a sure indication of their activity being the absence of the GB3NHQ beacon which is located on the headquarters building and causes some problems to the resident operators. There are plans to move this beacon to a new site a mile or so away, which will at least reduce the problem and mean that the beacon can be left running.

Permits and things

Further details have arrived about the issue of EI licences for the band. They will be able to operate in the band 50 to 51.75MHz and a maximum of 20 permits will be issued to class A operators who can show a genuine need.

There has been a lot of opposition to the class A only issue in this country, to the point where a large protest meeting was held in the Bristol area which attracted a lot of support. One interesting point that has been made is that the numbers could easily have been contained without class distinction if the licence had been granted only to those who applied for it. It is highly unlikely that as many as fifty per cent of the amateur population would have applied and the end would have been achieved without upsetting anyone.

Things in space

By the time you read this you could well have two more satellites to play with. The Russians were expected to launch RS9 and RS10 some time during February. These would be placed in a low polar orbit with a two hour period. RS9 will have a mode A transponder with the uplink between 144.86 and 144.9MHz and the downlink between 29.39 and 29.4MHz. The CW beacon will be on 29.402MHz. RS10 will have three transponders and beacons on 145.957 and 144.997MHz.

Top technology

Trio have announced a major technical advance called Digital Channel Link: an automatic connection to another individual rig with a selective calling system and the ability to find a clear frequency for you. The price is not known however.

How many people use all this guff, and when will someone get round to making a nice straightforward rig that is not loaded down with rarely used gimmicks, but sells at a reasonable price? At the moment you do not see much change out of a thousand pounds.

There must be a vast market for a simple sensibly priced rig; perhaps it is time that one of our home manufacturers started to fill a hole in the market. That was how the Japanese started out, but I have a feeling that they are now pricing themselves out of a large section of the market.

Microwave

The dates for next year's cumulatives have been announced and they are: April 13th, 10 and 3.4GHz; May 11th, 10 and 5.7GHz; June 15th, 10 and 3.4GHz; July 13th, 10 and 5.7GHz; August 17th, 10 and 3.4GHz and September 14th, 10 and 5.7GHz.

There is no special mention of 24GHz as it is now intended to give an award to the station who achieves the best results on this band on a day to day basis, which seems a much more sensible idea. The amount of activity on the higher microwave bands is now so high that the old idea of having special activity weekends is falling out of favour and is being replaced with the idea that it makes much more sense to encourage day by day activity.

The awards

One of the advantages (?) to be gained from claiming an award is seeing your call in this column, or so was the intention. However, claims have been coming in thick and fast, and due to the amount of news over the last couple of months we have got well behind on the publicity. Let's try and catch up on the current position.

The awards can be issued in a 'special' category, which means that if you think you have something worth claiming for then let me know. The first people to claim a special were G6DEG and G1RAO who claimed for a mobile to mobile contact on 10GHz whilst travelling on the M62. Terry says that they had far fewer problems from obstructing traffic than they thought they would. This could well be a first; as far as is known all previous contacts have been mobile to fixed.

G4WXX updates from 144 Silver to Gold, having been waiting a long time for the last country. John G6LOH goes for a 144 Silver, the distance being obtained with a 876kms contact with HB9RSO.

Over now to Martyn GW1FOF on the Gower peninsula, who claims a 144 Bronze. Being one of the most westerly stations in the UK this is quite an achievement. He says it could have been easier if only people would turn their beams that way more often.

Moving up in frequency we have a claim for a 1296MHz Bronze from Bill GM6MGS in Aberdeen, which includes a contact with GW8TFI. He passes on the news that GM4ZUK has worked into EA on 23cms, which is a long haul. G1GLB in Epsom weighs in with a claim for 144 Bronze, but also mentions that he is QRV on 432 and has worked YU1MWP at a distance of 1632kms. Another 144 Bronze goes to Mark G1HRP, with an endorsement for portable SSB operation only.

Hazel G1NOD of Culworth, becomes the first YL to receive a 144 Silver award, and from just up the road in Iver, David G6LAU stakes a claim for 144 Bronze. Travelling slightly further east we come to Hayes End and Howard G6STI, who goes for a 144 Silver and threatens an early claim for Gold. His best DX stands at 1129kms.

An update has arrived from Bob G3ZNZ who moves up to the 144 Gold. His QSL card contains an impressive array of awards already on the wall, including one for working 700 German radio clubs, and he is now on his way to the 1000!

There's more

G1PEF goes for a 144 Bronze, which he obtained in less than three months. Operating from Devizes, where he runs 5 watts to a seven element aerial, he shows that you do not need a 'cheque book'

station to get an award. From up in Ormskirk we hear from G1KDF who updates to a 144 Silver and claims Bronze, Silver and Gold for 432, saying he only needs two countries for the 144 Gold award.

Another multiple award goes to Roger G1HEJ of Tamworth, who claims Bronze and Silver on both 144 and 432MHz. He runs a TS770 with 8 watts out on both bands, the aerials being seven elements on two and nineteen on 70cms. An update from Martyn GW1FOF gets him the 144 Silver but he says the Gold will be a bit elusive from out there on Gower.

Terry G6LPS, from Worcester, claims Bronze for 144 and 432 and is another of those running only ten watts on each band, the aerials being a 14 ele on two and a 17 ele on 70cms. Bronze and Silver awards for 144 are claimed by Roger G4ZEC of Buckingham, the best DX being SM4GVF at 1276kms and SP3MFI at 1306kms. Terry G1KHN from Chorley, updates from Bronze to 144 Silver, and makes unprintable comments about some of the operating practices heard on two metres. An FT290 and 30 watt linear bring Mike Law of Derby a 144 Bronze.

Quantity discounts?

Not a bad idea if the claim from Colin G0DAZ is going to be a typical one. He goes for Bronze and Silver on 144 and a clean sweep of Bronze, Silver and Gold for 432, and then threatens greater things when the new 60 foot tower is installed. G1FUU gets a 144 Bronze with the best DX being OZ7NI at 761kms, while Jim G1FUT gets a 144 Bronze with a 710kms contact to HB9SAX. From Thetford G0CLT claims his two metre Bronze with a best distance to OZ1HQX at 611kms.

Another multi-claimant is Graham G6CSY from Orpington, who gets Bronze and Silver on 432 and a Bronze on 1296. On that band his best contact was with PA0BLL at 374kms and on 432 DL7QY at 750kms. From up in Leeds, Mike G1OVE claims a 144 Bronze and gets the distance requirement with a nice 1720kms contact with EA1CYE.

Even more

Tony G4NBS, from Cambridge, goes for a 144 Bronze, a 432 Gold and a 1296 Silver, which at least shows that he spreads his operating around a bit. He makes the point that he found getting the squares the most difficult part of the job. Down in Trowbridge, David G6EJZ gets a 144 Bronze award with a best contact with FE6FMO at 700kms. He is another of the FT290 and 30 watt linear brigade feeding a ten element Yagi. David G0DEP of Worcester, claims both Bronze and Silver for 144. Some of the nice DX listed in his claim included EA1BLA, EA2SW and SM7FJE.

Our second lady operator to claim comes from Doncaster and is Patricia G1OSU, who gets a 144 Bronze award which she worked entirely from portable operation.

Next on the list is G6UVZ of Gateshead, who claims a Gold award for 432 and says that chasing it has rather curtailed his two metre activity. Phil Hodgson G0CLT from Thetford now updates his two metre Bronze award to a Silver one and includes contacts with EA2AX, 9H1BT, 9H5AH and 9H1CH, which would look good in anyone's log-book. Paul GW6VZW located in Cwmbran, has the Silver on 144 using only 20 watts to a four element aerial, from what is certainly not a good site, and includes a contact with YU1PSF at well over 800kms. The final offering is from G0DAZ who threatened early action and certainly got on with it, having now obtained the 144 Gold.

The amount of interest in the awards is very high and it is nice to receive so many complimentary comments about them. Don't forget the special category referred to earlier, if you think you have done something worth some recognition please write and tell me about it. You could get a nice piece of wallpaper.

Tailspin

Thanks for all your letters and comments. Please keep them coming to me at 81 Ringwood Highway, Coventry or on Prestel 203616941.

ATTENTION ALL RTTY OPERATORS!!

DID YOU KNOW that 'Software-only approaches may demonstrate some elegent programming, but for reliability youcan't beat a terminal unit' REW March '86.

WELL SCARAB SYSTEMS ARE PLEASED TO ANNOUNCE THE NEXT BEST THING.

SCARAB SYSTEMS are pleased to announce the NITE-2 RTTY filter unit. This is a new concept in RTTY filters as it not only improves filtering on conventional terminal units but also provides the computer operator who is operating a software only package with substantial signal enhancement. The NITE-2 features a pre-amplifier, limiter, tuneable bandpass filter and output amplifier. The output from the unit is variable so allowing maximum drive for users of non interfaced programs. An audio isolating transformer is included, this has been found to reduce the noise fed back into the transceiver from the computer. The NITE-2 is a must for all RTTY operators and especially for those computer users still running programs requiring no terminal unit.

The NITE-2 is supplied either ready boxed (matching the MPTU-1) or as a ready assembled PCB excluding switches, LEDs and case.

The fully cased NITE-2 is available at £34.95 + £1.00 P&P.

The unboxed fully assembled NITE-2 is available at £14.95 + 50p P&P.

PLEASE NOTE. Software is not provided.

SCARAB SYSTEMS produce many other high quality software programs for other computers – please write for further details.

Distributors

UK Ward Electronics, D W Electronics, S P Electronics.

Scandinavia. Chara Electronics, Hofors – Sweden.

Australasia. Essex Mellor Pty Adelaide.

Or available directly from:-

SCARAB SYSTEMS

39 STAFFORD ST, GILLINGHAM, KENT ME7 5EN

TEL: MEDWAY (0634) 570441

GREAT NEW SOFTWARE

The RX 4 Multimode receive program for SSTV – RTTY – AMTOR – CW

No expensive hardware is needed. This program has everything you want, including text and picture store for instant recall, save and printer, dump. Frequency scale and fine-tune adjustment for accurate, easy tuning and a long list of other top features.
For **SPECTRUM** (not 16K), **BBC-B, CBM64, VIC20** (+ at least 8k). Tape **only £25.** (Spectrum needs no hardware, the others use the same interface as or RTTY/CW program (see below).

RTTY and CW TRANSCEIVE

You don't need a pricey terminal unit with our program, although if you already have one it will perform superbly with that, too. Split screen, type ahead, 26 saveable memories, auto CR/LF, preset baud rates and shifts, receives any shift automatically, autotrack CW to 250wpm, QSO review to screen or printer and much more. For **BBC-B, CBM64, VIC20** (+ at least 8k). Tape £20. Interface kit £5, ready-made £20 inc all connections (state rig).
CW-only version for **SPECTRUM** (no hardware needed) £12.

And superb programs for BBC-B, CBM64, VIC20, SPECTRUM, ELECTRON

MORSE TUTOR Britain's best. Absolute beginner to over 40 wpm. Easy, effective, with full learning guide. Tape £6. **For ZX81-16K also.**
LOCATOR QTH or Maidenhead locator or lat/long. Distance, headings, contest points, converts between locator and lat/long. Tape £7.
LOGBOOK Date, band, mode, call and remarks. Instant callsign search. Screen/printer output. VIC20 needs expansion. Tape £8.
RAE MATHS All the practice and testing you need. With comprehensive reference sheet. Tape £9. for **ZX81-16K also.**
Any BBC-B, CBM64, VIC20 program available on **disc at £2 extra.** BBC: state 40/80tk.

Prices include VAT and p&p by return 1st class inland, airmail overseas.
Channel Islands, Eire, BFPO Europe deduct 13%

technical software (AR)

Fron, Upper Llandwrog,
Caernarfon, Gwynedd LL54 7RF
Tel: 0286 881886

SECONDHAND EQUIPMENT GUIDE

by Hugh Allison G3XSE

Having their cake and eating it?

Suppose you have decided to replace your Nagombi GT rig with the latest Nagombi GTI. You take your old rig to a local rally and put it in the bring-and-buy. If it sells you get your asking price less the almost universal 10% commission. If it doesn't sell you get your rig back and go home a little wiser. Seems reasonable? I've always thought so, and bring-and-buys have run like that for years. It strikes me as a little greedy, therefore, to learn that some rallies are charging the 10% if it sells and a fixed charge (most ask a pound) before they will give it back to you if it doesn't sell.

An acquaintance of mine checked in quite a few items at a rally run as above. Most of his items sold, giving the club running the show £16 in commission. The five items that didn't sell cost him a fiver to get back, and their total value was about £30. He has vowed never again, and I, too, will vote with my feet and refuse to use bring-and-buys that charge you to get your equipment back.

Another selling practice that I have seen used a few times is the imposition of a small charge when booking in your equipment – sometimes a quid if the item value is over a hundred pounds, fifty pence if it's less – and then no commission charged on the sale. This is, I think, fair enough.

What seems to get up most peoples' noses about the '10% if it sells, £1 if it doesn't' is that the organisers get the best of both systems without taking any chance with it not selling. Heads I win, tails you lose? I'd like your views on this one, especially if you have organised a rally and used an 'unusual' system, but even if you haven't, I'd appreciate your comments.

CB to 10 metre conversions

Many years ago, before the birth of this magazine, your scribe wrote the first ever article on the conversion of *legal* CB rigs to the 10 metre amateur band. This sparked off a spate of similar articles, and importers and amateur radio suppliers etc were quick to spot a potentially lucrative market and were soon marketing ready converted rigs.

Quite a few of the newer HF rigs now feature FM as well as other modes, or FM can often be fitted at extra cost. As a result converted CB rigs are now available secondhand, or maybe the owners just get bored with them. John Petters G3YPZ has written good articles on the noble art of 10 metre FM and I would refer interested readers back to previous issues of this magazine for details of what can be achieved on the band with modest installations. Suffice to say that local 'dead band' mobile to base station contacts are normally viable over a 30 to 50 mile range with a four watt rig and when the band is open the whole world is there.

Retweaking

Rigs converted to the format of my original article were able to transmit and/or receive over about 29.4 to 29.7MHz, ie more than all the FM allocation, but not all of the 40 channels were used (the low channel numbers were repeats of the higher channels). Nearly all rigs in this article were the beloved Icom ICB1030 CB rigs, although a few other rigs were similar and would respond to the same treatment.

The method employed was a simple change to the phase locked loop (PLL) address, followed by a retweak. This made repeater operation difficult since it required much twiddling about of the channel knob. Following on from the original idea, several clever people came up with digital ideas that either involved binary adders and/or EPROMs to give all 40 channels in the band plus repeater shift. Although more versatile than my modification, any converted Icom rig seems to sell for about £20 to £25 on the secondhand market. Performance is quite acceptable. Two extra mods are worth thinking about.

The snipping off of the small blue IN4148-style diode on the underside of the board used in the Icom will stop the RF gain of the set altering with squelch setting. This modification may be of use to CBers using these sets as well. For those readers who have wondered what this diode did and had puzzled over the circuit, relax. It was, helpfully, omitted from the circuit diagram!

Fitting a filter

The second modification that can help this, and any 10 metre ex-CB rig, is the fitting of a decent 10.695MHz filter in place of the heap of rubbish used as a roofing filter. CB addicts fit the better filter to cure 'bleed-over' and, indeed, it does this well. For amateur use adjacent channel interference (the correct term for 'bleed-over') is not normally much of a problem, since there are not often dozens of amateurs to the square mile compared to the CB situation. What is not realised, however, is that the good filter, being narrower, will cut down on noise. The improvement in signal-to-noise ratio is of the order of 3dB, and this improvement is enough to make a good receiver superb.

The commercially modified variants, plus 'modified' LCLs, Oscars etc all use a new pair of mixer crystals to put the rig on the band. This not only gives full 40 channel operation (not as useful as it sounds, since the lower ones clash with the two in, ten out satellite frequencies and should not, therefore, be used) but does make repeater operation quite simple, since another repeater receive crystal can be switched in. The R Withers LCL was modified in this way and other mods were fitted, and it is one of the very best available, well worth looking out for. 'Commercially modified' rigs normally sell secondhand for £25 to £30.

The Mega rig

This attractive looking CB rig was British made and featured a decent roofing filter as standard. The synthesiser is a Motorola MC145151, which is capable of running to 30MHz direct. A simple EPROM between channel switch and address lines, plus a retweak, and it's there. The superb circuitry makes this a nice machine for 10 metre use. It was a shame that this rig never became a popular seller on the CB market.

Quite a load of surplus unsold rigs are now appearing on the amateur market (your scribe bought a boxful at Telford at attractive prices) and are well worth considering. Most of those seen seem to be lacking covers but are otherwise OK. I have heard rumours that quantities of these rigs will be 'dumped' on the amateur markets during the start of the 1986 rally season, so keep your eyes open! A good one, with covers and mike, is probably worth £30, and a less well-equipped one £20, I should think.

Aerials for 10 FM

The humble dipole at a goodly height mounted on a *non-metallic* pole can give good results, and the trade price of these is under £2, so even new, a fiver is too much. For even better results a five-eighths seems well recommended, especially for 'local' working. Some of these are extremely fancy with all sorts of funny metallic bars shooting out at odd angles. These were expensive new, up to £30 for some, but secondhand aerials are cheap, so don't pay more than five to ten quid. To get a CB aerial onto 10 FM frequencies, a little bit of length will have to go. Trim gently whilst watching a series SWR meter. Dependent on type, six to ten inches will normally do it.

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU

We are pleased to be able to offer you the opportunity to sell your unwanted equipment advertise your 'wants'.

Simply complete the order form at the end of these ads, feel free to use an extra sheet of paper if there is not enough space. We will accept ads not on our order form.

Send to: ***Amateur Radio Classified Ads,*** Sovereign House, Brentwood, Essex CM14 4SE.

DEADLINE AND CONDITIONS

Advertisements will be published in the first available issue on a first come first served basis. We reserve the right to edit or exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ Brother BP-30 colour graphic writer; excellent condition, still boxed and complete with instruction manual, £120 ono. Sharp PC-1500 pocket computer and four colour printer/interface; includes 4kRAM module, PSU, instruction manual and applications manual, £215 ono. Tel: Nick on Tadley 4111 extension 6176 (Berkshire).

■ Complete station FT290R multimode, MMB11 mobile bracket, ⅞ mobile antenna, YH1-YH2 mobile headset, BNOS 6 amp PSU, BNOS 50W linear pre-amp, ⅝ home base collinear, SMC FU200 light duty rotator, 12 element ZL special home brew beam antenna, £450, all as new, less than 6 months old. Dave G0DYC, 4 Burton Avenue, Wallasey, Merseyside L45 8QH. Tel: (051) 638 2463, after 6pm.

■ Yaesu 101 2D mint, only used for transverter, £425. Or swap FT221, FT225 or TS700, TS770, WHY? Offers. Tel: Chorley, Lancs. (02572) 60679 anytime.

■ JVC video camera GXN70, zoom, mic, carry case, remote control, plus HRC3 recorder, five batteries, charger, 12V adaptor, ten tapes, £1,250 ono. Tel: Great Yarmouth 667597.

■ FT290 with h/brew 10W linear and Rx pre-amp, case, nicads, charger and base PSU, £210. Vibroplex semi-auto key, chrome finish, £30. Pye PF70 UHF 3ch, inc batteries, good working condition, OK for 70cm, 2-off, £40 the pair, or £25 each. G3PTO Reynolds. Tel: (0454) 322518.

■ Yaesu FT480R 2 mtr multimode, 10W, complete with mic and original packaging, handbook, etc, £290 ono. KW2000B and PSU, 180W output, complete with handbook, spare set of valves, Shure mic, £190. Bob Fry G0CLI. Tel: (0842) 5184.

■ AVO transistor analyser, type TA, absolutely mint condition, £75 or WHY? Tel: (0475) 38998.

■ 125 magazines, *Practical Wireless, Wireless World*, 1950-1970, offers. Tel: (051 644) 9185. Merseyside.

■ Antennas galore! Two 432/19 MET, used for one contest only, £25 each. Four 25 el loop yagis for 23cm plus tonna four way splitter, £95. muTek GLNA432E high performance masthead pre-amp, complete with 70ft of cable, £100. muTek GFBA144E masthead pre-amp, £100, complete with 70ft of cable. Tonna 432 four way splitter, £30. Peter Crosland. Tel: (0905) 620041 anytime.

■ Trio TS530SP tcvr. Tel: Kendal 24461.

■ One Heathkit SW717 receiver, £87. One Trio R2000 receiver with VC10 converter unit, £425. Also one antenna coupler antenna tuning unit, £30. Wood. Tel: Clochen 378.

■ Scanner Fairmate AS32320 AM/FM 110-162MHz, 296-367MHz, 5/12½kHz steps. 20 memories. 13.8V dc, mobile mount, all in original box with handbook. SMC VHFL discone antenna, £100. G1FCU. Tel: 01-337 7735.

■ Yaesu FT980 gen/cov HF tcvr, one year old. CW Curtis keyer, 300Hz CW filter, manual, service manual, full break-in suitable for Amtor, recently realigned by importer, boxed, as new, £899 ono. Bruce G4WVX QTHr. Tel: (06286) 64415.

■ BMW R75/5 750cc motorcycle, absolutely mint condition, lovely machine, must be worth £750, will exchange for HF, VHF equipment with or without cash adjustment. Anything considered, new licence so I need all sorts, also have radio control models and ancillary equipment for swap – Futaba J series radio powered and glider models kits engines, etc, Cobra 148 multimode. Offers for all items please. Steve G0CUE, 76 Greenfield Road, Phydbrook, Glos GL17 9RE. Tel: Dean 61113.

■ Icom 290E, 4 months old, cost new £445, sell for £315 ovno KR400 kenpro rotator, 3 months old, cost new £120, sell for £70 ovno. Yaesu FT757GX transceiver, FP757HD heavy duty PSU, FC757 auto ATU, £825 ovno for the three Yaesu units. Tel: Cwmbran 61771 (home), Cwmbran 61211 ex 228 (work).

■ Icom IC271E 25W, 2M base multimode, fitted muTek front-end, £525. Brother M1009 centronic parallel dot matrix printer, true descenders, nearly brand new, £130. Trippler i/face link Commodore computer to Centronic printer, no software required, £30. Terry Bruce G6IAT, QTHr. Tel: Luton (0582) 23750.

■ Coaxial switches, BNC, two-pole, two-way, dc to 1000MHz, 24V coil, £5 each. Wanted: general coverage receiver for all modes (inc FM) up to 30MHz. Lowe SRX30D (with FM addition) or similar. Alan Williams G3KSU. Tel: (0983) 65551.

■ Swap, sell 70cm IC4E plus BC25, BC35, DC1, BP4. BP3, BP2, CP1, LC2, LC3, HM9, full service manuals for BC35 and IC4E, totals £460, sell £235. Multimeter Simson 260, advanced 77B millivolt/dB meter, function gen-sine, square saw, Scopex 4D 10A 10MHz bandW scope. I will sell or swap above for FT790R 70cm good/c. All in working condition, ring and make a deal and both happy. Tel: (0473) 85526.

■ Sommerkamp 788DX all mode transceiver, 26 to 30MHz, £250 ono. Also Ham International jumbo, offers. Tel: (04312) 242 5pm-11pm, or (04312) 416 Monday evenings.

■ Heath SB220 outer cabinet front and rear panels, switches. knobs, fan etc, bargain £12, plus carriage. Eddystone 880/4, needs attention, or for spares, £20. Odd lengths RG8U coaxial, state wants. Some ham 'M' spares, state wants. HRO knob, £3. Shure 526T trans mike, as new, £35. Electro voice model, good mobile mike, bargain, £15. SB220 manual, Collins 62S-1 manual, £5. Hallicrafters SX101A manual, £3. Also glass frequency for same. Barnett, 71 Lichfield Avenue, Evesham, Worcs WR11 5EB.

■ Oric speech synth, £10. Six ICs/Z80A, AV-3, 8500, calculator, Mastermind, Space Invaders, video game chips etc, £10 for the chips. Nagard dual beam oscilloscope parts: tube, chassis, plug-in units, probes, leads, etc. Almost a complete kit. Vast number of features and very high quality. Price is negotiable, but any offers will be considered (over £85). Buyer collects. Joel Billinton, 99 Canonbie Road, Forest Hill, London SE23 3AQ. Tel: 01-699 5354.

■ Trio 700G 2m multimode, fine condition, boxed, manual. all eleven memory crystals fitted 10W minimum output. One of the 2m classics, £275. Also Minolta MD fitting Hoya 135mm lens, case, mint, £20 or WHY? John G4WLD. Tel: 01-857 8096.

■ FT790R 70cm multimode, plus carrying case, strap, Nicads, new charger and mobile 3 × ⅝λ collinear, Oscar 430E and rubber helical, £270. Tel: Maidstone (0622) 672116.

■ Trio TS711E multimode transceiver, still boxed and only used a dozen times, immaculate condition, best ever rig made for 2 metres, £690. Also Jaybeam 14 ele parabeam with 50ft base telescopic mast, only £99. Ex MoD WSC12 wireless set of the late 1955s, also immaculate condition (Pye), must be seen to appreciate such quality, only £59 or £820 for the lot. Good reason for sale. G1KSW, 26 Langdale Grove, Selby, North Yorks YO8 9BQ.

■ HW-8 deluxe QRP transceiver, superbly built, 5W out on 80/40/20/15 bands, includes fitted RTT, 25kHz xtal calibrator, audio amp, Rx mute switch. Very small and light, runs off 12V, ideal portable rig, £110. Heathkit SB620 scanalyser – look at whole or part of any band, suits any Rx IF, £45. BBC-B Wx satellite system complete. Ring for details. Steve GM4GTU QTHr. Tel: (0224) 743039 evenings, or (0224) 646464 ex 251 daytime.

■ Versatower SP60 in excellent condition, complete with auto winch, £495. KR2000RC complete with 70ft of eight core cable. This is the ideal rotator for that large HF beam or multi-beam VHF system, £235. Trio TS711E, £575. Wanted: TS430S. Tel: (0905) 620041 anytime.

■ 19 set Canadian Russian markings complete with No 2 RF amplifier, £120. 19 set British make complete, £60. 1154 and matching 1155, £80. Other 1155s, £35 each. Racal 17 l receiver, £140, one knob missing. Collector's item: WW2 German radio equipment, offers. Ring for details. Other military sets also. G B Howell, 'Woodlands', Milton Abbas, Blandford, Dorset. Tel: (0258) 880523.

■ Yaesu FT101E transceiver, mint condition, £325 or swap FT707 100 watt mobile transceiver in equal condition. Colin G0DNQ. Tel: (051) 677 5194 Wirral.

■ Tectronix scope 581A with type 82 dual trace plug-in unit, with manuals for both. JWR 10 FM rig. Icom 255E, both good condition, exchange any for FT107 transverter with 2m or 6m, or exchange for ATU eg FC102 etc. Dave. Tel: (0709) 67471.

■ Mohican Rx tuning dial, £2. Transformer for early battery radio 3-1 ratio, black case, £3. Instruction sheets for Taylor 45c valve tester, £2. Service information for Perdio PR32 'Town, Country' radio, £3. Ex-WD whip aerial base, insulated, £3. Yaesu FSP-1 extension speaker, or mobile 6W max, 8Ω, £6. Heater transformer 6.3V 2.5A, £4. Gardners choke 20H 100mA. Command Rx AF choke 3H, 300Ω, £3. Transformer 5000Ω to 600Ω, about 50mA, £3. Mains transformer 'Partridge' tapped, output 275-0-275, 300-0-300, 325-0-325V, 250mA, £4 (W21lb). Another 275-0-275, 300-0-300, 250mA, £4. Yaesu FT101Z series 'AM' unit, instructions, as new, £7. Ex-WD class D Wavemeter, No 1, Mk 2 'T'. 1 mc/s plus 100 kc/s xtal 1.9 to 8MHz, harmonics to 30MHz variable oscillator, circuit, instructions, £12. Postage extra. Edwards, 32 Heldhaw Road, Bury St Edmunds, Suffolk IP32 7ES. Tel: (0284) 60984.

■ WS2000 modem, hardly used, 6 months old, sell for £110 ono, with free autodialer. Also Yaesu FT208R, brand new, sold with Nicads and charger, £180 ono. Also Aiwa amp and tuner – amp 60 watts with graphic equaliser (Mx90-Tx110) sell for £110. Reasons for sale: become a Government artist, draw the dole! Contact Andrew Jones, 4 Elm Farm Avenue, Marston Green, Birmingham B37 7AA. Tel: (021) 779 4441.

■ Lowe SRX30 USB, LSB, AM, has clarifier, RF gain, volume, pre-selector, socket for tape recorder, can be worked off 12 volts dc, covers 500kHz-30MHz, £80, no offers. Or exchange for Commodore 64 with data recorder, joystick software. Buyer to collect and inspect. Receiver is in first class condition. Mr K Pullen, 210 Hollett Road, Penfilia Estate, Treboeth, Swansea, West Glam SA5 9ER.

■ R107 WW2 army receiver, 1.2-17.5MHz, good condition, no mods, £40 ono, including manual and circuit diagrams. Tel: Bristol (0272) 421965.

■ FT209R, £195. HL45V 70cm linear, £115. FRG7700M ATU, £300. 70cm + 2m and duplexer (never used), £25. Sota 2m linear 40W, £45. Last. Tel: Ipswich (0473) 714563.

■ Mickey MK4000 mobile scanner receiver, 70-88MHz and 140-176MHz FM 4318 12½kHz channels, 8 memories sensitivity 0.5μV 20dB S/N in mint condition with original packing, £60. Pye PG1 pager Rx on 144.480 decodes 1750Hz, tone ideal to call XYL, vgc, £28. Tel: (0634) 660037 evenings.

■ Solartron 'scope type CD7115.2 CT414, £65 ono. PP G Rain, The Forge, Yearby, Redcar, Cleveland TS11 8HE. Tel: Redcar 484083.

■ Telereader model CWR-670F CW RTTY Asci reader, cost £370. Will sell or p/ex for HF Rx. Tel: Harwich 502195.

■ Trio R2000 receiver, fitted with VC10 VHF converter, plus Lowe ATU ultra loop UL-1000. Bargain £325. Tel: (0438) 61613.

■ Circuit copies of Heathkit HW16, HG10B, RAI, CL1, RG1 and Pye 1101A/3017A Rx and Pye black box Hi-Fi record reproducer. £2 each plus stamp. Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA.

FREE CLASSIFIED ADS

■ UHER report 4000 mono professional portable tape recorder, almost new, £395. Tandberg model II professional portable tape recorder, excellent condition, £225. Microphones, AK9 D509, £20, Shure 5885B unisphere B, £20, Calrec CM450 dynamic, £25. Reslo ribbon, £10. Film Industries ribbon, £10. Racal dual diversity unit MA168B with handbook, £45. Minnimitter low-pass filter, 30MHz, £10. B J Whitty, 'Fourways', Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: (0704) 840328.

■ Yaesu FT707 ATU, FC707 VFO, FV707DM PSU, FP707 mike, YM35, as new, boxed, manuals, £640. Datong ASP/A speech processor, £48 with MPU. Frequency meter PFM200, 20Hz to 200MHz plus leads, etc, £48. Oscilloscope 4D-10 dual trace, new condition, £125. Solid-state manual, one lazy trace scopex, Adonis base mike model AM6000 compressor, graphic equalizer, £50. Phone, best time evenings. W H Barnes, 58 Windsor Avenue, Hillingdon, Middx UB10 9AX. Tel: Uxbridge 54116.

■ Storno 10 channel handset, type 12 volt radiophone, complete with plugs and wiring, uses push-in type crystals, convertible to 2 metres, offers or exchange for 2m or 934 equipment. Keith. Tel: Ware (0920) 830756 (evening).

■ Fluke 8010A digital multi-meter, with mains lead and probes, £130. Weller 50W soldering station, temp controlled tip, £60 ono. Also FDK multi 800D FM 0-25W mobile transceiver, £130, or all three £300. Go on, save £20, or swap all three for either base or mobile multi-mode, eg: FT290R, IC251E with or without linear for the mobiles, or swap WHY? Tel: eves or weekends (0865) 773338.

■ ICR71E general coverage receiver, 2 months old, as new condition, £575 ono. T C Ridgway, 15 South Road, Aberystwyth, Wales SY23 1JF. Tel: (0970) 4271.

■ Barlow Wadley XCR-30 mkII Rx, first class condition, remarkable performance, best offer over £89. Icom RX71E, mint condition, includes remote control unit, RC-12, best offer over £620. Mr Alis. Tel: 01-902 2177, evenings only.

■ Yaesu HF all mode transceiver, FT102. Purchased May 1985, used 2 months only, £570. Tel: (0934) 812865.

■ Air band pocket portable plus AM, FM. New Xmas, £12, post paid, very good results, battery only. Tel: (0274) 676556 after 6pm.

■ WS19 complete, unused. Manpak HF156 complete. HRO, PSU, coils. Heath stereo amp S22. BC348, no mods. Decca HF marine Tx/Rx/PSU. Icom MC80 marine VHF. R1155A no mods. AR88. TCS12. Offers. Full list available sae. G3DVF. 18 Oaky Balks, Alnwick, Northumberland. Tel: 602487.

■ Ham International Concorde 3, 26.065-28.305, AM/FM/SSB, £125 ono. Also Bremi BRL210, £60 ono. Ham ant matcher, £7. SWR meter, £5. 25DB pre-amp, £8, or £180 the lot. Tel: Kilmarnock 34366.

■ Two metre base, receiver crystalled, R1, R2, R6, R7, S-10, S-12, £45. Phillips colour TV, portable, £75. Pre-amp 2-30MHz, £15, including postage. Eddystone EA12, not working, for spares, £10 with manual. SX200N for spares, £10. Walkmate cassette player, radio broken but works on one station cassette OK, £15. Punk records, Conflict, Crass, DK's, reggae, etc. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: 01-674 0513 after 11am.

■ Yaesu FT290R with nicads, charger plus YH1 headset and flexwhip, vgc, £265. Also FC757AT auto ATU suitable FT757 or FT980, little used and in vgc, £200. Tel: G0CCU, Bristol (0272) 721744.

■ Heathkit SW717 receiver, 550kHz to 30MHz, complete with manual, BFO, £45. Can deliver free within 150 miles radius of Bristol Avon. Tel: Tony (0272) 563491.

■ Lowe SRX30 receiver, 0.5-30kHz, USB, LSB, AM, preselector RF gain, clarifier, analogue readout, excellent condition, £80 including manual. Tel: Rochdale 43117 after 6.00pm.

■ Trio 2300 transceiver, synthesised, portable/mobile/base, with matching 10W P-amp aerials, Nicads, charger, carrying case, leads, manuals, mint condition, £150.00. Complete or consider exchange for HF transceiver (cash adjustment). Also wanted HF ATU for 100 watt transmitter, DFM up to 50MHz, cheap oscilloscope ideally up to 5MHz (small unit preferred). Can deliver/collect. Tel: Roy G0BZT, Sedgley (09073) 78792.

■ Bremi PSU, 12 volt, 5.7 amps, £15.00. Yaesu YD148 mic, £12.00. Sparker unit with noise filter, £5.00. 934MHz mag mount with BNC connector, £5.00. Two metre mag mount with BNC connector, £5.00 and Morse key Hi Mound HK-704, £5.50. Ring Rodney. Tel: (0786) 58825.

■ Tokyo Hy power 70cms PA model H4SU, 45W out (new), £129. Trio/Kenwood YK88C, 500Hz CW filter (new), ideal 830/430 HF rigs, £30. VHF comms weather sat frame store boards and notes, £15. NEC extra high res green screen monitor, £80. Wanted HF module for Yaesu 726, p/x for any of the above. P Chamberlain, 9 Goffs Close, Crawley, Sussex RH11 8QB. Tel: (0293) 515201.

■ AOR2001 scanning receiver, as new in original box, complete with PSU, mobile lead, telescopic and Discone antennas, £250 ono. Tel: Tref GW4WVB on Wrexham (0978) 840974.

■ Canadian 52 set, WWII C1944, complete transmitter and receiver, ac mains power unit, manual. HRO comm Rx, 6 coils, power unit, £48. AVO seven, wooden case, shunts, £18. Yaesu SP901 £15. Linear relay FRB707 £16. Tektronix 422 d/beam portable scope, £285. Several 1930s-1940s domestic radios available. Jim Taylor, No5 Luther Road, Winton, Bournemouth. Tel: (0202) 510400.

■ Generator 250V or 110V at 1.5kW, petrol engine good working order. £119. Buyer to collect please. Modem 1200/75 with software and leads for BBC computer, unwanted prize, only £45. Chris Womack, 4 Mill Close, Ackworth, Pontefract, Yorkshire WF7 7PU. Tel: (0977) 611395 after 6pm.

■ Eproms for CB conversions programmed from your Hex list if required. 2716 £5, 2764 from £5, 27128 from £6. Send sae for full details. Chris Womack, 4 Mill Close, Ackworth, Pontefract, Yorkshire WF7 7PU. Tel: (0977) 611395 after 6pm.

■ RTTY Acorn atom computer incl interface unit G4BMK RTTY on ROM. Also spare Acorn atom needs slight attention, £130.00. Phil G0ABY, 18 Waskerley Close, Hardwick, Stockton on Tees, Cleveland TS19 8LQ. Tel: (0642) 674615.

■ NEC colour monitor 12in superb resolution 640 × 400 as new. Must sell, offers around £250. Tokyo Hy power 45W 70cms linear new £128. Paul G4XHF. Tel: Crawley (0293) 515201.

■ JIL scanner SX200N little use, Withers inspected £150.00 ono. Denis G8MKU, QTHr. Tel: King's Lynn (0553) 674015.

■ Pye Dolphin II radio telephone 150kHz to 3800kHz plus 8 pre-set xtals, 12V and dynometer/freq changer? 2 807s on transmit and internal ATU ideal top band 80m, no hand set, £35. 3 St Johns Cotts, Charlton, Musgrove, Nr Wincanton, S/set.

■ Property of silent key. Yaesu FT290R all mode with Yaesu scanning mic. Very good condx £200. Trio 9R59D GC Rx £40. KW Vanguard 10-160m Tx £25. Both excellent condx. Mosley 2el 10/15/20m beam with CDE/44 rotator and control box £50. SEM Z-match 10-80m £35. Olympic loaded Z-match 10-160m 2kW rating £45. All items carriage at cost. Don MacLennan G3KGM, 66 Old Farm Avenue, Sidcup, Kent. Tel: 01-300 0767.

■ FRV7700 Yaesu converter 70-80 118-130 140-150MHz. Suitable for FRG7700 communications receiver £35. Two metre base station, receiver only, crystalled R1 R2 R6 R7 S-10, S-12 £45. Made by Tandy Corporation. Pre-amp 2-30MHz SEM make, £15 including postage. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: 01-674 0513 after 12 midday.

■ Free, free, free! I am clearing out a friend's electronics hobby box. It's mostly wire, plugs, switches, coils, pots, etc, so it's a bit heavy. If you could send £1 for post/packing I will send you a bag. Martin, 7 Griffin Crescent, Littlehampton, Sussex. Post only.

■ Yaesu FT270R, new battery, carrying case, charger, £90. Tel: Tisted 306 (after 5pm).

■ Signal generator, Taylor model 68A, 100kHz to 220MHz in 7 ranges. Audio modulation and output, RF attenuator and large scale, £20, carriage extra. Also for sale Adana model no2 H/S printing machine, £20. Collectors item. Stan G3XON, 14 Dagden Road, Shalford, Guildford, Surrey GU4 8DD. Tel: (0483) 36953.

■ Maplin frequency counter, 8 digit, 10Hz-600MHz, variable time gate, battery or mains operation, fully calibrated and in very good condition, £130 no offers. DSB2 80m transceiver, as featured in *Ham Radio Today*. Built from kit with case, mic, speaker and digital readout and service manual. Not fully working – problem in output stage. £90 ono, genuine reason for both sales. D Pratt, Old Vicarage, Helme Village, Meltham, Huddersfield, West Yorks. Tel: (0484) 850327.

■ Trio TS711E 2m, multi-mode transvr, still boxed and an excellent state of the art rig, £690 ono. Also Jaybeam 14 element parabeam antenna with 50ft telescopic mast, £100. Pye WS, C12 1955 ex mod Tx/Rx, must be seen to be appreciated, £60. Will accept £790 for all items above. Can deliver North Yorks, Humberside. G1KSW, 26 Langdale Grove, Selby, North Yorks YO8 9BQ. Tel: Selby 701881.

■ Coaxial switch, Daiwa CS-401 four way, new unused, £20.00. Clark, 37 Burmarsh Road, Hythe, Kent. Tel: (0303) 68132.

■ Multimode GW3SPA Eprom conversion to ten metres covers 28.51MHz to 29.70MHz in 3 bands, 10kHz steps clarifier, USB, LSB, AM, FM, with repeater shift, £100 inclusive of postage. Only a small number of multimodes left. For further information contact Roger Alban, GW3SPA QTHr. Tel: (0222) 707794, or during normal office hours (0222) 499022 ext 3156.

■ HQ1 mini beam (6m) 10m, 15m, 20m, £80. Or exchange for Spectrum 48K. Tel: (0353) 61323 anytime. Ely, Cambs.

■ FT901D 160-10 fan FM, FV901DM scanning VFO, YO-901 multi-scope, Shure mike desk, DX200 receiver 0.15-30MHz, Handic tester FS117, all in excellent condition. Offers for the above, or WHY? John. Tel: Newbury 30184.

■ 48 ele 70cm Yagi, varnished, assembled and never used. TET HF vertical antenna 144/28 transverter, hardly used. Clegg 25 watt variable power FM TCVR 143MHz to 149MHz. Dawe type 610B output meter. Icom 2E H/H, Icom 4E H/H, latter little used. Buyer collects antennas. Ernie G4YUG. Tel: (0473) 830147 anytime.

■ AR88 communications receiver, 550kHz to 30MHz, with manual, plus BC221 and No 10 frequency meters. All units in working order and unmodified apart from resistor and capacitor replacements, £60 the lot. Tingay, 18 Grove Road, Newbury, Berks RG18 1UH. Tel: (0635) 38228.

WANTED

■ FRG7 Yaesu receiver wanted in good condition phone or write: Wayne Searle, 39 Teignmouth Road, London NW2 4EB. Tel: 01-452 3025.

■ Trio 7930 2 metre rig, must be in mint condition. Also Yaesu YK-901 keyboard to match up with YR-901 RTTY reader. Tel: Colchester 394336 (Essex).

■ General coverage HF receiver wanted. Any working model considered. Up to £50. B Wright, 33 Bradshaw Ave, Glen Parva, Leicester. Tel: (0533) 777636.

■ Yaesu FC707 tuner. Mr Mellor, G0BYE. Tel: Ripley (Derbys) 48094.

■ Racal BCC533 battery charger, MA968 or MA934 batteries, TA944 or TA4044 linear, manpack such as TRA931, RA929, TRA967, or any PRM model urgently wanted by collector. Also any Racal or similar manpack spares or accessories. Have various modern Racal, Rodifon, etc, military equipment for exchange or possible sale. Interested in any post-larkspur manpack items. No matter how small! Please write WHY? 120 Birmingham Rd, Redditch, Worcs B97 6EP.

■ Collins 75A receiver in good working order. Hallicrafter SX28A receiver in good condition. Tel: (051644) 9185. Merseyside.

■ Collector requires to swap personal QSL cards – one of yours for one of mine. Also required an Eddystone EC10 receiver, good working condition (or similar). Tom, PO Box 4, Montrose, Angus DD10 9SZ.

■ Compact station FT707/TS120 or similar. Must be neat or will be banished to shed. Again have FT250 for sale or p/x for 2m multi-portable. Colin G1PRS. Tel: (0507) 828026 after 6pm please.

■ IC260 A or E and FT707 (100W). Cash awaiting for mint condition rigs. Must be local to Kent. Mark, G4RGB, QTHr 84/85 callbooks. Tel: Medway (0634) 30822 anytime.

■ Sony ICF2001 scanning Rx. Steve GM4GTU QTHr. Tel: (0224) 743039 evenings or (0224) 646464 ext 251 daytime.

■ Wanted Totsuko TR2100M 144MHz SSB/CW portable. State frequencies built into rig, any faults (non workers considered) price. Letters only please. Mr Iain J Menzies, 105 Craigton Road, Aberdeen, Scotland AB1 7TY.

FREE CLASSIFIED ADS

WANTED

■ Manual or circuit diagram for Heathkit electronic switch model 1D-101. Also any info on old AVO signal generator 50kHz to 80MHz in six ranges. Also wanted IC-700T Tx, non working for spares. Also circuit diagram or any info for Midland 3001. All costs will be met. Brian Dunn, 17 Duke Street, Clayton-le-Moors, Accrington, Lancs BB5 5NQ. Tel: Accrington 391682.

■ Pye pocket phone Rx/Tx, must be in good condition. W Hind, 12 Mendip Close, Peterlee, Co Durham SR8 2JL.

■ Receiver for home base use covering VHF RT channels in marine band 156MHz. D Casswell, 24 Kings Road, Lee-on-Solent, Hants PO13 9NU.

■ Trio R2000 wanted, complete with converter if possible. Tel: Rochdale 43117 after 6.00pm.

■ Ex RN B28 Rx, clean in working order. Full details and price to: Williams, 1/3 Myreside Court, Edinburgh EH10 5LX. Tel: (031) 447 6348.

■ Urgently wanted: early 1930s Philips, Ekco, HMV, American Philco, Zenith radios, any condition, cash or exchange. Jim Taylor, 5 Luther Road, Winton, Bournemouth. Tel: (0202) 510400.

■ Nato 2000 wanted urgently, cash waiting, must be in perfect condition. Also SMC ATU and rotator, 119MHz to 130MHz, suitable for FRG7000. Tel: (0283) 221870.

■ *World Radio and TV handbook*, any year, 1980 onwards. Microwave Modules 6m converter PMMC50/28. Tel: (0926) 498388.

■ Yaesu FTDX560 transceiver or similar, any condition but must be working. Would consider cheap FT707. Also cheap VHF linear 3W in 80+ out. GB9, 2 Marion Square, Kettering, Northants.

■ Nato 2000 in good working order. Transmatcher ATU, urgent, for cash. Rotator 3 wire mini beam for 27MHz. Also FRG7700 in perfect working order. Tel: (0283) 221870.

■ Borrow or buy circuit diagram and/or workshop manual of IB Mk 1 and Cossor Commando 703 VHF Tx/Rx. Fair price paid by young amateur, or pay postage. Tel: (0732) 846416. Kent. G1HRW, QTHr.

■ Service manual for Geloso G209, or circuit diagram or any hints or tips about this communications receiver. Expenses will be met. G1NQX. Tel: (0679) 62889, after 5.30pm.

■ Codar CR70A, good working order. Codar CRGG Rx, 'Q' multiplier RQ10X, ATU RQ80, any condition. D K Matheson, 2 St John's Rise, Restavon, Berpys Green, Westerham, Kent TN16 3AT.

■ Tandy Realistic PRO2003 or similar. North East preferred. Tel: Ashington (0670) 815067.

■ Portable professional SSB Rx. Private buyer, cash purchase. Tel: (061) 743 1570.

■ Service manuals or any data on National HRO MX, also any mods. Mr M K Smith, 4 South Road, Woodhouse Down, Almondsbury, Bristol BS12 4HV.

■ Wanted urgently to buy or borrow: manuals/circuit diagrams for Sommerkamp FL200B Tx and FR100B Rx, also Labgear LG300 Tx. All replies answered. Morgan G4NSA, 12 Rosalind Avenue, Bebington, Wirral, Merseyside LG3 5JR.

■ The 6800 SWL DX friendship society open to all users of Sony ICF 6800W short wave listeners DXers. See us in WRTH 1985. Write: Doug Hopkinson, 1012 1360 York Mills Road, Don Mills, Ontario, Canada M3A 2AZ.

■ Circuit diagram for sky king SU2000 rotator control unit, or type number of the 8-pin DIL integrated circuit used in the circuit. Postage refunded. Can anyone help? GW3GSJ QTHr. Tel: (0352) 780334.

■ I am now a lucky owner of a genuine Marconi coherer and earnestly require the tapper to go with it. Please help – Stan G3XON, 14 Dagden Road, Shalford, Guildford, Surrey GU4 8DD. Tel: (0483) 36953.

■ Trio SP230 speaker unit. SM220 station monitor. HF mini beam. Copy *World at the finger tips*. Geoff Barnes G3AOS. Tel: (02605) 276.

■ Exchange for Yaesu FRV7700 model E wanted, to replace model A, must be mint condition. Carriage paid. Dave Howes, 149 Warren Wood Rd, Rochester, Kent. Tel: (0634) 404096.

■ *Admiralty handbook of wireless telegraphy*. Tel: (0694) 722131, Emilio G0CYQ.

■ 70cm Pye Tx/Rx must be cheap HRO B/spread coils handbook and info. Tel: Chorley, Lancs (02572) 60679 anytime.

■ Xtal Calibrator No 10 for WS62, and vib/dyno PSU for WS19, plus AR88D, working or not for rebuild. Tel: (Harwich) 502195.

■ Wanted urgently circuit diagram for Sommerkamp HF tranceiver FT100. Expenses gratefully refunded. G0DLN, 39 Mitchley Hill, Sanderstead, Surrey.

■ Yaesu FP707 power supply, FC707 antenna tuner, FV707DM remote VFO with memories and scanner, will pay good price and any transport charges. Must be in good condition. Getting desperate. Tel: (041) 641 1567.

■ L-match ATU or similar in good conditon for SWL. Tel: Tyneside (0783) 267125.

■ Wanted *World Radio and TV Handbook*. Also *RSGB Amateur Radio Call Book*, recent as possible and as cheap as possible to redundant enthusiast. John Harris, 6 Pandy View, Trelewis, Treharris, Mid Glam, S Wales. Tel: Treharris 411664.

■ American Tx: BC-475 as used in DC-3 aircraft. German WW1 radio-radar gear, parts, literature wanted. Museum purposes only – does not have to be in working condition. Can anyone help with WSII? Offer British WW2 or cash adjustment will collect by car. OZ8RO R Otterstad, Vejdammen 5, DK-28YO, Holte, Denmark. Tel: 010-452 801875.

■ Comm receiver Trio 9R59DS, around £50. Tel: (94) 63162.

■ Does anyone have an FC102 that they are prepared to part with? Must be in good condition. Top price paid. Nigel G0ASM. Tel: (0783) 288079.

■ FT707 100W and FC707 ATU, or FT101ZD. Must be in good condition. DAve G0DYC, 4 Burton Ave, Wallasey, M/side L45 8QH. Tel: (051) 6382463 after 6pm.

■ 'Q' multiplier unit for Heathkit 'RA1' receiver. Also SSB unit for Murphy 'B40d' receiver. Can collect. London or Oxford area. Eason, 'Lynwood', Holton, Oxon OX9 1PU. Tel: (08677) 2300.

FREE CLASSIFIED AD FORM

Amateur RADIO SMALL ADS

PNP Communications
Communications Interface
for RTTY – Morse – AMTOR

Our popular range of communication modules is now available, fully boxed and tested under the model number.

CTU 20

The CTU20R is RTTY only & costs **£62.50** whilst the CTU20RM is for morse as well and costs **£75.25**
For shortwave listeners the MF2-DX gives the option of 170Hz, 425Hz or 850Hz shift reception and costs **£56.95**

Send a large (A4) SAE for full Cat
Please add VAT at the current rate.
Access & Barclaycard (VISA) welcome.

62 Lawes Avenue, Newhaven
East Sussex BN9 9SB
Tel: (0273) 514465

JAPANESE Ib's (PART OF OUR RANGE)

AN214a £1.80 AN7145 £1.80 AN7146 £1.85 BA521 £1.75 BA532 £1.50 HA1306W £1.60 HA1339A £1.60 HA1342 £1.70 HA1366W £1.50 HA1366WR £1.50 HA1377 £2.20 LA1230 £1.50 LA4460 £1.75 LA4461 £1.75 LC7137 £2.75 M51515 £2.50 M51517 £2.50 MB3705 £1.60 MB3712 £1.50 MB3730 £1.75 MB3731 £2.50 MB3756 £2.60 MB8719 £3.50 TA7205AP £1.00 TA7222AP £1.20 TA7227P £1.60 UPC575 £1.00 UPC1001 £2.00 UPC1156 £1.40 UPC1181 £1.00 UPC1182 £1.00 UPC1185 £2.20 ADD 60p POST AND PACKING AND THEN ADD 15% VAT TO TOTAL

T POWELL 16 PADDINGTON GREEN LONDON W2 1LQ
OPEN MON-FRI 10AM-5PM, SAT 9AM-12 NOON.
TELEPHONE: 01 723 9246
ACCESS/VISA. TELEPHONE ORDERS ACCEPTED OVER £5.00

XXX ADULT VIDEO CLUB

For the genuine adult films. Available only from ourselves. Ring

0924-471811 (24hrs)

For the intimate details or write

ADULT VIDEO CLUB
P.O. Box 12, Batley, W. Yorks.

MAXI – Q

COILS AND CHOKES
PREVIOUSLY MADE BY
DENCO SAE PRICE LIST

8 BRUNEL UNITS, BRUNEL ROAD, GORSE LANE IND ESTATE, CLACTON, ESSEX CO15 4LU.
TEL: (0255) 424152

DW ELECTRONICS G3 XCF

Amateur Radio Supplies
71 Victoria Rd, Widnes
Tel: 051-420 2589
ICOM
YAESU
Open Mon-Sat 9.30-6 (closed Thurs)
We supply Yaesu, Icom, Tonna, Jaybeam, Microwave Modules, Datongs etc

HEATHERLITE MOBILE MICROPHONES

4You've probably seen one and heard one, they're well tried and tested. Lightweight and inconspicuous, good audio quality, ease of operation, worn around the collar or over the head. Control box with mic gain control, scan buttons, LED indicator on transmit, made individually and plugged to suit your rig

with plug and scan buttons £24
with plug without scan buttons £21.50
with plug and extra amplifier for 8 pin Icom rigs eg IC 255 etc £22.50
Mic band and coax, no control box, circuit to make your own box £6.50

Post and packing £1.50 per order
Cheques to **HEATHER RODWELL**
GW8AV QTHR: Tel: 0401 50921

Booth Holdings Bath

GOLF CLUBLANE
SALTFORD
BRISTOL
Tel: 02217 2402
Open Tues-Sat 9am-9pm
Closed Monday

AGRIMOTORS

MERTON CB AND RADIO CENTRE
MERTON GARAGE AND POST OFFICE, MERTON.
Nr OAKHAMPTON EX20 3DZ
OPEN 6 DAYS 9-6
(SUNDAYS BY APPOINTMENT)

Amateur ... around £49.95.

Voucher removed

NEXT ISSUE ON SALE

Amateur RADIO

Thursday 27th March

G4MK RADIO SOFTWARE

****NEW FOR DRAGON 32/64 AND TANDY COLOR****

SSTV RECEIVE decodes audio direct from radio with tuning indicator and printer support Tape £11 25 GREYLINE & MUF/LUF PLOT Draws great circle world map with propagation data superimposed Tape **£8.00**
CBM64/128 RTTY TRANSCEIVE with Baud rate detector, and unattended mode. Tape £11 disk **£14.00**
CBM64/128 MORSE TRANSCEIVE with speed tracking and full type ahead. Tape £10. RTTY+CW disk **£22.00**
DRAGON AND TRS80C PROGRAMS ON TAPE OR CARTRIDGE RTTY+ASCII, Morse and AMTOR transceive Send SAE for details. State callsign (if any)

GROSVENOR SOFTWARE (AR)
2 Beacon Close, Seaford, Sussex (0323) 893378

B45HG VIDEO

Transmit from your video recorder throughout the house. Price £8.90 + P&P 50p. SAE for leaflet:

Electronic Mailorder A
62 Bridge Street, Ramsbottom
Lancs BL0 9AG
Tel: 070682-3036

ETESON ELECTRONICS

15B Lower Green,
Poulton-le-Fylde, Blackpool
Tel: (0253) 885107

Open: 9.30am-12.30, 1.30-5.30. Closed Wed & Sun.
Electronic Component Specialists.

PROFESSIONAL POLICE, FIRE, PUBLIC-SERVICE

POCKET SIZED MONITOR RECEIVER

With 54-176MHz VHF plus 10m Amateur Band (11m CB on request) and VHF Aircraft. Excellent sensitivity, VFO, Squelch provision, Whip Antenna etc. Tunes all your local 2-way VHF activity and morel.
Complete with accessories and frequency lists @ only £27.95 post paid. CWO/COD welcome. Prompt delivery from:

D TAYLOR, (Dept GSE8),
8 EMMERSON ST, CROOK,
CO DURHAM, UK.

GEARED MOTORS

12volt dc 40 rpm suit drive motor for childs buggy **£22.00.** Diodes 40amp 400v Neg stud **£1.50.** Bridge Rects 200v 12amps **£1.50.** Darlingtons M1000 gain 170 **£1.20**

MALDEN TRANSFORMERS
134 London Road, Kingston on Thames, Surrey
Tel: 01-546 7534

MORSE TUTOR

£4.00 on cassette. **£6.00** on microdrive for Sinclaire Spectrum. 4 to 19 words per minute, variable spacing, variable groups of random letters, numbers or mixed; Random sentences, own message, single characters and variable pitch. Feedback on screen, printer, or speech (Currah Microspeech 48K only) and repeat facility, 16K and 48K versions on one cassette 48K only on microdrive.

WD SOFTWARE
Hilltop, St. Mary, Jersey, C.Islands
Telephone (0534) 81392

US DEPARTMENT OF DEFENSE, FLIGHT INFORMATION PUBLICATIONS.

A large selection of these publications and charts are available. For example FLIGHT INFORMATION BOOK COVERING, UK, EUROPE, N AFRICA and MIDDLE EAST includes details of over 1,400 military and civil airfields. Thousands of communication frequencies on UHF, VHF and HF includes Operational, Base Commands, Maintenance Controls and many more. Airfield facilities, Services and other data is listed. A 66 page section covers USAF, Theater Flight Data and Procedures. Approx 450 pages packed with information, as used by USAF aircrew. SAE for details and prices to

EVANS AIR PUBLICATIONS
11 HILL VIEW, BRYN-BAAL,
MOLD, CLWYD CH7 6SL

MORSE READER PROGRAMMES

SPECTRUM | BBC 'B' | DRAGON | CBM 64 | VIC 20 | ZX81 16K | ATARI 600/800XL | AMSTRAD 464

Sinclair computers need NO interface, others use simple one transistor (BC107 or similar) interface Programmes self tracking 8/30 WPM. All connections to existing sockets Cassette with full instructions and interface circuit where required £6.00 inc P&P Interface built and tested £2 50 inc P&P

RTTY
FOR YOUR 48K SPECTRUM

Menu driven, 10 programmable memories, split screen, morse ident, four baud rates, etc etc NO TERMINAL UNIT, just a simple filter! Cassette with full instructions, circuit and filter layout £8 50 or SAE for full details Filter unit built and tested £6 00.

JEP ELECTRONICS
NEW ROAD COMPLEX
NEW ROAD
KIDDERMINSTER DY10 1AL
TEL. 0562 753893

USED AMATEUR EQUIPMENT?

I Buy, Sell & Exchange!
'SELLING? I pay the BEST POSSIBLE PRICES for your Clean Used Equipment!'BUYING? I have the BEST SELECTION of top Quality Used Equipment Available!
For the Deal You ve been Looking for.Phone Dave. G4TNY ANYTIME ON HORNCHURCH (04024) 57722 or Send SAE

G4TNY AMATEUR RADIO
132 Albany Road, Hornchurch, Essex RM12 4AQ

SCOTCOMMS

OPEN TUES-FRIDAY 10am-12.30pm, 2pm-5pm
SAT: 9am-1pm, 2pm-4pm. CLOSED MONDAY

25 Morton Street, Edinburgh 15
Tel: 031-657 2430

JAYCEE ELECTRONICS

JOHN GM30PW
20 Woodside Way, Glenrothes, Fife KY7 5DP
Tel: 0592 756962
Open: Tues-Sat 9-5

Quality secondhand equipment in stock. Full range of TRIO goodies. Jaybeam – Microwave Modules – LAR.

CRYSTALS Made to order for any purpose and large stocks of standard frequencies for computers, modems, etc. Amateur CW (QRP) freqs *£4.00* and CB conversion crystals at *£4.50*.
PROGRAMMABLE OSCILLATORS (PXO) for baud rates, MPU, and freq markers *£12.50*.
FILTERS Crystal, monolithic, mechanical and ceramic for all standard IF's. Special 10.695MHz for big improvement to most CB rigsl at *£4.50 each*.

SAE FOR LISTS. PRICES INCLUDE VAT AND POST

PR GOLLEDGE ELECTRONICS

G3EDW, Merriott, Somerset, TA16 5NS
Tel: 0460 73718

Telephone the advertising department on: 0277 219876 for details

ADVERTISERS INDEX

Amateur RADIO

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛ page	£66.00	£62.00	£59.00	£53.00
128 x 90 or 61 x 186	¼ page	£115.00	£110.00	£105.00	£92.00
128 x 186 or 263 x 90	½ page	£225.00	£210.00	£200.00	£180.00
263 x 186	1 page	£430.00	£405.00	£385.00	£345.00
263 x 394	double page	£830.00	£780.00	£740.00	£660.00

COLOUR AD RATES

colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£550.00	£530.00	£470.00
263 x 394	double page	£1,130.00	£1,070.00	£1,010.00	£900.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof & small ad	mono artwork	on sale thurs
Apr 86	27 Feb 86	5 Mar 86	7 Mar 86	27 Mar 86
May 86	27 Mar 86	2 Apr 86	4 Apr 86	24 Apr 86
Jun 86	1 May 86	7 May 86	9 May 86	29 May 86
Jul 86	29 May 86	4 Jun 86	6 Jun 86	26 Jun 86

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.

An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.

Previous copy will automatically be repeated if no further copy is received.

A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.

Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.

No additional charges for typesetting or illustrations (except for colour separations).

For illustrations just send photograph or artwork.

Colour Ad rates do not include the cost of separations.

Printed — web-offset.

PAYMENT
All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by the publication date.
Overseas payments by International Money Order or credit card.

FOR FURTHER INFORMATION CONTACT
Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219676

Commission to approved advertising agencies is 10%.

CONDITIONS
10% discount if advertising in both Amateur Radio and Radio & Electronics World.
A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

MARCO TRADING

ACCESS VISA

ELECTRONIC COMPONENTS MAIL ORDER CATALOGUE

SERVICE AIDS

Switch Cleaner	1.18
Circuit Freezer	1.34
Foam Cleanser	1.16
Aero Klene	1.10
Plastic Seal	1.28
Excel Polish	1.12
Antistat Spray	1.18
Aero Duster	1.40
Super 40	1.82
Video Cleaner	Head 1.06
Fire Extinguisher	3.06
Silicone Grease Aero	1.42
Ditto Tube	1.64
Heat Sink Compound	£1.08
Solda Mop 0.12mm	0.74
Ditto 0.06mm	0.76

CHART RECORDER SPECIAL

Brand new 3 channel pen recorders complete with charts. Full spec upon request. Once only price **£40 - £10 p&p**

A ONCE IN A LIFETIME OFFER WHILE STOCKS LAST

"D" type nickel cadmium rechargeable battery, manufactured by Saft.

D SIZE – 1-2 volt 4-0 AH

Brand new ex-equipment, unmarked, 10 for **£7.50**, 100 for **£60.00, 85p each**

Additional postage P&P **65p** 1-5, **£1.50** for 6-10, **£10** 100 off

ZENER DIODE PACK
400mW – 5 each value – 11 values – individually marked and packed – 55 Zener Diodes **Price £3.50 each**

TRANSFORMERS

British made transformers at very attractive prices

Primary	Secondary	Current	1	10	100
240V	6-0-6v	100m/a	£0.58	£0.52	£0.43
240V	6-0-6v	500m/a	£0.65	£0.60	£0.48

Carriage 45p transformer **£1.60** per 10

TRANSISTOR EQVI FROM BOOKS £9.00

ROTARY POTS

0.25W Carbon Log & Lin 1K-2M2 **40p** each
10 **300**
Any 100 **£28**

ZENER DIODES

400mW Plastic	3V-75v	**8p each 10/75p**
1.3W Plastic	3V-200V	**15p each 10/£1.4**
1.5W Flange	4.7-47V	**£1.26 each***
2.5W Plastic	7.5-75V	**64p each***
200W Stud	7.5-75V	**£1.25 each***

*Only available while stocks last

ROTARY SWITCH

1 pole 12 way 2 pole 6 way 3 pole 4 way 4 pole 3 way **50p**

CERAMIC CAPACITORS

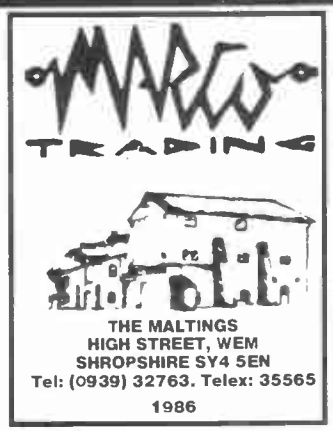
All 50V 1p to 10nf **4p each** 100 for **£2.75**

VALVES

Type	Price (£)
DY802	0.95
DY86/87	.65
ECC81	1.00
ECC82	.90
ECC83	1.00
ECC84	.80
ECC85	.95
ECC86	2.80
ECC88	1.25
ECF80	1.20
ECH81	1.40
ECH84	1.50
ECL82	1.10
ECL86	1.75
EF80	.75
EF86	1.80
EF183	0.90
EF184	1.00
EH90	0.98
KT66(GEC)	16.00
KT88(GEC)	19.00
EL34	3.25
EL84	1.00
EL509	7.85
EM87	2.55
EY86/87	.67
EY500A	2.50
PCC84	0.60
PCC85	1.75
PCC89	0.75
PCC189	0.85
PCF80	.95
PCF86	1.25
PCF200	1.95
PCF801	1.05
PCF802	1.05
PCF806	1.20
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	.90
PCL805/85	1.05
PD500	2.90
PFL200	1.85
PL33	1.50
PL36	1.75
PL81	0.85
PL82	0.75
PL83	1.20
PL84	0.75
PL95	2.00
PL504	1.40
PL508	2.70
PL509/519	5.25
PY88	1.60
PY500A	2.20
U26	1.90
UCH81	2.00
UCL82	1.60
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)
AC127	0.28	BC117	0.22	BC327	0.16
AC128	0.30	BC118	0.16	BC328	0.16
AC128K	0.34	BC119	0.28	BC337	0.12
AC141	0.58	BC125	0.14	BC338	0.12
AC141K	0.38	BC140	0.27	BC350A	0.24
AC142	0.56	BC141	0.26	BC440	0.36
AC142K	0.38	BC142	0.24	BC441	0.40
AC151	0.45	BC143	0.26	BC461	0.58
AC152	0.45	BC147	0.18	BC547	0.12
AC176	0.30	A or B	0.14	BC548	0.12
AC176K	0.44	BC148	0.10	BC549	0.10
AC187	0.28	A or B	0.12	BC550	0.10
AC187K	0.38	BC149	0.10	BC550C	0.10
AC188	0.28	BC157	0.12	BC557A	0.10
AC188K	0.38	BC158	0.12	BC558	0.10
ACY41	0.90	BC159	0.12	BCX34	0.29
AD142	0.80	BC160	0.30	BCY70	0.16
AD143	0.88	BC161	0.30	BCY71	0.17
AD149	0.72	BC168B	0.20	BCY72	0.16
AD161	0.42	BC169C	0.12	BCZ10	3.21
AD162	0.52	BC170	0.16	BCZ11	2.60
AD161/162	1.20	BC170B	0.16	BD124P	0.70
AF114	1.20	BC171	0.10	BC130Y	0.68
AF115	2.10	BC171	0.14	BD131	0.36
AF116	2.10	A or B	0.08	BD132	0.36
AF118	1.85	BC172	0.16	BD135	0.26
AF121	0.56	A or B	0.12	BD136	0.26
AF124	0.42	BC177	0.24	BD137	0.28
AF125	0.58	BC178A	0.30	BD138	0.30
AF126	0.58	BC182	0.10	BD139	0.30
AF127	0.38	A B or C	0.09	BD140	0.28
AF139	0.40	BC182L	0.12	BD144	1.82
AF178	2.28	A B or C	0.09	BD145	1.82
AF239	0.50	BC183	0.10	BD150A	0.68
AF279S	1.40	A B or C	0.10	BD160	1.58
AL100	5.40	BC183L	0.10	BD165	0.45
AL102	4.40	A B or C	0.10	BD183	0.70
ASY80	5.20	BC184L	0.10	BD201	0.52
AU110	2.80	A B or C	0.10	BD202	0.57
AY102	4.32	BC207	0.15	BD204	0.57
BA110	0.68	BC208	0.45	BD222	0.80
BA121	0.42	BC212	0.10	BD225	0.40
BA129	0.38	A B or C	0.10	BD232	0.45
BA148	0.16	BC212L	0.09	BD234	0.30
BA154	0.12	A B or C	0.10	BD235	0.30
BA155	0.12	BC213	0.10	BD236	0.38
BA157	0.28	A or B	0.10	BD237	0.38
BA164	0.14	BC213L	0.10	BD410	0.76
BB105B	0.30	A or B	0.10	BD434	0.58
BB105G	0.48	BC237	0.11	BD438	0.58
BB110B	0.42	BC238	0.14	BD439	0.85
BC107	0.10	BC239C	0.16	BD507	1.05
BC108	0.12	BC251	0.14	BD518	0.88
BC108B	0.10	A B or C	0.14	BD520	1.20
BC108C	0.12	BC301	0.30	BD699	1.89
BC113	0.42	BC302	0.30	BD707	0.74
BC114	0.12	BC303	0.30	BDX18	1.60
BC115	0.12	BC307A	0.18	BDX32	1.48
BC116	0.12	BC323	0.90	BF115	0.32



THE MALTINGS
HIGH STREET, WEM
SHROPSHIRE SY4 5EN
Tel: (0939) 32763. Telex: 35565

1986

ONLY £1.00

PRE-PAID ENVELOPE – SPECIAL OFFER ORDER FORM INCLUDES 50p FREE VOUCHER

MARCH SPECIAL OFFER

CERAMIC KIT (5 OFF 50 VOLT) EACH £3.50 (125 TOTAL)

NEW GAS SOLDERING IRON (PORTABLE) **ORYX** ONLY **£13.90**

PLASTIC BOXES

3x2x1	0.85
3x2½x2	0.93
4x3½	1.15
6x4x2½	2.50
8½x5x3¼	2.95

Colour Black all boxes with lids and screws

TELECOM EQUIP

BT Plug & 3M lead	1.25
BT Master Socket	2.85
BT Sec Skt	1.95
BT 4-core cable 1M	0.15
BT approved 100M	12.00

8T approved telephones

RESISTORS – CARBON FILM 5%

¼W 1RO to 10M (E12 Range)	2p each. 15p/10. 75p/100
¼W 1RO to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 1OM (E12 Range)	7p each. 40p/10. 3.50/100
2W 10R to 1OMm (E6 Range)	8p each. 60p/10. 5.00/100

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R – 1M 610 pieces	5.75
¼W pack 5 each value E12 – 10R – 1M 305 pieces	3.35
½W pack 10 each value E12 – 2R2 – 2M2 730 pieces	7.95
½W pack 5 each value E12 – 2R2 – 2M2 365 pieces	4.75
1W pack 5 each value E12 – 1OR – 1OM 365 pieces	15.00
2W pack 5 each value E6 – 10R – 1OM 365 pieces	18.50

RESISTORS – WIREWOUND Generally 5%

2.5W – 0.22 to 270R – available in preferred values	0.15
4W – 1R0 to 10K – available in preferred values	0.18
7W – 0.47R to 20K – available in preferred values	0.15
11W – 1R01 to 22K – available in preferred values	0.18
17W – 1R01 to 22K – available in preferred values	0.24

12 VOLT RECHARGEABLE UNIT £5.99 each + £1.85 p&p

ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

Soldering Section

Soldering Station complete with 30W or 40W Iron (state which) **67.95**
XS25W Iron Kit-complete with steel & plug attached **10.00**
CS 18W as above **9.90**
Antex 15W iron **5.25**
Antex 18W iron **5.50**
Antex 25W iron **5.75**
Antex elements **2.75**
Antex bits **0.90**
Antex stands **2.10**
Soldersucker **4.50**
Spare nozzles for Soldersucker **0.65**

74LS

74LS00	0.24
74LS01	0.24
74LS02	0.24
74LS03	0.24
74LS04	0.24
74LS05	0.24
74LS08	0.24
74LS09	0.24
74LS10	0.24
74LS11	0.24
74LS12	0.24
74LS13	0.33
74LS14	0.48
74LS15	0.24
74LS19	0.44
74LS20	0.24
74LS21	0.24
74LS22	0.24
74LS24	0.28
74LS26	0.24
74LS27	0.24
74LS28	0.24
74LS30	0.24
74LS32	0.24
74LS33	0.24
74LS37	0.24
74LS38	0.24
74LS40	0.24
74LS42	0.50
74LS148	1.28
74LS151	0.70
74LS153	0.70
74LS155	0.55
74LS157	0.45
74LS158	0.58
74LS160	0.62
74LS161	0.68
74LS162	0.70
74LS163	0.68
74LS164	0.74
74LS165	1.10
74LS166	1.50
74LS168	1.48
74LS170	1.40
74LS173	0.98
74LS174	0.75
74LS175	0.70
74LS190	0.82
74LS192	0.98
74LS193	0.98
74LS194	0.75
74LS195	0.74
74LS 196	0.84
74LS197	0.96
74LS221	0.85
74LS240	0.80
74LS241	0.80
74LS242	0.94
74LS243	0.94

CMOS

4000	0.19
4001	0.24
4002	0.24
4006	0.68
4007	0.24
4008	0.59
4009	0.44
4010	0.39
4011	0.23
4012	0.24
4013	0.35
4014	0.58
4015	0.58
4016	0.38
4017	0.54
4018	0.59
4019	0.59
4020	0.78
4021	0.58
4022	0.68
4023	0.30
4024	0.49
4025	0.24
4026	0.89
4027	0.44
4028	0.44
4029	0.73
4030	0.33
4031	1.28
4033	1.25
4034	1.40
4035	0.68
4036	2.48
4038	0.73
4039A	2.70
4040	0.58
4042	0.48
4043	0.42
4044	0.48
4046	0.58
4049	0.38
4050	0.34
4051	0.68
4051	0.68
4052	0.58
4053	0.58
4066	0.44
4068	0.24
4069	0.24
4070	0.24
4071	0.24
4072	0.24
4073	0.24
4075	0.24
4076	0.68
4077	0.24

Type	Price (£)
BF117	0.50
BF119	0.82
BF120	0.38
BF125	0.42
BF127	0.44
BF154	0.23
BF157	0.46
BF158	0.30
BF160	0.23
BF167	0.32
BF177	0.42
BF178	0.26
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.30
BF185	0.28
BF194A	0.15
BF495	0.12
BF200	0.30
BF222	0.38
BF224	0.20
BF224J	0.20
BF240	0.30
BF241	0.30
BF244	0.34
BF244A	0.30
BF244B	0.28
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF324	0.46
BF336	0.32
BF337	0.28
BF338	0.28
BF363	0.35
BF367	0.24
BF371	0.27
BF422	0.20
BF450	0.38
BF457	0.36
BF458	0.37
BF459	0.35
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.38
BFW11	0.84
BFW44	0.88
BFX29	0.28
BFX30	0.40
BFX80	6.46
BFX84	0.28

Type	Price (£)
BFX85	0.35
BFX86	0.44
BFX87	0.44
BFY50	0.22
BFY51	0.22
BFY52	0.22
BFY90	0.80
BFY90S	1.34
BR100	0.25
BR101	0.40
BR103	0.50
BRY39	0.50
BRY56	0.42
BSX19	0.32
BSX20	0.30
BSX59	0.78
BSX76	0.65
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT108	1.25
BT109	1.15
BT116	1.20
BT119	3.30
BT120	3.50
BT121	2.99
BT138/600	1.30
BTY79/400R	2.80
BU100A	2.30
BU104	1.80
BU105	1.20
BU105/02	1.55
BU108	1.75
BU124AE	0.90
BU126	1.40
BU133	1.40
BU204	1.30
BU205	1.30
BU206	1.50
BU208	1.40
BU208A	1.40
BU208/02	2.05
BU326S	1.75
BU407	1.10
BUX80	3.70
BUY20	2.75
BUY69A	2.60
BUY69B	1.98
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.08
BY135	0.35
BY164	0.45
BY179	0.56
BY182	0.80
BY184	0.38
BY187	0.65

Type	Price (£)
BY189	6.75
BY198	0.64
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/350	0.26
BYX55/600	0.30
BYX71/600	1.18
BYZ12	0.78
C106D	0.48
E1222	0.32
E5024	0.30
GET872	0.60
ITT2002	3.34
MEU21	0.62
MJ400	1.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE371	0.85
MJE520	0.44
MJE2955	1.60
MJE3055	1.40
OA47	0.10
OA90	0.07
OA91	0.07
OA95	0.12
OA200	0.06
OA202	0.10
OC26	2.65
OC28	3.15
OC35	4.75
OC36	2.75
OC42	0.72
OC44	0.72
OC45	0.68
OC71	0.60
OC72	0.70
OC81	0.68
OC200	2.46
ORP12	0.85
R2008B	1.20
R2010B	1.20
TIC44	0.38
TIC45	0.45
TIC46	0.48
TIC47	0.70
TIC106A	0.95
TIP30A	0.35
TIP31C	0.39
TIP32	0.35

NI-CAD CHARGER

Universal charger to charge PP3, AA, C, D
PRICE £5-17

NI-CADS

A Cells – **95p each**, 10 off **85p**.
C Cells = **2.14-1.98**
D Cells = **2.30-2.10**
PP3 = **3.75-3.65**

MARCO TRADING (DEPT AR03)
The Maltings
High Street
Wem, Shropshire SY4 5EN
Tel: 0939 32763 Telex: 35565

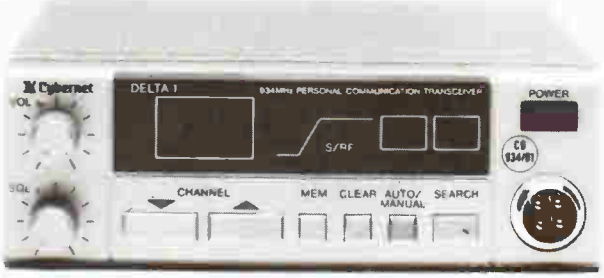
ORDERING: All components are brand new and to full specifications. Please add 65p postage/packing (unless otherwise specified) to all orde4rs then add 15% VAT to the total. Min order £5.00. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1986 catalogue – only £1.00 per copy. All orders despatched by return of mail.
NEW RETAIL 1000 sq.ft. shop now open Mon-Fri 9.00-5.00, Sat 9-12.00.

934 MHz PERSONAL RADIO

The Nevada Range

Join the growing number of people discovering this exciting radio band.

934 MHz offers 2 way high quality communications from 10 - 250 miles (according to location/weather conditions).



THE CYBERNET DELTA 1 934 MHz TRANSCEIVER
Has been engineered specifically for the UK market using latest "state of the art" technology.

- Sensitive RX (0.25 μV for 12 db SINAD).
- 16 memories available.
- Auto/Manual scan and search facility.
- External 'S' meter socket.

£355
+£5 SPECIAL DELIVERY

7.

POWER SPLITTER
Enables the co-phasing of any two similar 934 MHz antennas to give an additional 3 DB gain.
£24.50

HRA 934 L IN-LINE GaAs FET PRE-AMP
A super new ultra-low noise pre-amp which fits in line on any base or mobile installation. Guaranteed to give a staggering increase in received range. Extremely low noise 0.7 DB NF. 20 DB gain.
£125

SWR/POWER METER
This precise and extremely accurate meter features an illuminated scale, low loss 'N' type connectors and twin meters for both power and SWR measurement. Power 0-50 watts in two ranges.
£89.95

REMOTE ANTENNA SWITCH
High quality weatherproof masthead mounting switch. For switching 2 antennas with one cable feed.
£59.95

HRA 900 MASTHEAD PRE-AMPLIFIER
Super low noise GaAs FET pre-amplifier that mounts at the masthead. Low insertion loss and noise (typically 0.8 dB) coupled with 15dB gain enable this unit to double the received range of many sets.
£139.95

HAS-2
Remote DC switch for mast head antenna switch
£6.95

WR 900 SWR/POWER METER
A low cost unit measuring power to 100 watts in three ranges.
£49.50

1. 2. 3. 4. 5. 6.

ANTENNAS
Manufactured to the highest possible specification.

1. **PA7-E BASE COLNEAR** Gain 7.14 dBi stacked ⅝ array. **£66**
2. **P714-RE** High gain gutter mount, mobile antenna. **£44**
3. **P7-ME** High gain mobile magnetic mount antenna. **£44**
4. **P7-E** High gain gutter mount mobile antenna. **£44**
5. **G900A** Low profile, bolt thru mobile antenna. **£25**
6. **G900R** Low profile bolt thru mobile antenna in black. **£25**
7. **Tc 12L MKII 12 ELEMENT BEAM** A new aluminium version of our succesful 12 element loop quad. Gain: 18dBi. **£49**

NEVADA 934 *Professional Series*

ASK YOUR DEALER FOR MORE INFORMATION OR CONTACT US DIRECT.

Telecomms, 189 London Road, Portsmouth PO2 9AE. Tel: 0705 662145 Telex: 869107 TELCOM G

Nevada 934 MHz Catalogue with full details and specifications of the complete range is available from Telecomms £1.00.