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HAM RADIO TODAY

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VOLUME 6 NO 9 SEPTEMBER 1988

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MYERS PROSECUTION

In the latest of a recent string of successes on the part of DTI investigators an unlicensed radio operator appeared before Bedford Magistrates on Monday, April 25th, to hear himself fined a total of nearly three thousand pounds for a number of wireless telegraphy offences. The magistrates also ordered that he should forfeit transmitting and ancilliary equipment valued at between four and six thousand pounds.

In a recent case a radio pirate operating in Bedfordshire discovered that he would lose more than a few Pieces of Eight for his trouble — Keith Townsend, G4PZA, has the story.

Aeronautical Interference

On various dates during November of last year, transmissions within the 6MHz aeronautical band had been traced to the home of one Mr L Myers and a subsequent visit by RIS officials uncovered the fact that this was not the only band in which he had been taking an interest. DTI officials were able to seize three transceivers, a Trio 930S, a Yaesu FT726R and an FT102, along with a Butternut HF antenna, a 100 watt linear amplifier, computer equipment and a variety of microphones, speakers and antenna tuning units from a number of manufacturers. There can be no doubt that Mr Myers was very well equipped for his clandestine hobby.

Court Appearance

At his court appearance Mr Myers was charged under Section 1(1) of the Wireless Telegraphy Act (1969) with four counts of illegally installing radio transmitters designed or adapted for transmission within the band 6.535MHz to 6.685MHz, which is allocated exclusively for aeronautical use, and a similar charge of installing a combined VHF/UHF amateur transceiver. He was fined six hundred pounds on each of the first four charges and four hundred pounds in respect of the amateur bands. Mr Myers was also ordered to pay £150 toward prosecution costs and all of the confiscated equipment was ordered to be forfeited, bringing the total penalty to somewhere in the region of a staggering ten thousand pounds.

Penalty

At a casual glance this might seem to be a severe penalty but the magistrates had clearly been aware of the potential danger of unauthorised operation within a band designated for the direction of air traffic and there can be no doubt that the fines imposed were intended to discourage others who might feel tempted to join in on this band, the main purpose of which is to relay flight information to aircraft above the north Atlantic. Under the terms of International Radio Regulations 3630 (Article 50) "any band allocated to the aeronautical mobile radio service is reserved for communications relating to the safety or regulation of flights . . . along national or international civil air routes".

Pilots Comment

Asked to comment on the dangers posed by Mr Myers and others pirating the aeronautical bands, one experienced pilot commented. "The possibilities are too frightening to contemplate. These and other HF frequencies are used mainly for ssb transmissions between ground control stations and aircraft flying long distances. The types of message carried might include directions for avoiding an area of bad weather or instructions to divert to an alternative destination, perhaps because an airport is fogbound. On does not need a vivid imagination to understand the risk to both passengers and crew of such a message being drowned out by some idiot who wants to talk to the Italians and can't be bothered to obtain a proper licence and use properly authorised bands." He continued, "Authorised equipment within the aeronautical HF band is not accessed by selective calling, so that any unlicensed transmission poses a very real threat to any aircraft which

STOP PRESS

Mr L Myers — Appeal to Luton Crown Court

This appeal was heard on 24 June 1988, and the Judge ruled that the sentences, fines and Forfeiture Order imposed on Myers by Bedford Magistrates on 25 April 1988 were entirely right.

In relation to the sentences and fines he made two further judgments: —

1. In order to show the public how serious these offences are, for the charge of using (6.69MHz) on 29 November 1987 he sentenced Myers to two months imprisonment, suspended for two years.
2. The fines imposed should be related to Myers' means, and so he reduced the original total fine from £2,800 to £1,000, *i.e.* £200 for each of the five charges.

Myers was ordered to repay the above fine, including the original prosecution costs of £150 at a rate of £80 per month.

The original Forfeiture Order still stands.

"I'm only minding it for a friend"

is legitimately operating on the frequency in question. Piracy is a very real danger to air travellers and must be stamped out at all costs, before it leads to disaster!

Pirate Investments

Whilst it would be unrealistic to suppose that radio piracy can easily be eradicated, the most puzzling feature of a case such as this is perhaps not the unauthorised and potentially dangerous use of such a vital part of the spectrum, but the fact that although an amateur licence is available to anyone who is prepared to put in a little effort, there are still those prepared to invest very heavily in illegal operation, despite the fact that their actions are likely to attract very heavy penalties which could even include a term of imprisonment. Although some expensive equipment was involved in Mr Myers' case, this is by no means the first instance of pirates having been found in possession of literally thousands of pounds worth of radio equipment and yet, even knowing the risk involved, there always seems to be one more miscreant prepared to tread the same path.

As to illicit frequencies, whilst pirating the amateur bands can be a nuisance, there can be no acceptable excuse for hijacking such vital frequencies as those used by Mr Myers and others, who seem to put their own pleasure before the safety of others. Clearly Bedford magistrates take the same view and have issued an unequivocal warning to anyone prepared to put the safety of others at risk. The 6MHz band has been something of a haven for unlicensed operators for at least the last thirty years but the cost of getting caught may now start deterring such activities.

LETTERS

LETTER OF THE MONTH

Dear HRT, I was astonished by Martyn Bolts letter proposing the next AGM of the RSGB should be held in Cleckheaton Town Hall. I had no idea Cleckheaton was the centre of the UK!

The RSGB should, however, consider my locality (Breacon, Powys). Not only would Bwlch Village Hall be much cheaper to hire than Cleckheaton Town Hall, but it has the additional advantage of being right on the middle of nowhere. But, beware, once the participants have tasted local hospitality they won't want to go anywhere else and AGMs will be held monthly!

Bruce Carter, GW8AAG

OK — Bwlch Village Hall it is then. We'll be sending you the £10 as a booking deposit!

Editorial Prejudice?

Dear HRT, I was astounded by your reply to the letter from Sam Manne, ZS6BBW, published in the May issue of HRT. Your comments could equally well apply to many countries of the world but only South Africa is singled out because it is 'smart', 'with-it', 'the done thing' and also very easy to jump on the bandwagon of anti South African rhetoric. The conscience of many people seems to be very selective indeed and the ruthless subjugation of Estonia, Latvia and Lithuania (to name only three!) by the Russians passes without care or comment.

You prejudice reminds me of odious politicians who visit South Africa, head immediately for Soweto and condemn the conditions there, yet refrain from visiting or commenting on the dreadful slums of Kinshasa, Nairobi or even Rio.

We, as radio amateurs must either 'shut up' about politics or not be selective. You have chosen the easy, glib, hypocritical option.

A Tait GM4LBE

I would make two points here. Firstly, the reason South Africa came in for criticism was that my reply related to a letter sent in from South Africa. Secondly, just because South Africa alone was mentioned it should not be assumed that one 'supports' equally odious regimes elsewhere in the world!
— **G4IRQ**

Secondhand Radio

Dear HRT, I was interested to read the letter by Ron Taylor and your reply in the January '88 issue of **HRT**. I agree with Ron that many newcomers to the hobby must be horrified by the big glossy ads and price tags of £1000 plus, add all the extras and a final figure of £2000 is nearer the mark. I wonder how many newcomers to the hobby look at the secondhand ads in your magazine alone, looking at all the numbers and names, wondering what they are, what they do and what they look like.

Perhaps more importantly, whether a fair price is being asked for the equipment involved. Unless one has a source of magazines going back to the early 1970's showing the glossy ads of the day the newcomer may not be able to find the answers or find out what the variations of that equipment were along with the optional extras that were available. I cannot remember any magazine printing a comprehensive listing of older Yaesu, Trio (Kenwood), Icom and KW equipment from the early 1970's.

In a previous magazine you reviewed a commercial receiver with a price tag of £3000 or so; I was intrigued as to the reason why you reviewed such a receiver. I would imagine that such a receiver must find a very limited market with your readers. With the control systems used on that receiver it would be beyond a lot of people to repair or service and to send that off to the manufacturers would prove very costly indeed. After using some of that company's equipment professionally I know that certain types can be very 'awkward' especially when special tools may be required before you can even start.

Having said that, why not run an article on available surplus equipment? Equipment that has a more interesting price tag and in many cases built to be serviced easily in the field with basic test equipment using cheap, commonly available components. Equipment that is designed to take 'stick' which will not 'fall over' at the operators first mistake. The most commonly known is probably the Racal range of receivers, the older RA17 and 117s but newer solid state ones are also on the surplus market now along with equipment from Eddystone/Marconi, Redifon and Plessey to mention but a few. I use a pair of Redifon 551 receivers with matching exciter and linear amp, the receivers were bought for just over £200 in good condition and like most surplus equipment they do not have whistles, bells and clocks built in, but then I can buy a clock down the road for a fiver, can't I?

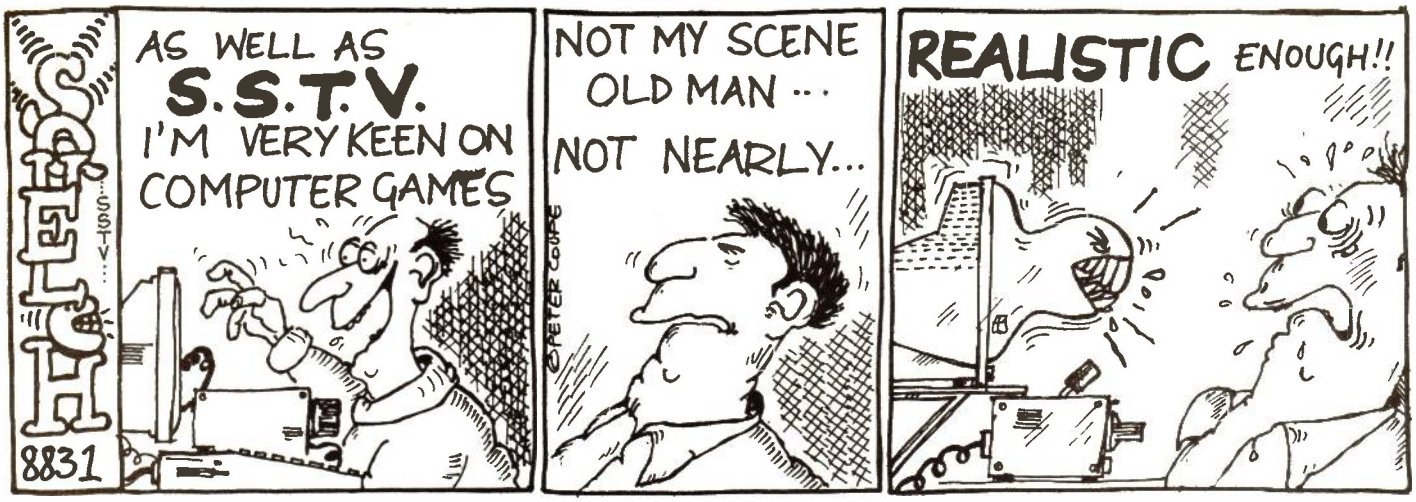
I believe there is a strong call for a magazine to redress the balance of all the glossy ads with glossy prices. I would imagine that a good many of your readers buy your magazine to persue the secondhand adverts looking for the first pieces of equipment at a price they can afford. Why not be the first magazine that caters for this need showing that good equipment is available if only you know what to look for. HAM RADIO TODAY! It doesn't have to be HAM RADIO £1000+!

Derek Riddle G4BMR

Certainly fair comment Derek, there is a growing demand for equipment which will not break the bank — and in some measure the manufacturers are responding to this with their budget rigs such as the Yaesu FT747 and rumour has it, Icom aren't far behind. As for good second hand rigs we have featured second hand gear in the past and there is another series already in the pipeline, in addition to our very popular ex-PMR conversion articles.

The reasoning behind the £3000+ receiver article was simply that readers might want to know how their equipment compares to professional grade gear. We also reviewed the top of the range Icom transceiver recently, which at around £4,500 can't be described as exactly cheap — yet our information suggests that at least half a dozen of these have already been sold!

Our hobby seems to be broadly divided into two camps, those who are willing and able to pay the prices asked for new gear and those who won't or can't. As secondhand prices seem to track the cost of new equipment even



this avenue is closed to those of limited means and may go a long way to explain why — as David Evans mentioned in RadCom recently — less than 200 members of the RSGB are below the age of 18.

As far as the balance of coverage in HRT is concerned, you're probably aware that we have recently undertaken a readers survey and as soon as the data from that has been processed we will be looking at how or if readers want their magazine to be changed.

Finally — if you feel that there is a need for such articles we would always welcome contributions! — **G4IRQ**

RSGB Ostriches?

Dear HRT, After many articles and letters, and contributing myself, the RSGB are like a flock of ostriches with their heads buried in the proverbial sand and pampering to the establishment — they are splitting hairs over the introduction of a novice licence. Let's simply call it a novice licence, after all we all have to start somewhere.

Next, why say they are aiming at the 11-16 years age group; that's not on, it smacks of age discrimination. This method is used by modern day employers — if you are over 30 you are too old. One would have to be careful about this, the RSGB could be taken to task especially as the rules state over 14 years, the issue of a novice licence should be. . . to those that are taking instruction for their RAE or any person having passed one of the two papers. This would perhaps spur them to greater effort.

Personally I would increase the age limit to 18; there are enough teeny-boppers on CB. I dread the thought of letting them loose on HF. I myself would not like the idea of infringing on the HF bands until I was proficient to do so. Also why not issue the novice licence to operate on all the modes on the 26.965 to 28.205MHz band, those that illegally use this band on all the modes try very hard to be very responsible operators and there are some excellent linguitst amongst them, so what better way for the RSGB to increase its membership and get some credibility and not be old stick-in-the-muds. It will also give them more muscle to fight the privatisation of the radio spectrum by the DTI.

J H Clifton

Like any organisation the RSGB does some dumb things, but it also does some smart things too — what is dumb and what is smart does, of course, tend to depend on your point of view! We should ask ourselves what the chances would have been concerning the allocation of 50MHz and 70MHz if there had been no national society to negotiate for the amateur radio fraternity.

As for the accusation that the RSGB has 'given in' to the establishment over novice licences, my view is that most administrations tend to obey Newtons Laws — ie. a body will only move when a force is applied to it — so unless the DTI had wanted something to do one rainy afternoon there would be no novice licences — no new band allocations.

You also mention 'ageism' in your letter — but surely you are guilty of the same charge if you see yonger people as 'teeny-bappers' who will abuse the bands, are we 'oldies' really any better? — **G4IRQ**

Was 'Against', now 'For'

Dear HRT, I used to be one of those people who was vociferously against the introduction and implementation of a novice licence in the UK. I saw it as the demise of amateur radio. I now subscribe to the opposite view.

Our hobby desperately needs the enthusiasm and youthful imagination that a novice or student licence, call it what you will, might possibly bring to amateur radio.

Unfortunately there are many amongst us whose Draconain and shortsighted views would suffocate any such innovation. These same maybe, disillusioned people, would rather have amateur radio become an exclusive and elitist clique. We must reject this retrograde ideology if our hobby is to perpetuate its inventive spirit.

R Howes

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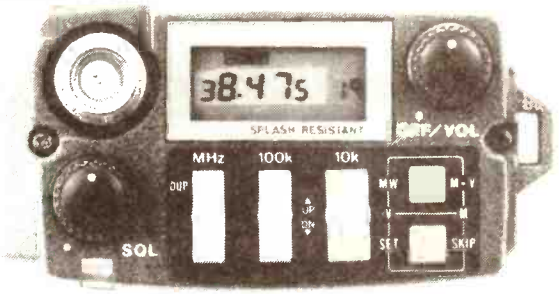

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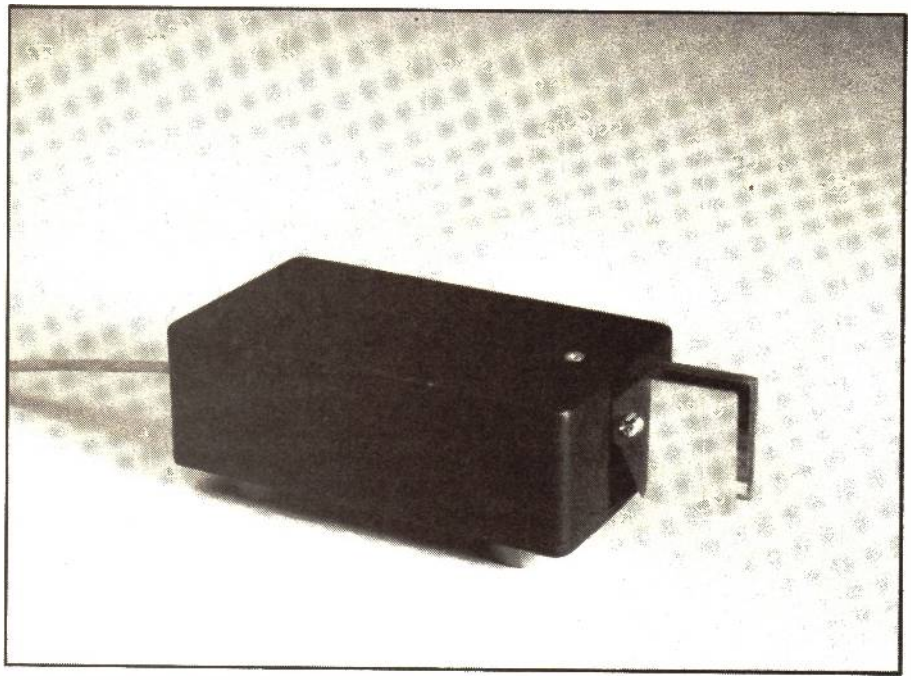
Paddle Keyer PROJECT



Terry Grice, GP4SL, delves deeper into the world of electronic morse with a rather unconventional paddle unit.

The electronic paddle described in this article is designed to be used in place of a conventional mechanical paddle. Operation relies upon two touch sensitive pads which replace the mechanical dot and dash levers found on a conventional paddle unit. Although initially designed for use in conjuction with the 8044 Electronic Keyer published in the *July* and *August* issue of *HRT* the paddle is equally capable of operating other keyers which have their dot and dash inputs switched to a common 0V rail during use. Most commercial keyers use this arrangement.

Circuit Description

The complete circuit, shown in Fig.1, is based around a single 40106B CMOS hex schmitt trigger inverter IC.

IC1a, R1 and C4 form a 60kHz square-wave oscillator and as the output drives two identical circuits, operation of only the dot circuit will be considered here. The dot paddle capacitively couples the signal from the oscillator output at pin 8 to the input at pin 13 of buffer IC1b. The inverted square-wave signal present on the output pin 12 rapidly charges C5 through D1 to 5V (logic 1). This steady DC level present at the input (pin 11) of the final buffer IC1c is inverted, resulting in a 0V level (logic 0) on the output at pin 10, as Q1 receives no base drive it does not conduct. This is equivalent to open dot contacts.

When finger contact is made with the dot touch-pad the signal reaching the input of IC1b is severely attenuated through body capacitance to ground. When RV1 is correctly preset the DC voltage present on the slider will hold pin 13 at logic 1, resulting in a logic 0 appearing on pin 12. This allows C5 to discharge through R2 placing a logic 0 on pin 11 of IC1c. The logic 1 now available on pin 10 sources current via a current limiting resistor R3 into the base of Q1 causing the transistor to saturate and remain in its conducting state as long as finger contact is sustained with the touch-pad. This condition is equivalent to closed dot contacts.

Operation of the dash circuit is identical to that described for the dot circuit where IC1d and IC1e replace IC1b and IC1c respectively. IC1f serves no purpose and has its input grounded.

To ensure reliable operation it is necessary to provide a stable DC power source. For this reason REG1, a 5V positive voltage regulator, has been employed. A standard 78L05 regulator may be used, however the drawback associated with using this device is in the 2V dropout voltage lost between the input and the output terminals. Alternatively, a LM2931AZ-5 regulator can be installed. This device features a very low dropout voltage — less than 0.6V — allowing the battery to be used right up to the end of its useful life, ie. when it reaches a terminal voltage of 6V. Furthermore, the quiescent current drawn is also very low, maximum operating current being in the order of a few hundred micro-amps, resulting in very long battery life. Capacitors C1 and C2 respectively provide regulator input and output decoupling; whilst C3 provides DC smoothing – note that it is essential to include this component with a value no less than 100uF when using the LM2931 regulator in order to maintain output stability.

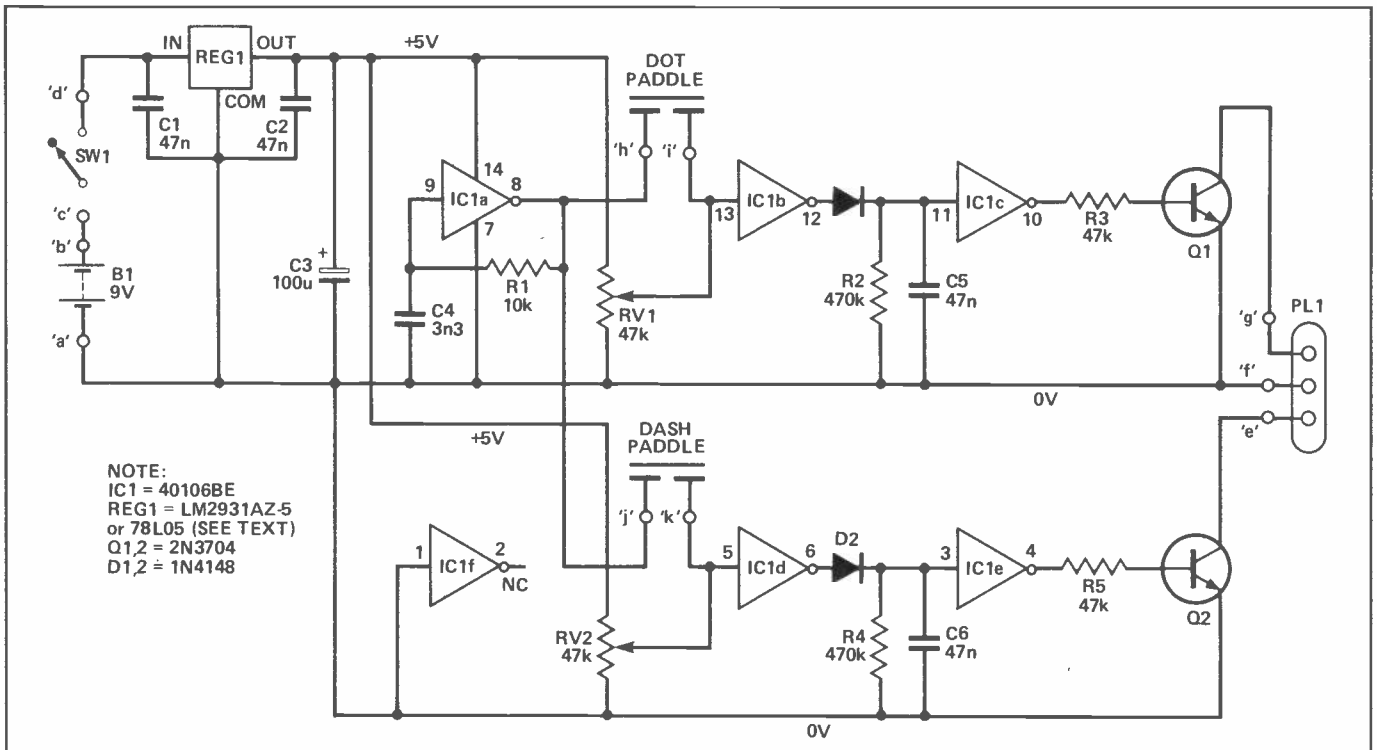
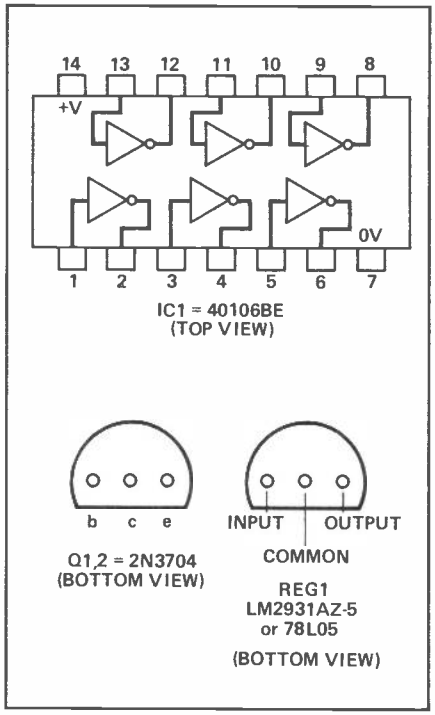


Fig. 1: The complete circuit



PCB Construction

The artwork for a single-sided PCB is shown in **Fig.2**, refer to **Fig.5** for the component layout. PCB holes for components RV1 and RV2 along with the seven holes 'a' to 'g' which accommodate veropins need to be drilled 1mm diameter, identify the single PCB fixing hole to the right of Q1 and drill this to provide M3 clearance. All other PCB component fixing holes are drilled 0.8mm diameter.

Commence assembly by soldering the seven veropins and the two PCB links, LK1 and LK2, into place. Next install and solder resistors R1 and R5, presets RV1 and RV2, and capacitors C1 to C6 onto the board, being careful to observe the correct polarity when installing C3. Mount a 14 pin DIL IC socket, check orientation and solder down Do not install IC1 at this stage.

Now install diodes D1 and D2, transistors Q1, Q2 and voltage regulator REG1 and check for correct insertion. Use of a heatshunt on each leg is recommended —a croc clip will suffice.

The artwork for the dot and dash touchpads is given in **Fig.3** and are manufactured from 1.6mm s/ 70micron double-sided copper clad board. The artwork only shows the innermost side of each pad but prior to etching the outermost side (the

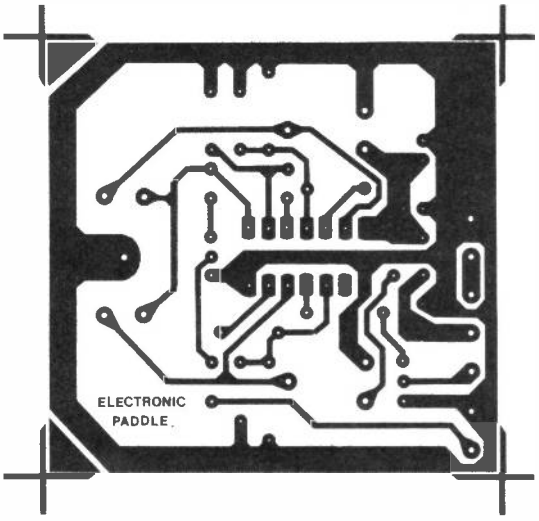


Fig. 2: PCB board

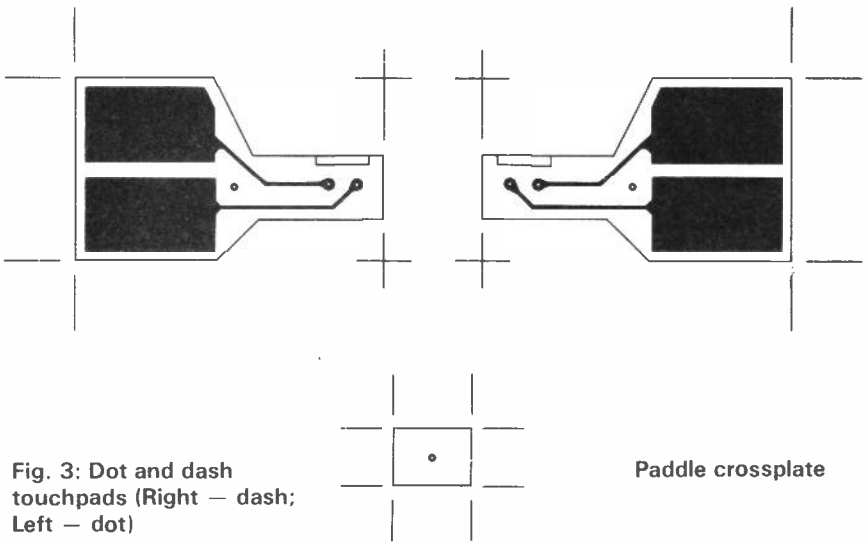


Fig. 3: Dot and dash touchpads (Right — dash; Left — dot)

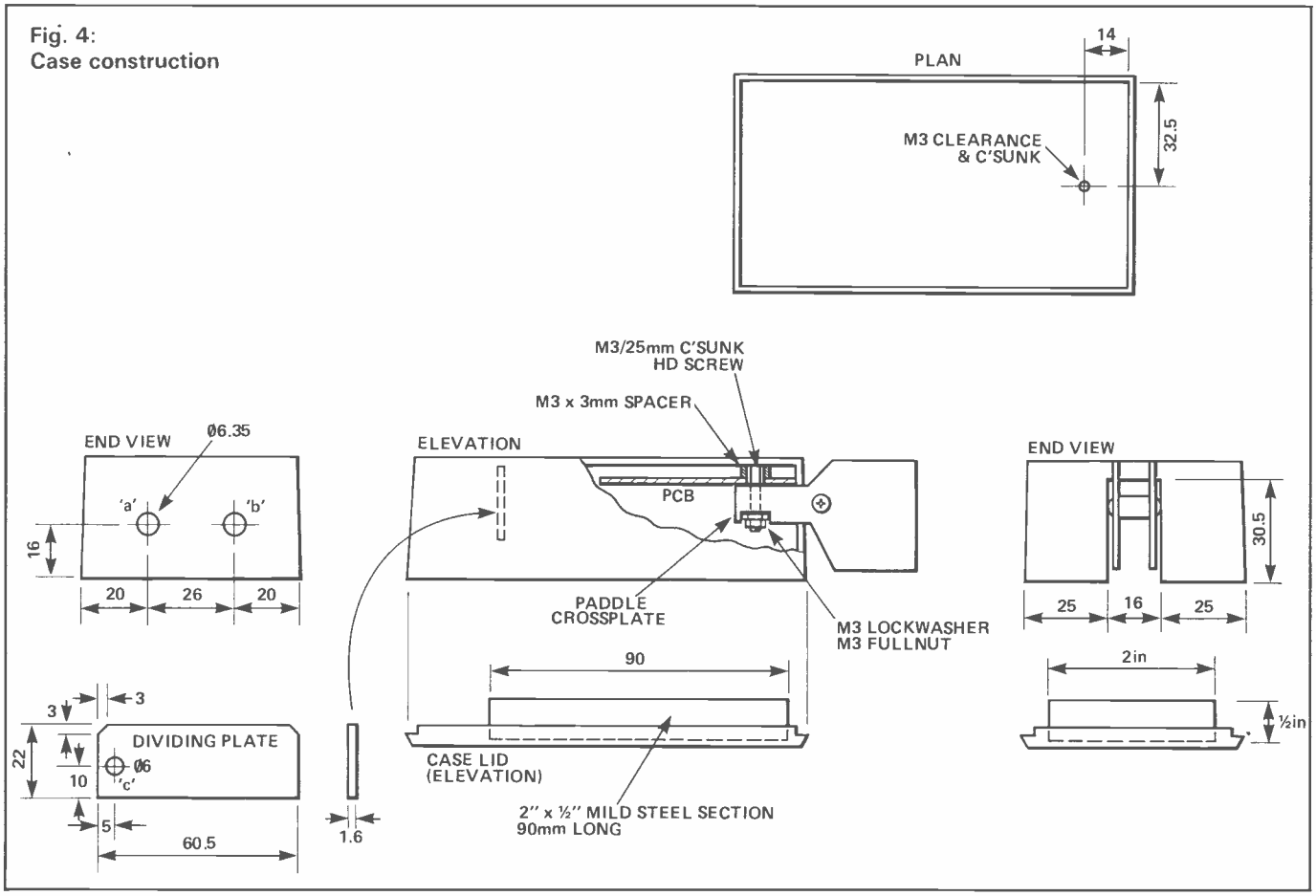
side with which finger contact is made) must be masked off to prevent the copper being etched away. At least one side of the cross-plate must be void of copper. After etching, two 0.8mm diameter holes should be drilled in each touchpad and a spot-face cutter or small drill is used to remove copper around the holes on the unetched side of each pad. Identify the location for the spacer fixing hole on each pad and drill for M3 clearance. The touchpads and cross-plate can now be cut and shaped by filing to the inside of the lines.

The pads on the prototype were tin-plated, and although this process is not essential for reliable operation it does provide a more aesthetically pleasing appearance. As an alternative, silver conductive paint could be used. Next place a 15mm length of 22 swg tinned copper wire through each 0.8mm hole and solder into place then bend each wire downwards forming a right-angle approx 2mm away from the pad. Connect the two pads together using a 10mm insulated spacer, after which the assembly may be mounted onto the PCB and soldered into place. When PCB assembly is complete trim all component leads as short as possible as the board sits close to the case when installed. A final check of the soldering is recommended to ensure that all leads have been soldered and no solder bridges exist. Drill a M3 clearance hole in the crossplate and set this aside for use at a later stage.

Construction and Wiring

Referring to **Fig.4** and **Fig.5** begin by forming a slot in one end of the case. One simple method of doing this is to drill a series of small holes horizontally across the top of the slot below a scribed line and saw up each side of the slot until a hole is reached then, using a pair of strong pliers, the unwanted metal can easily be snapped out. Finish off by filing the slot to shape removing any sharp edges.

Fig. 4:
Case construction



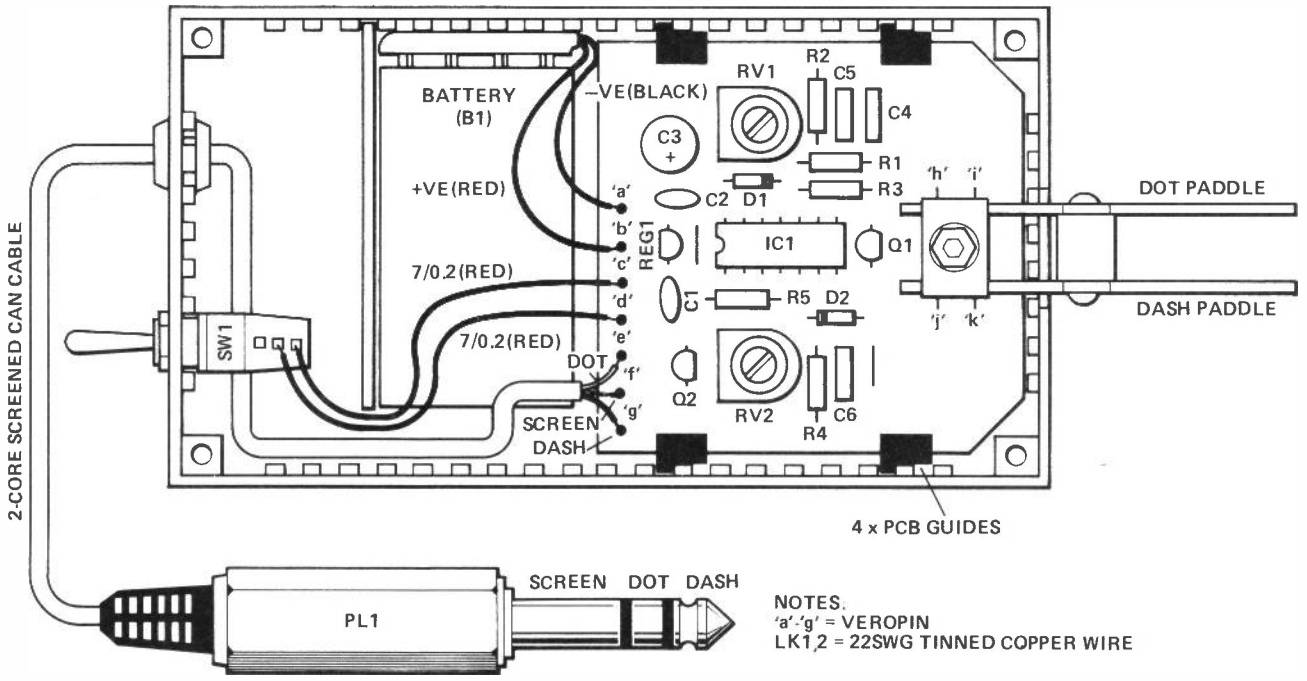


Fig. 5: Components layout

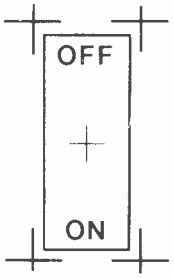
Next drill two 6.4mm (¼") holes in the opposite end of the case along with an M3 countersunk clearance hole in the top of the case and debur all three holes. The dividing plate can be made from an offcut of 1.6mm copper clad board so drill and debur a 6mm access hole and remove the upper two corners of the plate as shown so as to provide a good fit.

Insert a 6.4mm (¼") grommet into hole 'b'. A durable label for switch SW1 may be manufactured by photocopying the legend shown in **Fig.6** onto a piece of thin card. This is covered with clear protective film and a strip of double sided adhesive tape is attached to the back. The label is then trimmed to size. Align the lower edge of the label with the lower edge of the upper case housing and carefully locate the label over hole 'a' and press into place. SW1 should now be installed, taking care not to overtighten the fixing nut as this will wrinkle the protective film. A 90mm length of ½" × 2" mild steel section is fixed into the case lid using epoxy adhesive. This added weight ensures that the paddle stays put when in use! Other materials may be used according to availability however the dimensions stated should not be exceeded. Use a file to remove any sharp corners and edges before installing, and fit four self-adhesive rubber feet to the case lid.

The PCB can now be installed. Insert an M3/25mm countersunk head screw through hole 'd' and place an M3 × 3mm metal spacer over the screw. A metal spacer must be used to provide a connection between the PCB 0V and the case. The four PCB guides should be reduced to one notch and used to position the board as illustrated. The paddle crossplate is now dropped into place ensuring that the copper free side is in contact with the touchpads, then the PCB is secured using an M3 lockwasher and nut.

The unit may now be wired. Take care to observe the correct polarity when soldering the battery connector leads to the PCB — two lengths of 7/0.2 or similar instrument wire can be used to wire SW1 to the PCB via the dividing plate access hole. The two-core screened cable takes the same route, leaving the case through the grommet, the other end of this cable being attached to PL1. Select a cable which fits snugly into the grommet — if required a cable tie may be placed around the cable close to the grommet on the inside of the case to prevent the cable being pulled out.

Fig. 6: Label for SW1



The prototype housing consisted of an aluminium die cast box sprayed matt black, but a suitable prelacquered case is also available. Details are provided in the components list.

Test and Setting-Up

Insert IC1 into the PCB holder observing both orientation and CMOS handling precautions. Set RV1 and RV2 to the fully counter-clockwise position. Place SW1 to the OFF position and connect a voltmeter set to the 10V range across the output of the voltage regulator, two convenient points are LK1 for the meter positive lead and the bottom of R4 for the negative lead. Connect a 9V PP3 battery, and with SW1 closed 5V should register on the meter, at a current in the order of several hundred micro-amps. Disconnect one side of the battery connector and insert an ammeter set to read 1mA or greater to confirm this. This reading may be taken again on completion of the setting-up routine, however even with both touchpads 'on' the total current drain will be less than 1mA. All being well insert PL1 into the key

socket of the electronic keyer, make finger contact with the dot touchpad and adjust RV1 until dots are produced by the keyer, if possible use a plastic or other insulated adjustment tool. Next make contact with the dash touchpad and adjust RV2 until dashes are produced by the keyer.

Touching both paddles (squeezing) should cause the keyer to generate a string of alternating dots and dashes, if this is not so, fine adjustment of RV1 and/or RV2 is required. This should be done whilst sustaining contact with both touchpads. A final adjustment to either or both potentiometers may be required to cause the touchpads to respond to finger touch rather than finger proximity. Once satisfactory settings are obtained the paddle unit will provide reliable operation. This completes the setting-up procedure of the Electronic Paddle which is now ready for use.

A plain aluminium diecast box may be obtained from:—
Verospeed, Boyatt Wood, Eastleigh, Hants SO5 4ZY.
Tel. No: 0800 272555.
Price: £2.51 (inc. VAT); Order No: 86 — 20102B.

A pre-lacquered hammertone grey case, p.c.b. guides and M3×10mm spacer can be obtained from:—
Maplin Electronic Supplies Ltd, P.O. BOX 3, Rayleigh, Essex SS6 8LR. Tel. No: 0702 554155.
Diecast box. — Price: £3.30 (inc VAT); Order No: DCM5004.
P.C.B. Guide. — Price: £0.08 (inc VAT); Order No: XR72P.
Ins. Spacer. — Price: £0.74 (inc VAT) (pack of four); Order No: FS36P.

LM2931AZ—5 can be obtained from:—
Electromail, P.O. BOX 33, Corby, Northants NN17 9EL. Tel. No: 0536 204555.
Price: £1.43 (inc VAT); Order No: 630 — 702.

All other components are readily available through normal outlets.

Components List

RESISTORS

R1	10k
R2, 4	470k
R3, 5	47k
RV1,2	47k hor. s-min preset

All 0.33W 5% carbon film unless specified.

CAPACITORS

C1, 2	47nF ceramic
C3	100uF 10V elect.
C4	3n3 polyester
C5, 6	47nF polyester

SEMICONDUCTORS

D1, 2	1N4148
Q1,2	2N3704
REG1	LM2931AZ—5 or 78LO5

MISCELLANEOUS

SW1	sub-min toggle SPST
PL1	¼" stereo jack plug

I.C. holder 14 pin, battery clip PP3, veropins, t.c. wire 22s.w.g. inst. wire 7/0.2, 2-core screened cable, rubber feet.

Packet Radio

Part 1

Everyone's talking about it but what exactly is it? Chris Lorek investigates Packet Radio

You've heard amateurs talking about it, you've seen the reviews of these strange 'TNC' things, but what's it all about? Would it really interest you or is it just for the computer freaks? All day and all night, 145.650MHz is alive with messages to and from amateurs, automatic mailboxes throughout the country forwarding bulletins, unattended NET/ROM digipeaters communicating, continuously finding new paths to use between each other.

Packet Radio is fast, faster than RTTY, AMTOR, faster than any human being can send CW, and it is 100% *error-free*. Also, it automatically *tolerates* QRM, so much so that dozens of QSOs can use the same frequency. If you can't communicate directly, you can go hop-by-hop across the country using other stations as digipeaters, all completely automatic. Interested? Then read on . . .

What's It All About?

Packet Radio is digital communication, you type in your message on a keyboard and you view messages on a display. Being fast and error-free, it naturally lends itself to transmission of large amounts of data as well as reliable person-to-person QSOs. Being error-free, there are no 'gaps' or corruptions in your messages due to electrical interference or other forms of QRM. Because it is very fast, individual transmissions can 'slot in' between others, each transmitter only being keyed for upwards of a fraction of a second to put a call out. Being purely digital, intermediate stations between two amateurs in QSO may act as store-and-forward 'digipeaters' without introducing any degradation in the quality of the message. A radio 'network' hence evolves, comprised of packet radio stations throughout the country ready to be used upon command.

Because of this digital nature, message storage is a simple reality, if the station you call isn't in the shack, you can leave a message for him to read upon his return. If you like, you can send a 'bulletin' for all amateurs to read on their local 'mailbox', your bulletin being automatically for-

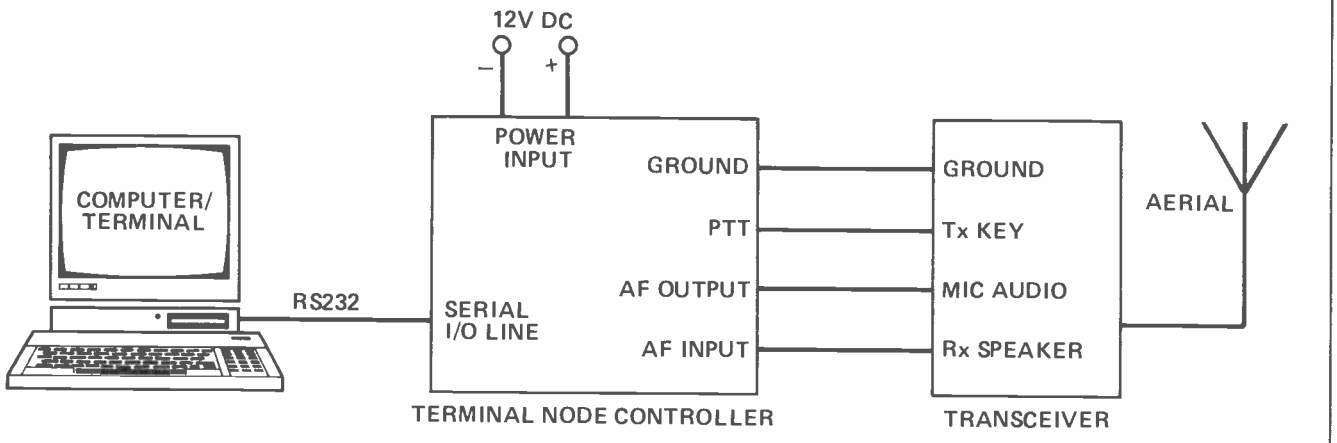


Fig. 1. Basic TNC Connections

warded for you to all mailbox stations (great if you need a circuit diagram or some unusual parts for your restoration project). Is it any wonder that packet radio is the fastest growing area of amateur radio today?

What Do I Need?

First, you need a radio. Most types will do, either HF SSB or 2m/70cm FM, although most of the activity takes place on 144.650MHz FM. This series on packet radio will hence concentrate mainly on 2m operation, however a guide to operation on HF and the like (packet meteor-scatter on 6m?) will be included where appropriate.

Secondly, you need a terminal with a keyboard, this may either be a computer or a purpose-built terminal unit. Many amateurs do indeed use a low cost computer as their 'human interface', employing either a simple program to emulate a 'dumb terminal' or a more complicated program to use the computer's facilities to their full advantage. Needless to say, several programs on cassette or disc for many popular computers are freely available to do all this for you.

Last, but most important, you need what is called a 'Terminal Node Controller', or TNC for short. This is a small box operating from a 12V supply that fits between your terminal and radio, doing all the digital processing work for you. It forms your messages into short 'packets' ready for transmission, and modulates your transmitter with tone frequencies of 1200Hz and 2200Hz to represent the digital 'ones' and 'zeros'. A radio data transmission rate of 1200 baud (ie. 1200 'bits' per second) is used for normal communication, whereas on HF 1600Hz and 1800Hz tone frequencies are commonly used at a slower data rate of 300 baud. Most low-cost TNCs offer only VHF operation, however some offer either or both at the same time, so bear this in mind when you purchase if your prime interest is in HF. **Fig. 1** shows the arrangement of a typical packet radio installation.

How Does It Work?

Packet communication consists of messages between amateurs, using the internationally agreed 'AX.25' protocol. Text is mainly sent but often data as well, last Christmas I even received some lovely computer-type 'Christmas Cards' over the air! A 'link' is first established between two amateurs, if this is direct then all communication 'packets' contain the sender's and recipient's callsigns, however if intermediate stations are used as digipeaters, the callsigns of these are also included as appropriate. **Fig. 2** shows the general arrangement of an initial 'Connect' message, where station A calls station B, **Fig. 3** shows what occurs when text information is passed from one station to another. Towards the end of the short transmis-

FLAG	ADDRESS	CONTROL	FCS	FLAG	FIELD
8 BITS	112-560 BITS	8 BITS	16 BITS	8 BITS	LENGTH
01111110	CALLSIGNS OF SENDING AND DESTINATION STATIONS, + ANY INTERMEDIATE DIGIPEATERS	FRAME TYPE	FRAME CHECK SEQUENCE	01111110	INFORMATION

Fig. 2. Un-numbered/Supervisory Packet Formation

FLAG	ADDRESS	CONTROL	PID	INFORMATION	FCS	FLAG	FIELD
8 BITS	112-560 BITS	8 BITS	8 BITS	ANY NUMBER OF 8 BITS		8 BITS	LENGTH
01111110	CALLSIGNS OF SENDING AND DESTINATION STATIONS, + ANY INTERMEDIATE DIGIPEATERS	FRAME TYPE	PROTOCOL TYPE	TRANSMITTED TEXT OR DATA	FRAME CHECK SEQUENCE	01111110	CONTENTS

Fig. 3. Information Packet Formation

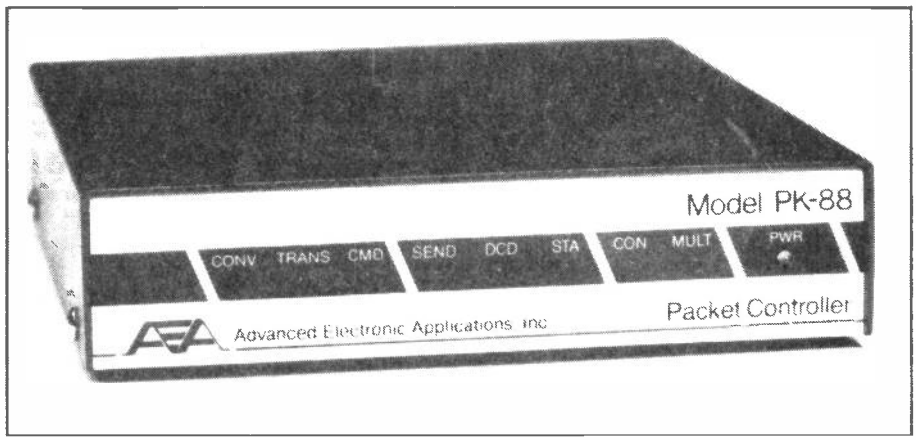
son, a 'Frame Check Sequence' (FCS for short) is sent and the destination station uses this to calculate whether the message was received correctly or not. If not, a request for re-transmission is sent back by the destination station, the TNC only passing information to the terminal when a 100% error free message has been decoded. Remember that your TNC does all this for you; this brief description of what happens is of course very simplified but several volumes of AX25 protocol information are available in print for those interested.

The text from your terminal is arranged into short packets of, say, 40 or 80 characters a time, or of lines of text terminated by your pressing the 'carriage return' bar. These are stored in the TNC, to be transmitted one at a time when the frequency is clear, hence preventing 'collisions' with packets from other stations.

On the front of your TNC are several LED indicators, amongst these are TX, DCD, STA and CON. TX simply indicates that your transmitter is being automatically keyed. DCD stands for 'Data Carrier Detect', i.e. your TNC is detecting other packet transmissions. STA indicates that your TNC is awaiting an automatic confirmation from the destination station that your transmitted packets have all been received correctly. CON is lit when you are 'Connected' to another station, two-way communication then taking place between just you and the station you are connected to. With most TNCs you can, if you wish, 'connect' to several stations simultaneously.

Getting Started

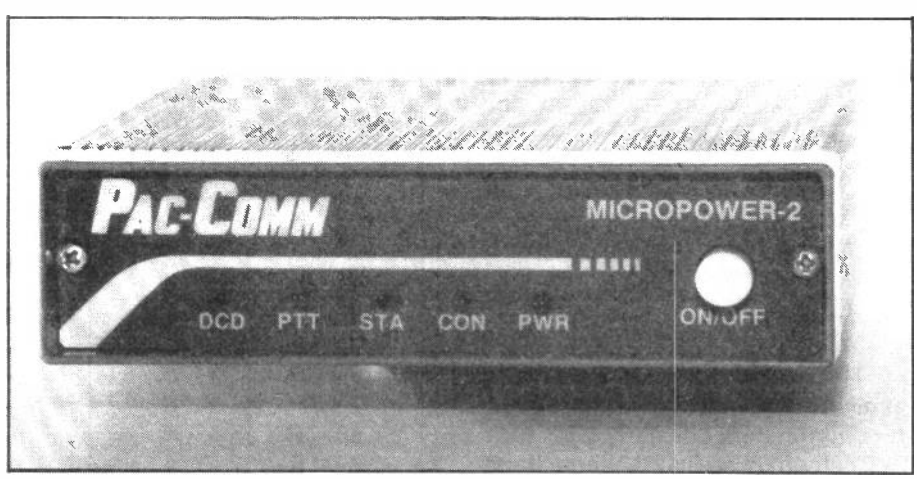
First, ensure you have a 2m FM rig capable of operation on 144.650MHz. HF operation commonly takes place a few kHz above 14.100MHz with LSB mode being selected on your transceiver. If you intend buying a simple crystal-controlled rig to use on VHF FM then I would advise fitting crystals for 144.675MHz as well for local one-to-one QSOs at busy times, to get away from the often congested main frequency. Your choice of terminal or computer is almost limitless, make sure that it has a facility for external communication such as RS232 port (this may sometimes be fitted as an optional extra) or a TTL output connector suitable for the TNC of your choice. If you intend using a computer, then it may be wise to ensure that you also have access to a suitable 'dumb terminal' program or other software to enable communication with its RS232 or TTL port *before* you part with your cash to buy one. You'll find that if you use a popular computer such as the BBC or a PC clone that you'll have no problem. Then, track down your TNC.



Above: the AE PK-88

Because of the popularity of packet, you'll rarely see a secondhand TNC advertised that's still for sale when you hear about it! There are the odd one or two though, I would advise that you purchase a 'TNC-2' clone rather than the earlier and very much rarer 'TNC-1 versions. As the price of new TNCs is dropping fairly quickly, you may find little difference in cost between new and secondhand. At the time of writing, there are a couple of basic VHF models available at just over £100, such as the Pac-Comm 'Tiny-2' reviewed last month, or the AEA PK-88 pictured here. Both of these TNCs have a TTL port (eg. for use with some Commodore computers) as well as an RS232 port, the PK-88 also having a 'Mini-Mailbox', a facility to store messages to you received at your station in your absence but with the radio and TNC powered up.

If you'd like the facility to connect your HF radio to then the Pac-Comm TNC-2200 or Kantronics KPC-2 should do the job nicely, the latter having a few extra facilities such as an internal 'KP-Node' to allow better digipeating by other stations using your set-up as a 'hop', WEFAX (Weather-Fax) reception capability with suitable computer software, and again a personal 'Mini-Mailbox'. Both of those TNCs are currently priced at around £150 and the KPC-2 was reviewed in the *March 88* copy of *HRT*. If you have a PC clone computer and would like the easy life, then the Pac-Comm PC-110 single port and PC-120 dual port 'plug in' TNC boards are available that literally plug inside the computer, however these do not offer a price advantage over external TNCs. For the amateur who'd like the 'works', such as AMTOR, RTTY, CW,



Above: the Pac-Comm Micropower-2

WEFAX and the like as well at Packet, then the Kantronics KAM and the AEA K232 are available at around the £270 mark. The KAM was also reviewed in the *March 88* issue of *HRT*.

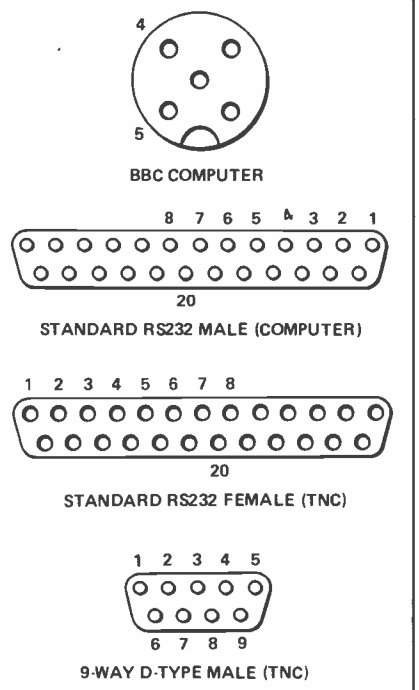
Wiring Up

Many suppliers are able to sell you ready-made leads to connect between your TNC and computer, however you can save money by getting your soldering iron out of course and follow the example shown here. You will in any case need to wire up a suitable mic plug to match with your transceiver. **Table 1** shows the required connections to link most popular TNCs to various RS232 connections, **Fig. 4** showing the pin connections used on the various plugs. Also given in Table 1 are the various functions of each connection pin, for many purposes though you will only need three wires, these being the Receive Data (RXD), Transmit Data (TXD) and Ground (FG). Some computer programs however may require the Request to Send (RTS) and Clear to Send (CTS) connected to ensure a correct flow of data. If you eventually aspire to running a fully-fledged computer mailbox (as opposed to those internal to the TNC then you may need the Data Carrier Detect (DCD) line connected also, depending upon the program used, this line going 'high' when in a 'connected' state.

Depending upon your chosen TNC's TX audio and PTT connections, these need to be wired up to your transmitter's mic plug, a TNC lead unterminated at the TX end is sometimes supplied. The receive audio may simply be taken from the external speaker connection, a suitable lead often being provided for this purpose. Some TNCs have the added facility of a 'squelch' line input, connect this if you have a suitable line available from your transceiver going 'low' on a busy signal, some 2m FM rigs for instance have this internally linkable to be available on the mic plug.

Baud Rates

The next thing to do is to make sure your terminal or computer is set to communicate correctly with your TNC. When using RS232 serial data, the 'ones' and 'zeros' are sent back and forth at a given number of bits per second, called the 'Baud Rate'. Don't confuse this with the *radio* baud rate, this is normally fixed at 1200 baud for VHF, 300 baud for HF, by the TNC itself, this having nothing to do with the terminal baud rate. Run your computer terminal program, or consult your terminal handbook, and set it up to match the 'default' value as shown in your TNC handbook. This would normally be something like 7 or 8 data bits, 1 stop bit, even or no parity, and a baud rate of 1200, 2400, or 4800. The baud rate is often linkable on the rear panel of TNCs such as the Tiny-2, with a default of 1200. With some TNCs, such as those from Kantronics, an 'auto-baud' run is initiated when first switching the TNC on, here the TNC electronically matches its baud rate to your terminal, in this case initially set your terminal to anything suitable such as 1200 or 4800 baud.



Note: All connections shown from SOLDER side

Fig. 4. RS232 Connection Pins

Connecting Up

By now you'll be itching to try it out for the first time, so connect the leads up, apply the required power, and switch on. If all goes well, you should see an initial 'sign-on' message on your terminal screen, like;

Pac-Comm Packet Radio Systems
Tiny-2
AX.25 Level 2 Version 2.0
Release 1.2.5 08/28/87
Checksum $3A
cmd;

or alternatively if you're running a TNC with an auto baud routine, such as Kantronics types, you'll see lines of symbols followed by 'PRESS * TO SET BAUD RATE' or similar at which stage you quickly do as instructed. You will then get an initial 'sign-on' message with an invitation to type in your callsign, which you do.

In case you don't see anything, check your electrical connections between TNC and computer, make sure you have in fact enabled the computer RS232 ouput as required and that the baud rate matches that of your TNC. If your terminal requires

Table 1 — RS-232 CONNECTIONS

COMPUTER			TO TNC	
Standard 25 Way D Male Skt	IBM AT 9 Way d Male Skt	BBC RS423 5 Pin DIN Female Skt	Tiny-2 9 Way D Male Skt	TNC-220/KAM /PK232 25 Way D Female Skt
1 FGH	Shell	1	5	1
2 TXD	3	3	3	2
3 RXD	2	4	2	3
4 RTS	7	5	7	4
5 CTS	8	2	8	5
6 DSR	6	—	6	6
7 SG	5	—	nc	7
8 DCD	4	—	1	8
22 DTR	4	—	nc	20

RTS/CTS 'handshaking' then initially link pins 4 and 5 together on the terminal's RS232 connector and try again, if still nothing then connect pins 6, 8 and 20 together to check if your terminal requires the DSR (Data Set Ready), DCD (Data Carrier Detect) and DTR (Data Terminal Ready) lines to be active. Sometimes the standard of data 'transmitter' and 'receiver' are ambiguous in connections, with RS232 male connectors being required at both ends, in this case try reversing the connections to pins 2 and 3 at one end of the lead to act as a 'crossover'.

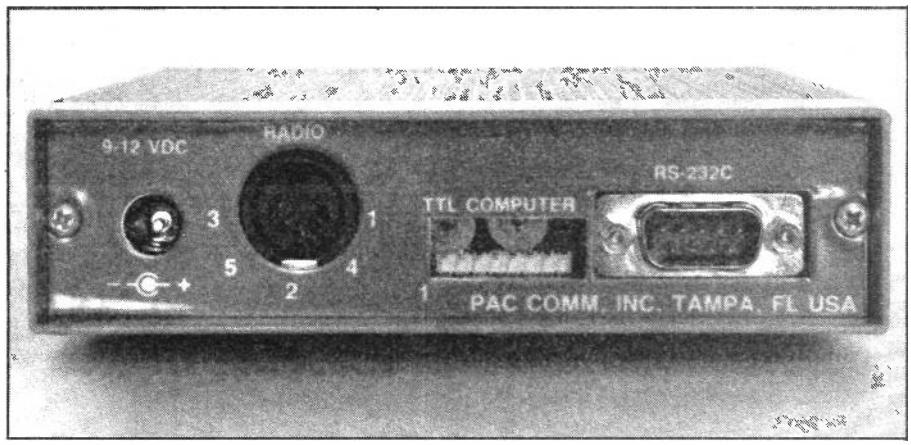
By now you should hopefully be in business, and the first thing to do is to enter your callsign if this has not already been automatically requested by the TNC. To do this, you type; MYCALL G7XYZ or whatever, followed by a carriage return <CR>. To check this has been stored, just type MYCALL followed by a <CR> and you should see the magic phrase 'MYCALL G7XYZ' appear followed by a 'cmd;' prompt on the next line. If you start seeing two of everything you type, then type in; ECHO OFF <CR> or if you see nothing, try typing ECHO ON <CR>.

On The Air

Turn on your 2m radio and tune to 144.650MHz on FM, and with a bit of luck your radio should be receiving packet transmissions flying back and forth on the air. At this stage ensure your squelch is set correctly at the threshold point, that your transmit auto-toneburst is off, and your repeater shift is also off. On your terminal keyboard type MONITOR ON <CR> and slowly adjust your volume control until the DCD LED on your TNC lights in sympathy with received packets. Your VDU should now start to display the magical text messages that previously were just strange sounding 'brrrp brrrp' noises. Note that some short packets may be 'supervisory' messages generated by TNCs for requests for re-transmission and the like, these are sometimes not displayed unless you enter MRESP ON <CR> on your keyboard, ie. to monitor response packets. Also remember that your are monitoring individual packets, these being sections of communication which may be broken up into stages.

Now is the time to go through the command list in your TNC handbook to adjust the TNC parameters to your liking, most handbooks are excellent in their instructions even if very poor in telling you how to actually communicate! Many commands also have an optional 'shortened' form, such as CONV for CONVERSE, M for MONITOR and so on. In this series I will use the full command for clarity, as you become experienced you will no doubt become used to operating in TNC 'shorthand'. Note that different TNCs vary slightly in their actual command messages between manufacturers. As a starter though, I would suggest setting the calendar/clock with the correct day and date, followed by the command DAYUSA OFF <CR> to present this in European format. Then enter BKONDEL (Break On Delete) OFF <CR> to ease your 'delete' or 'backspace' entries when you mis-type, and BEACON EVERY 0 to prevent random transmissions at this stage.

Other settings such as SCREENLEN allow you to enter the desired screen length in terms of character numbers to suit your display, and HEADERLIN to place the callsigns of monitored packets one line above the text to allow more comfortable monitoring. Some TNCs store these settings for you with a battery-backed memory, others such as the KPC-2 require you to enter PERM <CR> to store these into memory for recall when switching on again.

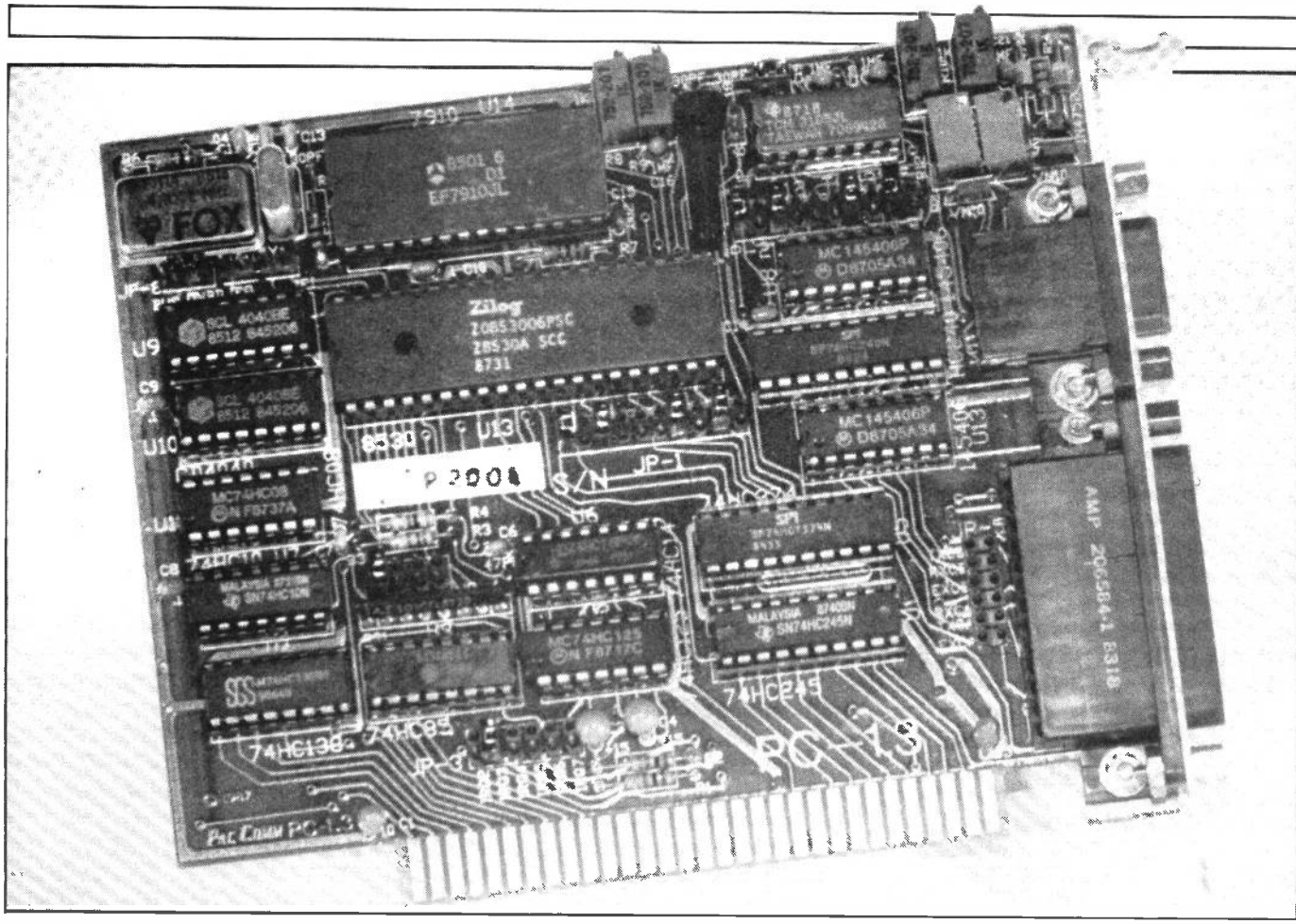


Above: the RS-232C

Don't Panic

If all this sounds complicated, then don't worry! All TNCs have 'default' setting which are set for you, you only 'fine-tune' it to your requirements as and when you wish. One thing however that may require setting for your transceiver is the TXDELAY. This is, again, often set at a reasonable 'default' time delay, this being a short 'lead in' time to allow your transmitter to key up and start generating power, together with allowing time for the receiving station's squelch to open, following the PTT command generated by your TNC. This is measured in increments of 10mS each, I would suggest set-

Above: the Pac-Comm Tiny-2



Above: the Pac-Comm pcb

ting this to TXDELAY 35 <CR> (ie. 350mS) as an initial measure, following a few QSOs you can then experiment to see which is the shortest time delay you can use consistent with reliable communication.

Now, find a station to 'connect' to. You may see 'beacon' messages floating about or 'ID' messages such as 'GB3NP Netrom Node', 'GB3PX TheNet' and so on. Choose one which is reasonably strong, then type 'CONNECT G7XYZ VIA G3ABC <CR>' where G7XYZ is *your* callsign, and G3ABC is the callsign of the *monitored* station. If you can get a friend to help you, either another packet operator 'on air' or an experienced visiting operator, all the better. After a short while, your TNCs TX LED should light and your transmitter key up. If not, check your mic connector wiring. If your DCD light is permanently lit, your TX will not key, make sure you have set your squelch correctly in this case.

If all goes well, your CON LED will light and your VDU will display *** CONNECTED TO G7XYZ, you will in fact have 'connected' to yourself using the other station as a 'digipeater'. Your TNC will now have automatically changed to 'Converse' mode rather than 'Command' mode, and the 'cmd;' prompt at the left of the screen will no longer be given. Anything you type now, followed by a <CR>, will be digipeated back to you in short packets.

When you have finished, return to Command mode by pressing your 'Control' key and 'C' at the same time, then at the 'cmd;' prompt type DISCONNECT. You should shortly see *** DISCONNECTED on your screen and you will again be monitoring other activity. If something is amiss, such as your transmitter not giving out sufficient audio or indeed too much, or the other station not acknowledging your existence, your TX LED will briefly light several times followed by 'Retry Count Exceeded *** DISCONNECTED' being displayed. In this case, check your transmitter deviation level if possible by comparing its audio against other packet transmissions. It is often possible to vary the TNC mic output level by potentiometer adjustment or a link or resistor change, depending upon the manufacturer, this is certainly worth testing.

Assuming everything goes OK though, now is a good time to test the TXDELAY setting, by digipeating back to yourself and shortening the time interval as appropriate. If your transmitter ends up continually sending packets following a single <CR> without your STA LED extinguishing a short time later, you'll know the TXDELAY is either too short or the link has otherwise failed. To change between 'Command' mode and 'Converse' mode enter Control-C and CONVERSE <CR> respectively, note that any text for transmission must be made in 'Converse' mode, 'Command' mode allowing you to vary the TXDELAY or other TNC parameters without transmitting what you type in.

Communicating

By now you may be quite good at talking to yourself on Packet, and you may want to broaden your horizons a little. I would first suggest a period of monitoring, to see what is about. If you enter the command MRPT <CR> you will see displayed any intermediate digipeaters used in a received sig-

nal, for example G1LOK>G4HCL, G0BMS indicates that the received packet was sent by G1LOK to G4HCL VIA G0BMS as a digipeater.

One thing you may also notice is the use of what are termed 'SSIDs', these being Secondary Station Identifiers such as G4HLC-2. G4HLC-8 and so on. These allow a single station callsign to be used for different purposes, for instance as a mailbox, digipeater and so on. For example, if I am in my shack you can connect to me if in range by the use of CONNECT G4HLC <CR>. However if I don't reply or I'm not in, you can DISCONNECT and then CONNECT to G4HLC-2, which is the callsign of my personal 'Mini-Mailbox' to leave a message asking if I'll be at the next club meeting so that you can buy me a pint. *(Talk about pushing your luck! — Ed).*

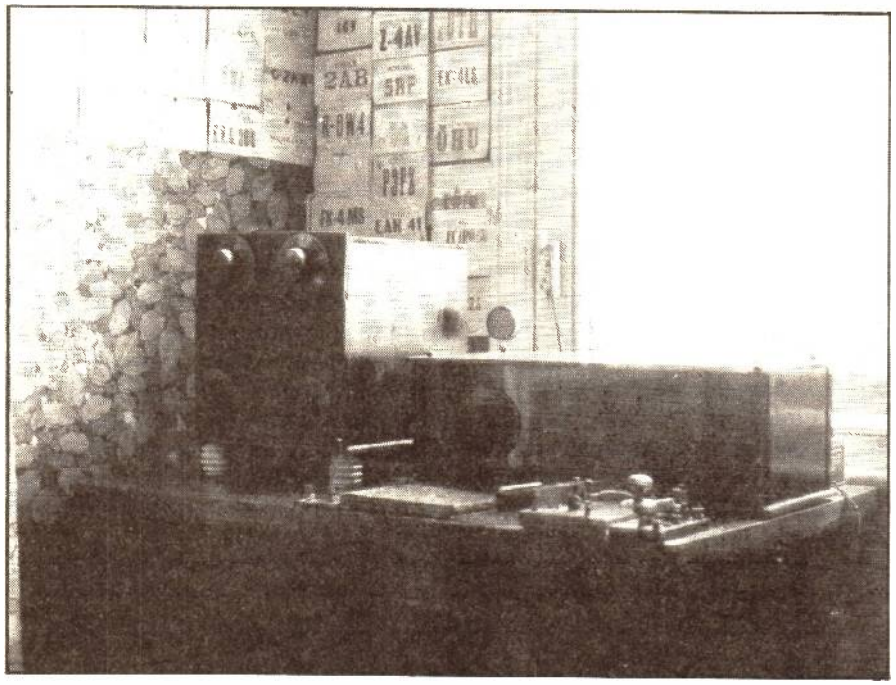
There are various 'Node' stations which add SSIDs to the callsigns of forwarded packets for reasons to be described later on (it won't all fit in this issue!), and occasionally you will see G4HLC>GB3PX as one packet, followed by the same message content but with G4HLC-15>GB3NP as a source and distination. To use these 'Nodes' (G4HLC-8 is one for instance) for higher throughput 'digipeating', you initially CONNECT to the Node, then once connected you type, still in 'Converse' mode, CONNECT G4ABC or whatever callsign you wish to connect onto as the next 'hop'.

If you are in range of one of the national trunking mailboxes, which together with Nodes, Digipeaters and Beacons we will talk about in detail later, you may see interesting lists of messages being displayed. You may even care to try connecting to one of these, via any intermediate digipeater callsign if appropriate, and join the ranks of Electronic Mail operators: Almost universally simple 'user-friendly' instruction 'Menus' are presented to help you use many of their facilities successfully. As a starter when connected to one, try typing H <CR> for help, or LL10 <CR> to get a listing of the last ten messages. DO NOT simply type L <CR> on your first try or you will request on on-air listing of EVERY stored message since day 1, which could take all night as well as making you rather unpopular!

In QSO with other amateurs, it is common practice to keep your overs short, often to one or two lines, and remember you can 'interject' with messages while the other station is still typing, useful if you've just been called for dinner! It is standard practice to end an 'over' with the > symbol to say 'you go ahead now', you will see this on mailboxes also when they are ready for you to issue a command. When issuing commands to a mailbox incidentally, do not use the > yourself, just the command followed by a <CR>.

In your first steps remember also, you *never* need to type anything twice, because Packet is error correcting, what you type will get there or you will get * * * DISCONNECTED, nothing is otherwise lost. All good stuff eh! Next month I will elaborate on the intricacies of mailbox operation, such as how to send messages to be automatically forwarded anywhere or everywhere in the country, even to your packet operator friend in Sweden or Australia.

ONE MAN'S RSGB



Station G5UM in 1929, the year when its owner joined RSGB. At left the 2-valve transmitter for 160 metres, crystal controlled on one frequency. At right the 3-valve receiver (oscillating detector and two audio stages working into headphones). Output — a few watts — was recorded on a hot-wire ammeter. The knife switch on the wall is aerial changeover. All operation was on cw using the home-built sideswiper key at the right. Power was from HT batteries and a rechargeable 6 volt accumulator: everything was gas mains in North London at that time.

Jack Hum, G5UM, takes an affectionate look-back over some of the national society's 75 years now being celebrated.

Whenever an institution or organisation of repute reaches a significant point in its life (such as its centenary or half-century or whatever) there is a temptation to track back through time and compile a calendar or list of its achievements. All very worthwhile if you want a reminder of what happened and when, but making for tedious reading if you don't. "Institution of repute. . .": the Radio Society of Great Britain: "significant point," the 75th anniversary of its founding way back in 1913. What follows is an attempt to shine a human face towards a very large slice of the amateur radio history of these islands in which the RSGB has been inextricably involved. Every ham who has lived through any of that history will have his or her own reminiscences to impart and no doubt some of them would make good reading in *HRT*.

Other reminiscences will go back farther and those which follow do just this. For it was 59 years ago that your G5UM joined the national society and he hopes (if he is spared) to celebrate his sixtieth in 1989. He being barely three at the time does not of course recall the Society's founding — few who are still alive can — but he does recall how, when the British amateur radio movement was a very small one, the RSGB did battle on its behalf with very few funds behind it, and won concessions from On High which the individual ham of the Twenties could never have won on his own.

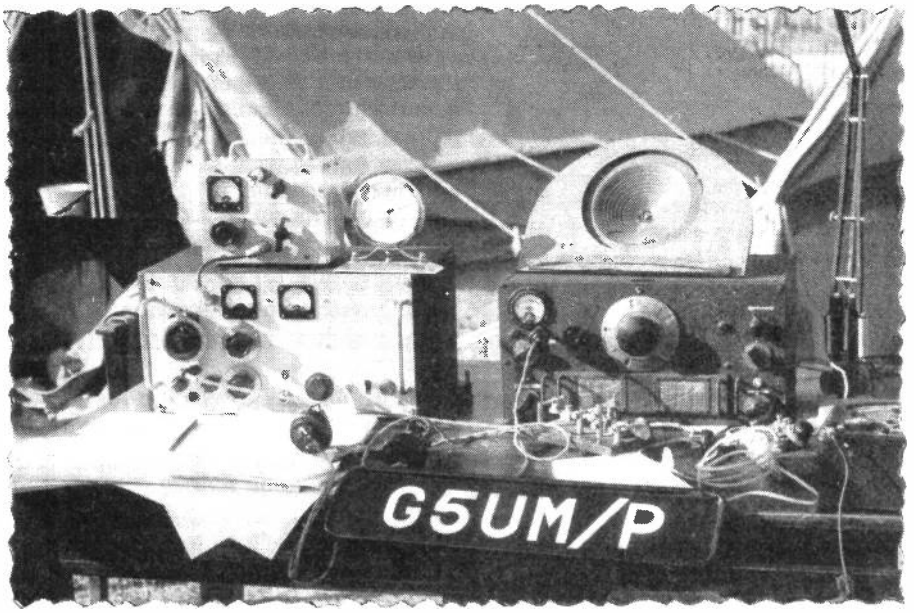
After the RSGB metamorphosed from the Wireless Society of London it was granted a pitifully short time in which to spread its wings: the start of the 1914 war saw to that. The resumption afterwards was a slow business, not helped by the attitude of the defence organisations, ever wary of what they saw as upstart young men wishing to do their own thing untrammelled by "the exigencies of the Service" and the possibility that one or some of them might clobber BYA, Admiralty, Whitehall, with their spark transmissions.

Yes, spark: but with the launching of the BBC in 1922 came the fear that heavy interference from amateur spark stations might cause havoc to those rudimentary broadcast programmes on today's medium wave (they used carbon mikes!). When the post-War licence was eventually drafted, with a few discreet prods from RSGB, that memorable phrase "The use of spark is specifically forbidden" was written into it.

T & R Section

To adopt the name of *Radio Society of Great Britain* was a bold move at a time when everyone else said *wireless* and the word *radio* was regarded as an upstart Americanism. Most of Britain's ham clubs of the Twenties were wireless societies, rarely radio clubs.

Most of these societies were populated by enthusiasts for anythig



National Field Day, 1955: this station of the Mid Herts Group was entirely valve powered. A sample of the legendary HRO receiver will be recognised at the right.

to do with wireless, for the most part the reception thereof. There was great competition, encouraged by the now long defunct popular magazines of the day, in the field of station-getting. "I heard from Rome last night . . ." or POZ Nauen or wherever. To do any transmitting themselves was farthest from their thoughts.

Many of the more scientifically minded of these enthusiasts joined the RSGB. Practically all who aspired to transmit, or already held transmitting licences (We few, we happy few) did so. Before long it was clear that RSGB would become predominantly a transmitting operator's organisation. To cater for him a 'Transmitter and Relay' section was established. Not that anyone did any relaying or was even allowed to attempt it: but eyes had been cast USA-wards to see how ham radio was conducted there, where a highly organised system for passing third-party traffic by amateur radio was in being. Relay facilities in the UK? 'Not on your life' said the Licensing Authority.

Before long the T & R Section represented the tail wagging the dog, and the Twenties were not far advanced before it became recognised that 'RSGB' was synonymous with 'transmitting amateur'. For years the Society's journal was known as *The T & R Bulletin*, much later as *The RSGB Bulletin*, to evolve in due time to its present title of *Radio Communication*.

Hard Times

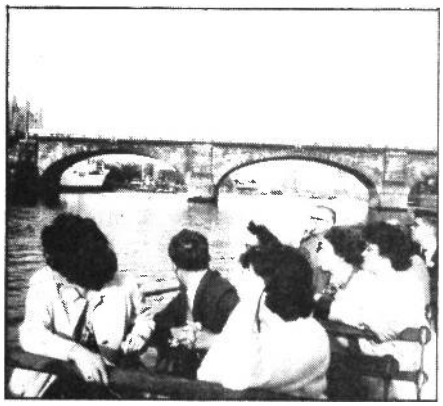
When G5UM joined the RSGB in 1929 he had been on the air for almost two years. Why did he not join before! There was a simple answer: he couldn't afford even the modest subscription then asked. Already he had had to extract from a sceptical parent in 1927 the needful thirty shillings with which to pay the licence fee. As for a sub for RSGB: "You'd better pay for that out of your wage".

This was not easy when the Great Depression (the economic one) was enveloping the more advanced nations of the world, and wage rates were so low that an individual was glad to earn anything at all at a time when millions could'nt.

No wonder it was difficult for many intending members of RSGB to amass the needful 21 shillings when there were calls on his meagre pay packet for such essentials as valves for his transmitter and receiver (both home built) and wire for the long HF aerials of the day, not to forget the poles on which to support them. And those high voltage power packs sucked further funds from the weekly collateral.

In these circumstances G5UM was pleased to be allowed a surreptitious look at the *T & R Bulletin* which came to the home of his close and much older friend, the late G6FI. Happily, by 1929 the younger of the two was able to pay his own sub and get his own *T & R Bulletin*.

The late Doug Findlay, DFC (G3BZG), both as RSGB President and later its General Manager, was much in demand at social occasions. The one shown here is the Tenth Anniversary Dinner in 1956 of the Mid Herts RSGB Group. At right: G2CN and wife Kathleen. At left: Grace, Mrs G5UM.



Twenty-five years before the 1988 RSGB celebrations came the 1963 Golden Jubilee Week in July. One of its many attractions included a river trip on the Thames ending at Hampton Court, where members of the Thames Valley Amateur Transmitting Society formed a reception committee.

By contrast with its American counterpart, *QST*, with its massive advertising content and 24,000 circulation, *The Bulletin* was a modest publication catering for less than a tenth of those numbers. Nor could it draw upon the highly developed research facilities which ARRL members enjoyed. Small wonder, then, that many of the practical developments in amateur radio equipment came from 'the other side'.

Permanent Secretary

Those hard times threw up an unexpected bonus for RSGB. They gave the Society the opportunity to engage a permanent paid secretary at a time when all RSGB jobs were 'love jobs' and there were no paids. The honorary secretary, for example, was the late John Clarricoats, G6CL, who, affected by those same hard times, became available at just the right moment to be appointed its first paid secretary at the end of 1932. Truly, this was an instance of the right man at the crucial time. G6CL was endowed with formidable organisational powers vested in a thrusting personality plus a phenomenal memory which, quite unaided, could recall the name, callsign and QTH of almost every member at a time when there were increasing numbers of them.

These attributes occasionally caused personality clashes. There was a memorable occasion when a member hearing G6CL announce himself as "G6 City London" from the quiet North London suburb where he dwelt addressed a call to him as "G6 Cork Lino"! The occasional brushes apart, few were in any doubt about the asset RSGB had won in securing G6CL. Not only did he possess the attributes described, but having served as honorary secretary for some years, he had developed a valuable insight into what made the RSGB tick. His impact became steadily more evident as the Thirties continued on their troubled way. He gave advice to the Navy when the need arose to form a Royal Naval Wireless Auxiliary Reserve composed of proficient CW operators, either amateur or ex-Service. The RNWAR suffered from the presence of the dreaded word WAR in its title, a bit of a disincentive when World War One was vivid in the memories of many who needed to cast their minds back only 15 years to recall it. Added to this, there was a widespread peace movement, understandably strong in the UK, and indeed elsewhere.

Within half a dozen years the *zeitgeist* had changed completely as the prospect of another war loomed. This meant that when an RAF Civilian Wireless Reserve was proposed in 1938 it attracted large numbers of British hams into its ranks. Among them was the present writer, who for a while held a second callsign, MQJ!

In his capacity as hon secretary of the new VHF Committee G5UM was in at the start of many projects that later came to fruition. One of them was the granting in 1956 of the 70MHz band (RSGB persuaded Authority that there was a vacant slot there, and couldn't the British have it to compensate for the loss of Five?), and rather later, the launch in 1972 of the very first 2 metre repeater, the first of the many which have transformed operations on the metre-waves. Another of his duties was to contribute the monthly metrewave column to the RSGB Bulletin at a time when so much was going on that it was never difficult to fill half a dozen pages, thanks to the members who helped keep the feature topical by their contributions.

Then one evening in the late Fifties after an arduous Council meeting G5UM felt highly flattered when the late G3BZG, then President of RSGB and later its General Manager, suggested that this OM should offer himself as President. The answer was: "No, I had better not. I know my limitations. And I've seen what a fraught and time-consuming office it can be when I'm already fraught and time-consumed by my job in publishing . . . RSGB has

National Field Day, 155 again (stations must be operated from tents): G5UM ponds the key while BRS John Owen does the logging.

10,000 members and I don't feel I could do them justice."

That is the end of that, came the thought, but no: half a dozen years later G5UM was informed much to his surprise that he was to be created a Life Vice-President of the Society. At the Society's AGM at the end of 1974 he was handed his Vice-President's badge (he didn't quite know why: probably for services to VHF). At the same time the late G2AOX was created a Vice-President for services to amateur space communication, as was the late G4KD in recognition of the work he had done to establish and expand the annual RSGB exhibition. These three awards were by the unanimous vote of the 1974 Council.

Come On In!

A near six decades of RSGB membership then, which initially saw the Society as a humble body with a humble membership of around a thousand. Now its membership has grown forty-fold. It could have been sixty-fold if everyone who is in The Callbook came on in. Many, it is known, retain their licences but not their radio-activity; but enough are still out there who take for granted the concessions won by the Society plus new bands (just think of 50MHz for one) yet cannot bring themselves to contribute towards a national society which enjoys a lot of clout in high places and applies it (discreetly, of course) to the betterment of British ham radio everywhere.

What has been said, you might think, represents the close of the G5UM involvement in RSGB operations. It hasn't quite worked out that way. In 1966 he took over from G3GMY the office of VHF Awards Manager, and now, 22 years later, he has been making noises to suggest that someone younger should do the job.

Clarricoats on behalf of the RSGB played a valuable behind-the-scenes role in bringing the CWR to practical fruition, though its life was to be shortened by the inevitability of September 3, 1939.

Could RSGB survive in such a situation? Many of us wondered. We need not have worried, for G6CL, now running the Society from his home in North London, saw to it that every member, wherever he might be

When VHF National Field Day was instituted, much pioneer work was done on 23cm. Two of its protagonists, G8ACE and G3LIA, are fourth and sixth from left in this group. The dish bears the callsign of G3LIA. The time: September, 1965.

serving, should regularly receive his *Bulletin* and in one way or another be kept up to date with what was happening on the Home Front, even though paper was rationed and mails restricted. Nearly always, in G5UM's experience, *The Bull* did get through.

The Great Resumption

Eventually — and thankfully — peace broke out and with it the hope of a resumption of amateur transmitting facilities. As may be guessed, overpowering Service requirements asserted that frequencies could not be immediately released. But they were, the prods from RSGB skilfully applied by G6CL saw to that. To quote one instance: Bomber Command made out that they needed one of the two megs of the 2 metre band. They were quickly persuaded that they didn't; soon the full 2MHz

A rare picture of the late G6CL (centre) taken when he visited an NFD site in 1950. To his left (drinking tea) is another well known North London ham, G5DJ.

spectrum of Two became available, as did the HF bands in increasing number.

Sadly, there was one band whose surrender was inevitable: Five. The post-war allocation of 58.5 to 60MHz gave the VHF enthusiast the opportunity to build equipment that would function much more effectively than anything he could build for Two for the simple season that valves worked better at the lower frequency. Yes, everything went by valves forty years ago. The short life of Five was terminated when the spectre of television loomed o'er the land. Britain's second television station near Birmingham gobbled it up.

In 1952 your G5UM — much to his surprise and trepidation — was elected to the RSGB's governing body, its Council. So was a clutch of other hams keen to see the Society take more interest in the very highs. Among the initiatives they fostered were a VHF Convention, a VHF Committee, and a VHF National Field Day to complement the HF NFD which had been born in 1933.

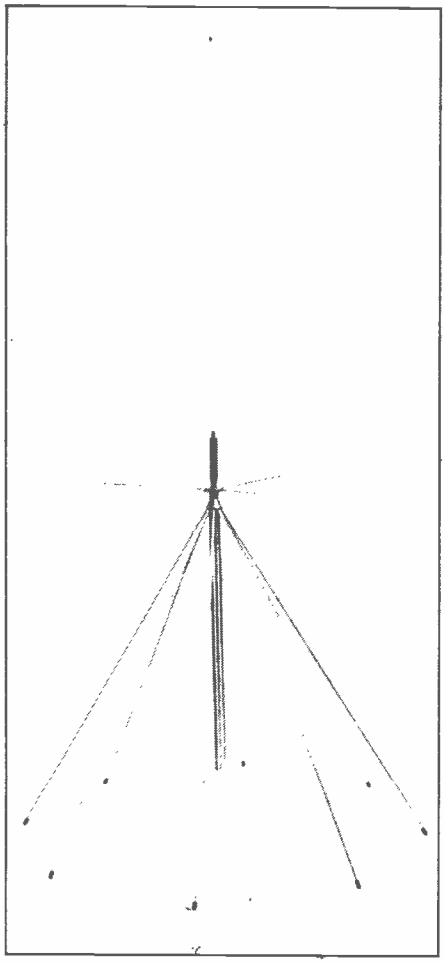
He remains a corresponding member of the VHF Committee and attempts to offer it random thoughts on relevant matters, even though some of these are a little dated since the time the Committee was formed three decades before. And no wonder: he remains a valve man, and although he has succumbed like almost everybody to the Japanese onslaught, he can still show a few valve transmitters to those visitors to his shack who are either interested in them or who have ever heard of such things!

Finally, finally, G5UM recalls with pleasure two events which, though not directly connected with RSGB matters had lots of RSGB members present.

One of these events was his fifty years licensed. He took his local Village Hall to accommodate all who wanted to be there. Ten years later he was amazed to find he had reached his Sixtieth, with 58 of those years in RSGB membership with never a regret. The event was placed on record by the issuing of a newsletter sent to all who might be interested to tell them that 1987 was indeed a momentous year, for it was the year when G5UM was able to celebrate sixty years wedded to amateur radio and forty years wedded to Grace!

Royal 1300 Discone

Discones have been around for a long time, yet only in the past few years have they won popularity amongst the radio-aware public for their wideband, omnidirectional properties. One can often spot the proud receive-everything scanner owner nowadays by the 'sputnik' like aerial adorning his chimney, but lately amateurs have also found them very useful indeed. It can often be very difficult to put up more than one vertically polarised, omnidirectional radiator when you only have one pole available, as colinears and the like exhibit rather strange radiation patterns when stood off from the side of the mast.



Chris Lorek gives us his review on the new Royal 1300 Discone.

Discones Galore

There are now many discones on the market, most of these are advertised as being suitable for receive use only, ie you risk blowing up your transmitter PA due to the high VSWR (Voltage Standing Wave Ratio) presented. However two virtually identical Japanese made discones are currently sold in the UK for wideband transmit and receive use, and the latest offering to come on the market appears to be almost an 'English Copy' of these, being manufactured by Hembro International in the Midlands. Offering a receive coverage of 25-1300MHz with transmit capability of 200W, it could be a useful 'do everything' addition to one's station. The *HRT* review team went into action . . .

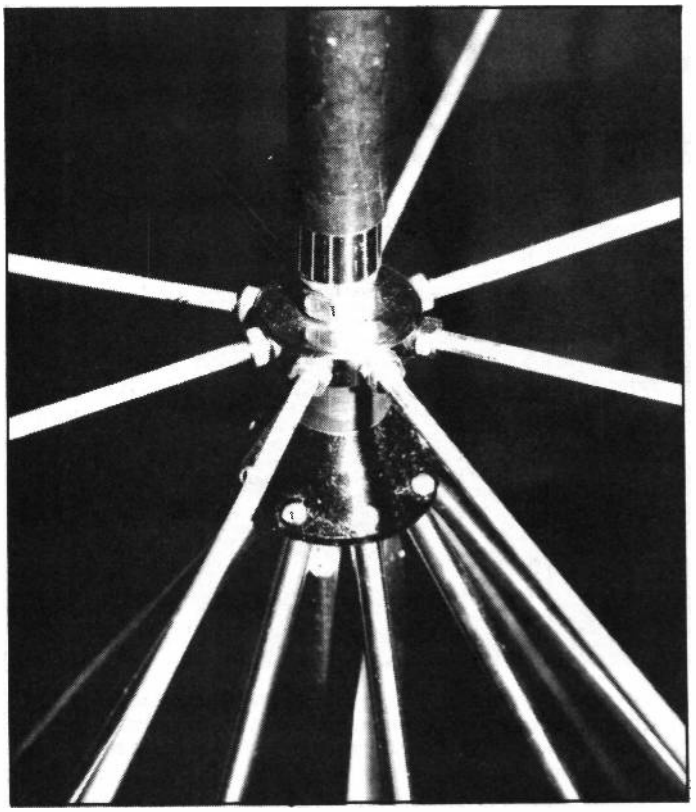
Construction

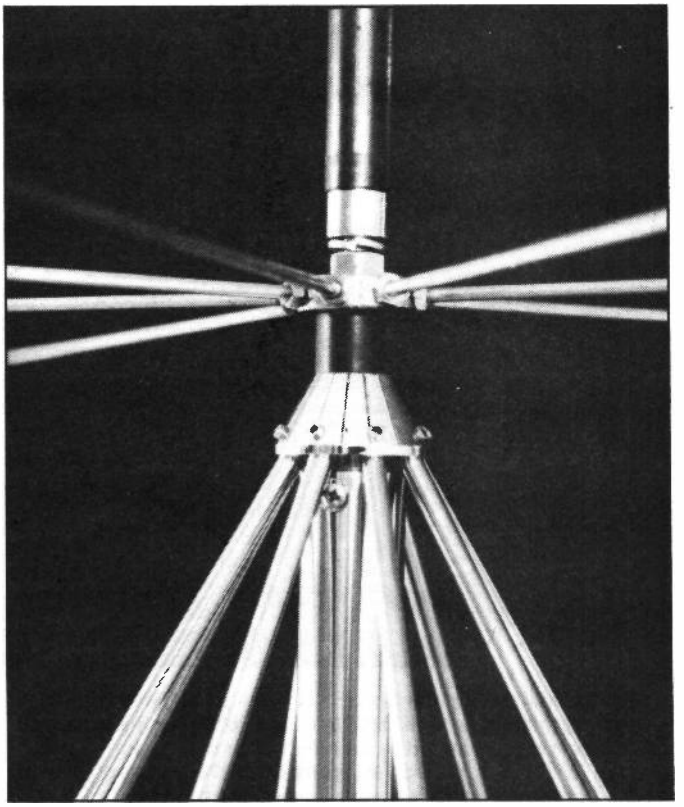
The aerial is constructed of eight 'disc' and eight 'cone' elements, together with a base-loaded whip connected to the 'cone' centre extending the LF coverage, all elements being made of stainless steel. A plated brass centre piece is used with threaded holes incorporated for element fixing, an N-type socket being integrally fitted to support the structure, the discone being 1.7m in total length when assembled. A pair of alloy mast clamps are supplied allowing you to mount the assembly to a main mast of 25-52mm diameter, and to complete the package a 15m length of RG213 coax together with two silver-plated Greenpar N-Type plugs are provided. To aid assembly, an instruction sheet is proficed together with the required Allen key for grub screw fixing.

In Use

Putting the discone together took me around twenty minutes out in the garden, the end result being (in my opinion) a very smart looking aerial, whilst no doubt making the neighbours think *'Oh, no, not another one!'* The disc elements were threaded at their ends and these were screwed into the machined centre and secured by small locknuts, the cone elements (the drooping ones) being secured by small grub screws. The top whip section fitted onto a central threaded bush, a spring locking washer being supplied here, however this appeared to be plated steel hence I left this off for fear of subsequent corrosion. Following an exercise with the N-type plugs and soldering iron, the completed assembly was fitted to a 4m long pole and the air tests began.

Comparing the Royal 1300 with the 50-500MHz discone I normally use showed no appreciable difference on the 4m, 2m, and 70cm amateur bands in terms of received performance, coupling a wideband scanner however showed the Royal 1300 to be significantly better around the 10m band and also a few dB better around the 935MHz area, possibly due to the better quality coax used as supplied with the aerial. As all UK amateurs on 6m (50MHz) and 23cm (1296MHz) currently use horizontal polarization, through licence requirements on 6m and historical reasons on 23cm, the discone was of limited use on these bands. A small MRZ Alford slot used on 23cm for instance yielded significantly better signals from my semi-local 23cm repeater. With the growing number of mobile and portable



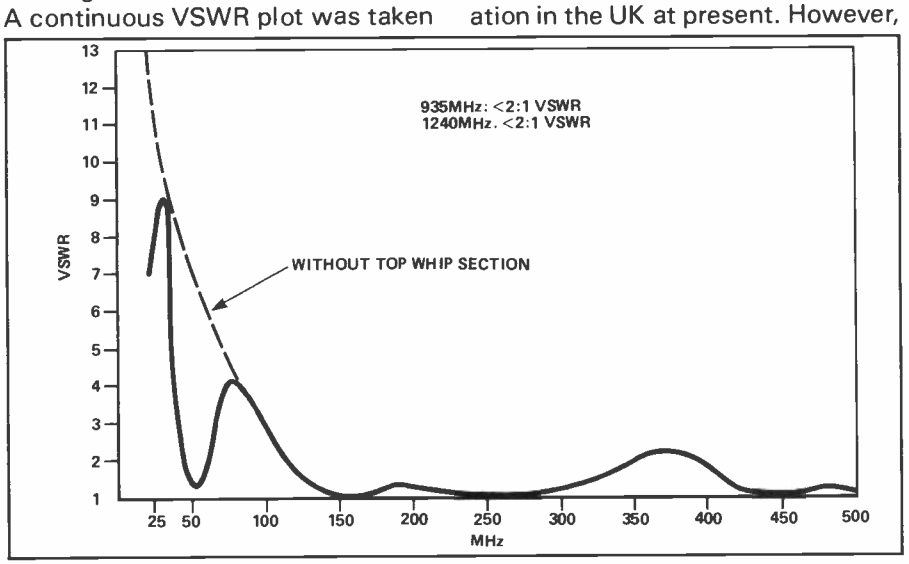


stations on 23cm, this however may change if common sense prevails.

Standing Waves

Out came the laboratory test equipment, and seeing it was a nice sunny day, your reviewer decided to confuse the neighbours even more by taking the test gear out into the garden again, meters, indicators and displays galore. There is a valid reason for this of course, to ensure coax effects and other surrounding aerials do not affect the results and had nothing to do with the nice weather! A continuous VSWR plot was taken of the aerial between 25 and 500MHz, the results being shown graphically, the further tests using transmitting equipment at 935MHz and 1240-1300MHz were performed. The top whip section was then removed to examine the effect, this being shown on the graph by the dotted line.

It can be seen that the discone is quite suitable as a transmitting aerial on 2m and 70cm, and on 23cm with vertical polarisation. The low VSWR at 50MHz shows the top whip section is doing its stuff, but here we are not allowed to use vertical polarization in the UK at present. However, although not tested, this shows that if the top section were replaced by a 10m base loaded whip, a good match may possibly be achieved here at the expense of 50MHz. I am informed by the suppliers that this indeed is the case, and a suitable replacement coil will be available as an optional extra.



Conclusions

The Royal 1300 discone is a useful do-everything compromise where vertical polarization is required over a wide frequency range, as such it would be ideal for scanner receiver owners, and as a local natter aerial for 2m and 70cm FM simplex and repeater operation. Having a theoretical gain roughly equivalent to that of a dipole, it cannot compete with individual colinear aerials for each band, however, it has the advantage of requiring only one mounting point and a single feeder run. It appears to offer good value for money, particularly if one considers the added cost of the supplied coax and connectors. Being constructed almost entirely of non-corrosive hardware, it should be capable of staying bright, shiny, and offering good performance for several years.

My thanks go to Raycom Ltd for the supply of the review sample.

The TS 140S from Kenwood
A bargain at £10,000?

What would you say if I announced that the TS-140S would in future cost anything between £10,000 and £75,000? This apparently odd question was prompted by a reader's letter in Radcom (page 483 June 1988) which related the picture of the 1924 station of 2NM on the front cover of the February issue, to the picture of an IC-781 shown inside the same issue, and implied that this relationship illustrates the reason for the decline in the hobby of amateur radio. (Go on, read the letter.)

The notion that somehow current amateur equipment is expensive, complex, and out of reach of the amateur is often heard, but on this occasion I decided to do a little research based on the comments of the letter writer to see if there really was some truth in this idea.

I first did a detailed costing of the items visible in the photograph of 2NM, using 1924 component catalogues and magazine advertisements. My final estimate came to something around £100, and did not include any items which may have been in the station, but not visible. I then obtained a figure for the average annual salary of a skilled worker in manufacturing industry in 1924 ("Wages and Salaries in the UK 1920-38", Agatha Chapman, Cambridge University Press, 1953) and this turned out to be £129. In other words, the station of 2NM cost almost a full year's salary for the average man. Even the IC-781 costs a lot less than today's average salary, and rigs such as the TS-140S seem almost a bargain.

Having a 1924 callbook, I was able to check the address of 2NM and researched newspapers of the period (British Library, Colindale), in order to ascertain the probable cost of his house. This was almost certainly in the order of £250. I then checked the current value of the same house with Caterham estate agents, and their estimate was about £300,000. Even allowing for the ludicrous inflation of property prices in Surrey, it does mean that 2NM's station cost him almost half as much as his house — would you like to pay half the cost of your house today for your station?

One obvious conclusion of my little quest is that in 1924 amateur radio was definitely a pastime of the better off individual, and was enjoyed by a relatively small number of people — not the 50,000 licensees we have today. As far as the relative cost is concerned, the TS-140S which is the subject of this advertisement is actually not expensive, and if you take into account the sheer technical performance of the transceiver, there can be little doubt that amateur radio equipment offers remarkable value for money compared to that used by 2NM.

On the subject of equipment complexity, I wouldn't mind betting that it took a great deal more skill and effort to operate 2NM than it takes to use a TS-140S, so I don't believe the argument is valid. In any case, the equipment used in a station can be viewed as a tool to further the operator's skill and enjoyment. You don't necessarily have to build a motor car to enjoy driving or be an expert driver.

The final observation I would make is that we all occasionally make statements based more on intuition than fact; I am for example quite convinced that every summer during my childhood consisted of nothing but sunny days, and that ice cream doesn't taste a bit like the ice cream we ate then, but when the facts are determined the truth may well not support one's opinion. I'm simply glad that I don't have to commit a year's salary to buy my amateur radio station, and will come on 80 metres using my TS-140S with a lighter heart. . . .

Caveat scriptor (et lector).

John Wilson G3PCY/5N2AAC

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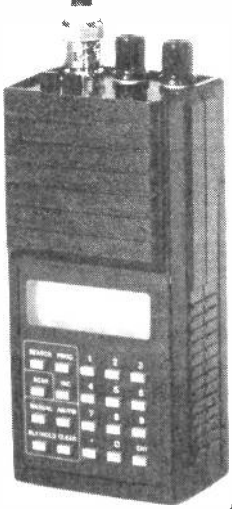
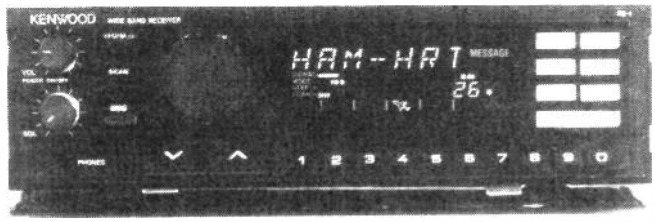


In the realms of hand held scanners, it would be hard to beat the new AR800E. This compact package (only 60 x 50 x 135mm) contains an AM/FM scanning monitor covering the frequency ranges 75-105, 118-174, 406-495, and that most requested band 830-950 MHz. Channel spacing can be programmed from the keyboard for 5, 10, 12.5, and 25 kHz according to band, so all frequencies are correctly selected. AM and FM modes are available, and there are 20 memory channels to store the most used frequencies. You can also tell the set to search automatically between frequency limits set by the user, and transfer any frequency of interest directly into an unused memory. To cap all this performance, the AR800E comes complete with rechargeable batteries and mains charger, and at an attractive price.

AR800E . . . . . £199 inc. VAT. Car. extra.

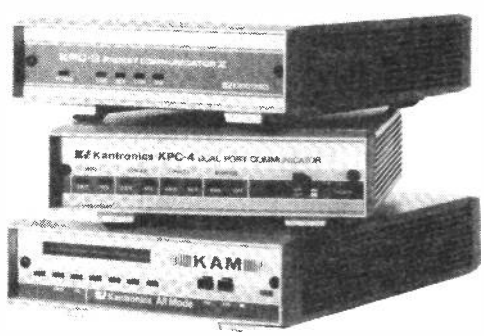


The radio to end all radios. The new RZ-1 from Kenwood may look like a high quality in-car wireless, but in fact is a mobile monitoring receiver covering 500kHz to over 900MHz, Modes available are AM, FM (communications), FM (broadcast and TV), and channel spacings are included to meet all requirements. Consider the fact that with this one package you can listen to almost everything, from Medium wave broadcast, Short wave stations, high quality FM and TV broadcasts, all communications channels including VHF and UHF airband, right up beyond 900 MHz. (Although the spec says 905 MHz, all RZ-1 receivers supplied by us have the upper frequency extended to 950 MHz at no charge.) The excellence doesn't end there; the display can be programmed by you to show a readout of the station title eg "Radio 2" or "Lond. Twr.", in any of the 100 (yes, 100) memory channels. Kenwood engineering quality and ease of use are combined to make the RZ-1 a must.

RZ-1 . . . . . £465 inc. VAT. Carr. extra.

As you may guess, we stock, sell, and take care of almost everything connected with the hobby of listening, from Long wave to UHF. If you need any advice or assistance, we are here to help, and information is available at all times on any of our product range. In addition to the "Listener's Guide", we also publish the "Airband Guide", so if you send us £1 for postage, and ask for both these guides, we will be happy to send them off. Happy listening.

KANTRONICS



Packet radio is one of the fastest expanding areas in Amateur Radio. Access is available to national and international data, messages may be left on "mailboxes", and of course you may conduct a QSO just like RTTY or AMTOR.

KPC2 £159 inc. VAT. (Carr £18)
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P.S. WEFAX means you can receive those wonderful Met forecast pictures off-air.
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This and That

We cannot advertise everything we sell, because it would take the whole of this magazine to do it, which at £500 a page is a bit expensive. Instead, we send out reams of information every day, covering almost anything connected with radio. To send an interesting pack of reading, all we ask is a contribution towards postage costs, so if you clip the coupon on this page and send it to us with your £1, we will fire back all the info you want. Mention any special interests or particular rigs, and we will feature them in the pack.
We don't only lurk in Matlock; we have branches in many major cities and we try to keep all that we sell at every branch. Just ring for the address of your nearest Lowe shop, or see the front of our product list for details. In the absence of a branch, we also supply approved dealers who are of proven reputation and integrity. There are others who, for our own good reasons we prefer to avoid. So should you if you thing about it, because anyone who cuts a price, and hence his operating margin, can only be cutting his service and backup. There isn't anywhere else the cut can be made. We prefer to maintain our standard of service rather than "Forty quid off, John" and no backup. The choice, of course, is yours.

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Radio Propagation and The Sun Part 3

In part 2, we examined the *Solar Wind*, how it was generated and then followed its journey into the upper atmosphere of the Earth. the solar wind ebbs and flows away from the sun, given added impetus by events such as quiescent and active prominences, and solar flares. I've used the general name of 'charged particles' to cover emissions from these events, but this covers a multitude of radiations. The particular kind of radiation we will be concerned with here is ultra violet (**Fig. 1**).

This month Kevin Fox G4MDQ continues his long walk in the sun . . .

We looked at aurorae and their effect on VHF propagation and finally, I left you to listen to the solar wind. In this part of the series we'll examine the effect the solar wind has on the F1, F2, E and D layers of the ionosphere, and how they can be boosted or retarded by ultra violet radiation from the sun.

Ionisation

This is a word that's going to keep on cropping up all over the place so I'll define it straight away. Patrick Moore in *The Astronomy Encyclopedia* defines ionisation as:—

The name given to any process by which normally electrically neutral atoms or molecules are converted into ions by the removal or addition of one or more electrons. This gives them a positive or negative electrical charge. An ion can itself by ionised, such as by losing or gaining a second electron (double ionisation).

No wiser? Have a look at **Fig. 2a** where we have a perfectly happy atom, its two electrons peacefully orbiting around the two nuclei. However; in **Fig. 2b** a rampaging photon of ultra violet light bangs into the atom with such force that it rips off an electron, leaving only one. The atom has become ionised.

Not unnaturally, the atom strongly resents having an electron amputated! It will try every trick in the book to regain its missing particle? and when the ultra violet has weakened or is no longer present, the atom will grab the nearest electron (any one will do) and return itself to its previous state of blissful peace as in **Fig. 2c.** This is called *recombination* and it will become important later.

It doesn't have to be ultra violet light, any particles with sufficient energy to strip electrons can ionise. Although for years, ultra violet was considered to be the only radiation ionising earth's atmosphere, new research indicates that this is not necessarily so. There is evidence that more energetic particles, such as X and gamma rays also assist in the ionisation process. This then is a simplification of the ionospheric ionisation process. It's happening all the time, right above our heads, and can be both useful and a nuisance. Sometimes both at the same time!

Ionospheric Ionisation

Ultra violet radiation arriving at the earth and carried here by the solar wind, hits the atmosphere and begins the ionisation process. First — the more rarefied gases at the top of the atmosphere are ionised relatively easily. Then the ultra violet penetrates deeper into the atmosphere, encountering a greater density of gas the lower it goes. Ionisation increases (because there's more gas to ionise) but at the same time this constant collision with the atoms of the atmosphere is robbing the ultra violet of energy.

Eventually the ultra violet is completely exhausted and has no more power to ionise. Therefore, the ionisation process stops, leaving a thinly ionised region above and below the area of intensely ionised atmosphere. Ultra violet radiation from the sun varies in frequency, and the gasses in the earth's atmosphere also respond and ionise at different frequencies, hence the coloured light in an aurora. The net effect of this is ionisation of the atmosphere taking place at different heights above the surface. These zones of ionisation are named the F, E and D layers.

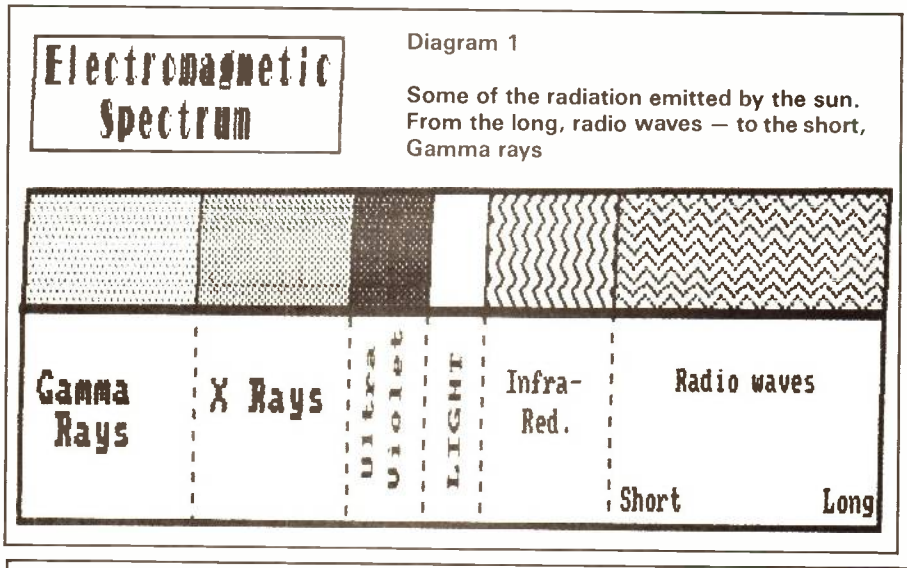
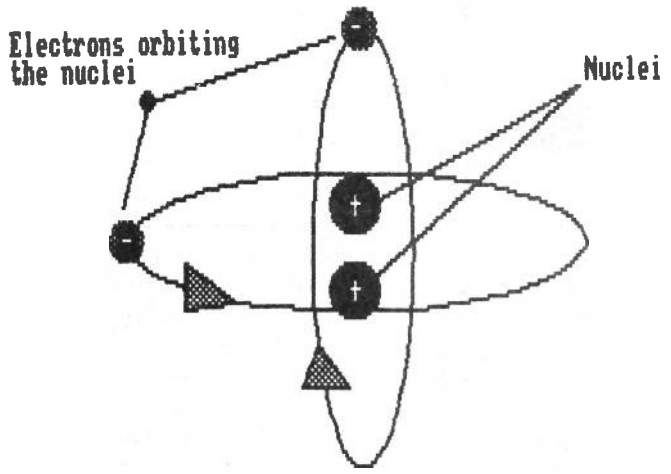
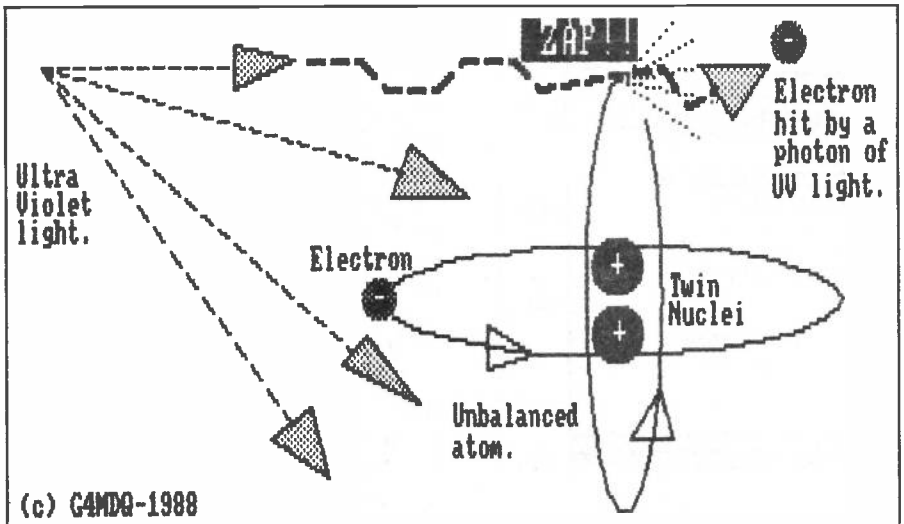


Diagram 1

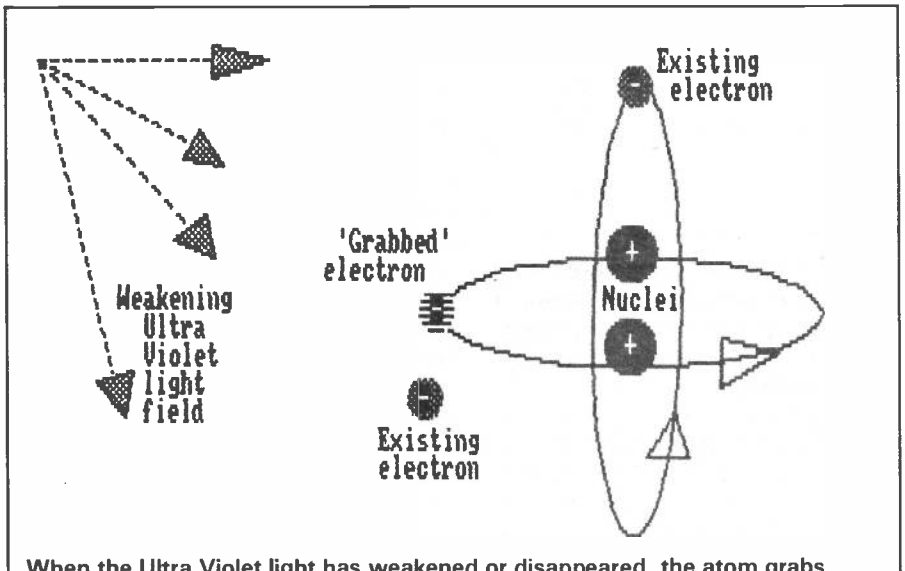
Some of the radiation emitted by the sun. From the long, radio waves — to the short, Gamma rays



The atom is at rest. Two electrons are orbiting the twin nuclei, therefore the atom has no effect on aything. It is in equilibrium.



In the presence of Ultra Violet light one of the electrons is hit, and removed from the atom, causing ionisation.



When the Ultra Violet light has weakened or disappeared, the atom grabs the nearest electron to return itself to equilibrium.

So how come patches of ionisd gas in the sky can actually manage to bounce a radio signal back to Earth? Imagine a huge net in the sky. The holes (mesh) in the net are a fixed size — this is our ionospheric reflecting layer of gas. Now we need a ball which will be our radio signal (see **Fig. 4a**). If the size of the mesh is twelve inces wide, and our ball has a circumference slightly greater than twelve inches, and we throw the ball at the net, it will hit and bounce back off.

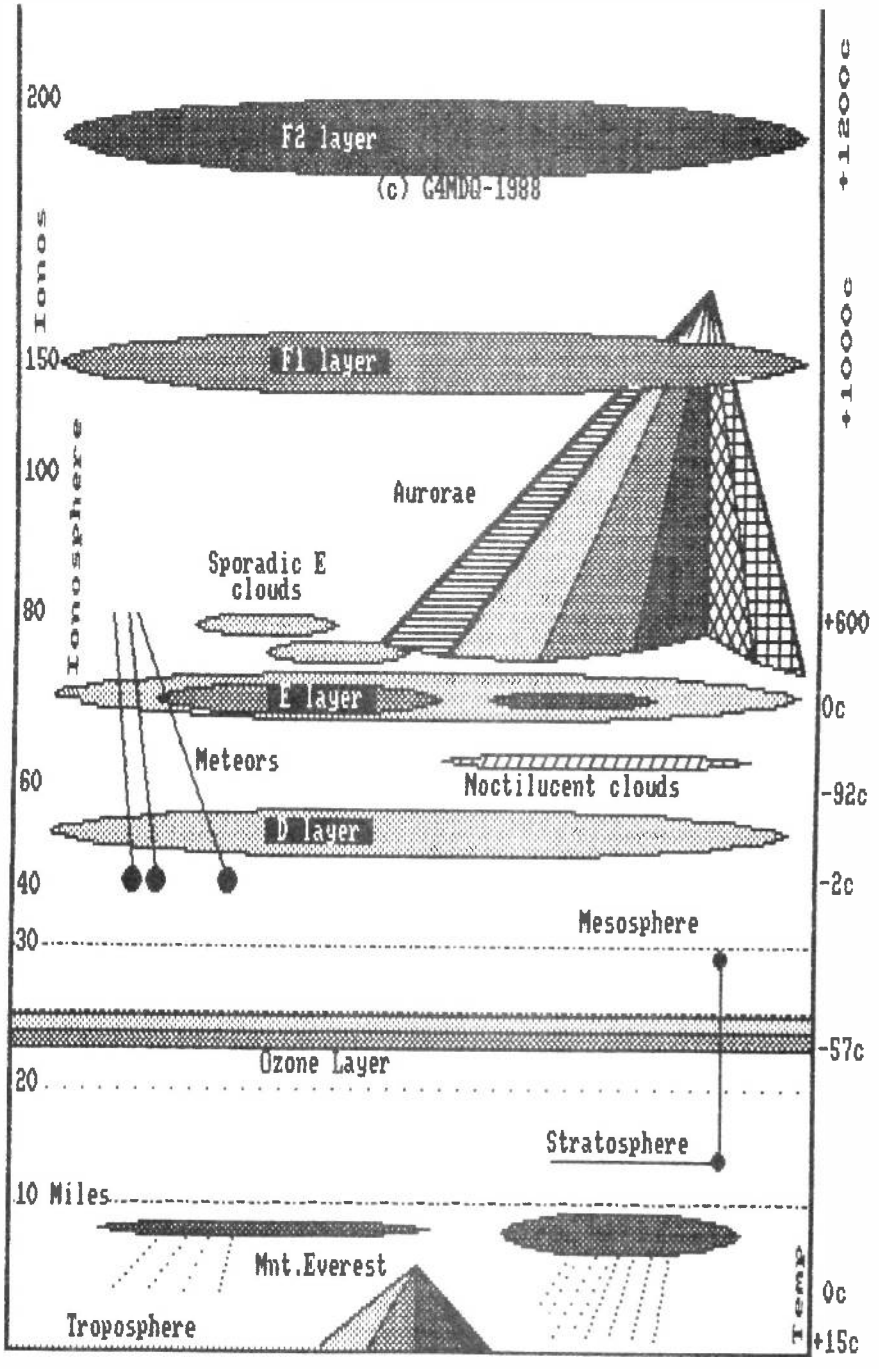
Also if we throw the ball at a steep angle to the net, then the distance from the throwing point to the point where the rebound occurs will be quite small. Throwing the ball at the net with a wider angly will increase the distance from the throwing point to the rebound point. If the circumfrence of the ball is *less* than twelve inches, then the ball will pass through the net and will be lost to us as in **Fig. 4b**. Again, if the ball is much bigger than twelve inches, it will lose a lot of its energy when it strikes the net.

Putting this back into technical terms; our net represents the ionospheric layers as in **Fig. 4c**. The size of the holes in the net are constantly varying, getting wider and then narrower. They are generally 'wide' in times of low solar activity, and 'narrow' towards higher solar activity. So our ball, which represents a radio signal, is like the frequency chosen. Low frequencies — large ball; high frequencies — small ball. Amateurs should always aim to use the highest possible frequency to work DX; but, if the 'hole' in the ionospheric layer are 'large' and the frequency selected is high — (small ball), then your signal will pass through without reflection. In other words, you've exceeded the Maximum Usable Frequency.

The angle with which the radio signal hits the ionospheric layer depends on the chosen frequency and the angle of radiation of the aerial in use. Low angle radiation and a high frequency is the equivalent of throwing the ball at the net with a wide angle, increasing the distance between the 'throw' and the 'rebound' points. The analogy isn't exact, but it's near enough for practical purposes.

Ionospheric Layers

Fig. 3 illustrates the ionospheric layers and from this diagram you



The ionospheric layers

might be forgiven for thinking that the layers start and stop with surgical precision. However, this isn't really the case as boundaries between layers are gradual, with one layer gently merging into the next.

Starting at the bottom, the *Troposphere* contains most of the earth's water, either as invisible (to the eye, but not RF) water vapour, or as clouds. The air in the Troposphere is in a continuous state of motion, causing the phenomenon we call weather.

It's also in this area that the condition amateurs call *Tropo* occurs. 'Tropo', or a 'lift' happens in the Troposphere because these conditions depend on weather patterns.

Interestingly, two thirds of the earth's atmosphere is contained below the height of Mount Everest! A fact brought dramatically home during the 1968 Olympics in Mexico City, whose height above sea level is only eight thousand metres, where the athletes were dropping like flies due to oxygen deficiency!

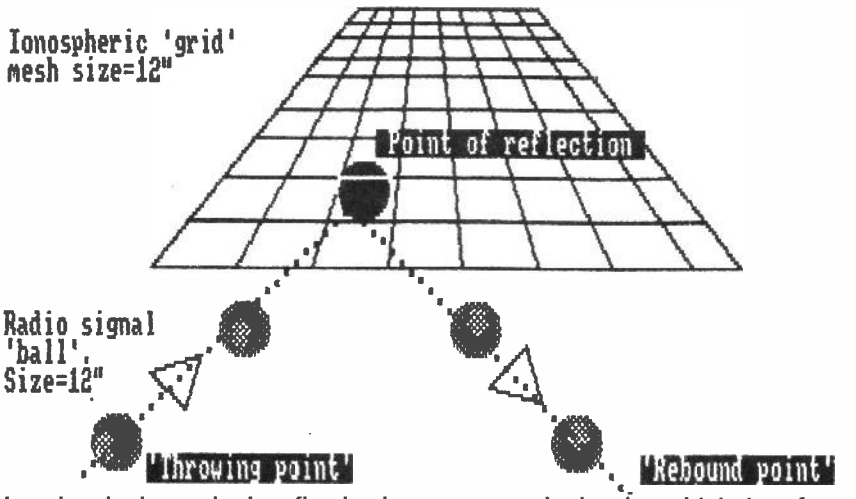
In Tropo conditions, warm air rises and becomes trapped between layers of cool, dense air (see **Fig. 5**). This produces a kind of 'tube' which becomes capable of refracting (note the word) VHF type signals. You can demonstrate refraction quite easily by putting a straw into a glass full of water, the apparent bend of the straw as it enters the water is caused by the light reflecting from the straw passing through a denser medium, eg. water. VHF signals normally zoom through the Troposphere and out into space. If they meet a temperature inversion, the signal can be bent (refracted) and returned to earth a good distance away.

In the *Stratosphere*, at a height of fifteen to thirty-five miles, lies the Ozone Layer we've all been hearing so much about recently. The Ozone Layer performs the vital function of filtering out those wavelengths of ultra violet radiation which are injurious to life. There is evidence that Chloro-Fluro-Carbon gases used as propellants in aerosol sprays and as coolant in refrigerators are destroying the ozone in the Ozone Layer, but more research is needed before this can be definitely confirmed.

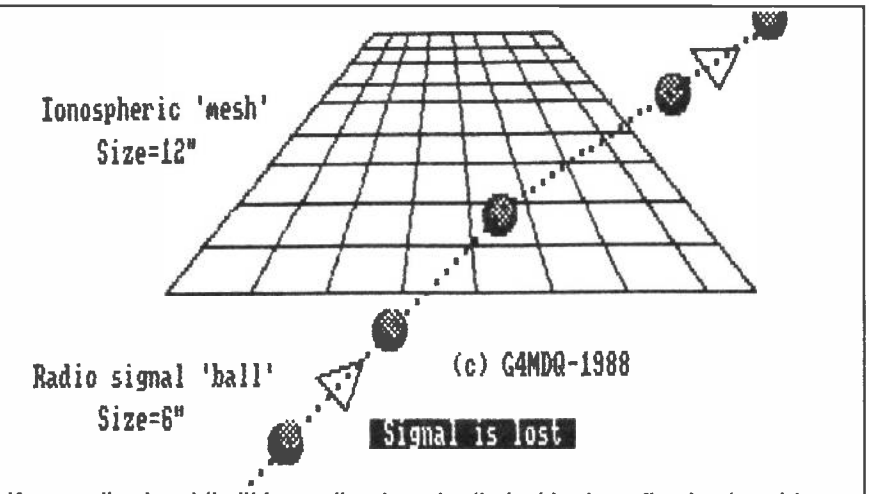
Moving up, we enter the *Ionosphere*. Sir Robert Watson-Watt, one of the inventor of radar chose the name by the way. He was a co-worker alongside Sir Edward Appleton who discovered and named the F, E and D layers. The first 'radio layer' we come to is the D layer.

D Layer

Located at a height of between thirty-five to fifty mies above the surface, less is known about the D zone than any other ionospheric layer. It exists only during the hours of daylight, gradually disappearing as the sun sets and recombination takes place. Signals below 300kHz can be reflected by the D layer, but anything over this is attenuated. Below the D layer the main method of propatation is by means of Ground Wave. Because the D layer is the lowest, it doesn't usually receive much ionisation (the UV runs out of steam), which is just as well because all radio signals passing through the D layer are attenuated. Lowest frequencies are most attenuated, whilst the higher frequencies are least so.

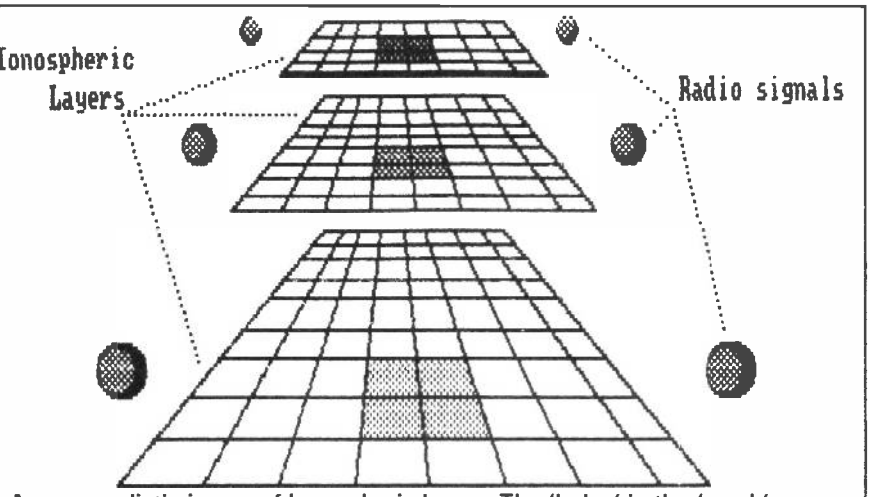


Imagine the Ionospheric reflecting layers as a net in the sky, with holes of 12 inches. A ball of 12 inches circumference (which represents our radio signal) would bounce off the net when thrown at it. If the ball was smaller than the holes in the net, it would pass straight through and on into space (Dia 4 — part B)



If our radio signal 'ball' is smaller than the 'holes' in the reflective 'mesh' — then our signal will pass through the mesh and on into space.

In other words, we have exceeded the Maximum Usable Frequency. We must ensure that our signal ball is the smallest that can be reflected by the mesh.



A more realistic image of Ionospheric layers. The 'holes' in the 'mesh' vary from layer to layer, and within the same layer, from hour to hour. The frequency of our signal is dictated by the size of the 'mesh'.

Short Wave listeners are quite familiar with the performance of the D layer, they know they've not much chance of hearing American East Coast Medium Wave radio stations during the hours of daylight. But when the sun goes down . . .

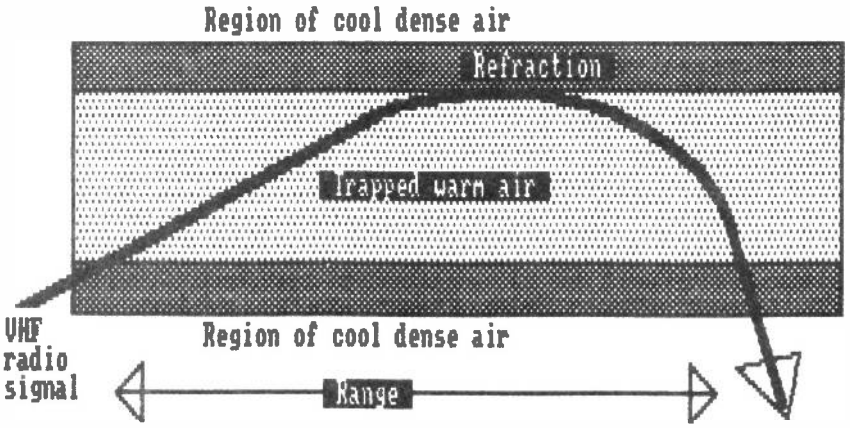
Ionisation of the D layer is very dependant on the position of the sun, and is greatest in the Northern Hemisphere during the summer months, in particular June at around the Summer Solstice (see **Fig. 7**). During the years of sunspot maximum, an interesting phenomenon known as SID can occur. SIDs — or Sudden Ionospheric Disturbances to give them their proper name, occur in the D layer. You'll remember from my description of the ionisation process that the further 'down' the atmosphere the ultra violet travels, the weaker it gets.

In sunspot maximum years thee can be massive upheavels on the sun which increase the amount of UV in the solar wind many thousands of times. When this extra amount of UV hits the earth's atmosphere, it travels deeper and ionises more, so that the D layer receives a massive blast of ionisation. The more ionisation the D layer receives, the more it will attenuate signals until it almost reaches saturation point, where nothing gets through it at all! Dellinger Fade Outs (as they used to be called) are fascinating to hear. The band will be bubbling along, carrying the usual traffic. Then the signals start to fade, but unlike QSB, they keep right on fading until there's nothing at all, anywhere on the band!

This situation can remain for hours during really severe storms, or just for a matter of minutes. The higher frequencies come back first, gradually moving down to the lowest frequencies. Sometimes only the lowest frequencies are wiped out. I've been listening to an SID on forty, then switched to fifteen metres to hear a couple of German stations discussing the SID on forty! These solar storm conditions are also responsible for disrupting magnetic compasses, inducing ground currents and, the only good thing about an SID, fine auroral displays!

E Layer

At a height of around sixty-five miles, the D zone meges into and becomes the E layer. Like the D zone, the E layer is very much a daylight



Warm air trapped between strata of cool air becomes capable of reflecting (bending) radio signals. This has the effect of greatly increasing the range of the refracted radio signal.

phenomenon, with ionisation closely following the path of the sun. In the northern hemisphere, maximum ionisation occurs at solar noon, around the time of the summer solstice, see **Fig. 7**. At night, the layer recombines — imagine a bath tub full of water. Pull the plug and the water drains away from the bottom of the tub, lowering the height of the water at the top.

Ionisation is more difficult in the lower regions of the Earth's atmosphere, and these regions are always the first to recombine. The E layer starts to recombine at the bottom, which both lowers the height of the layer, and also thins it out, juch like our bath tub analogy. In times of low solar activity, virtually all of the E layer recombines but in times of higher solar activity a residual layer can still persist into the night, facilitating radio reflections.

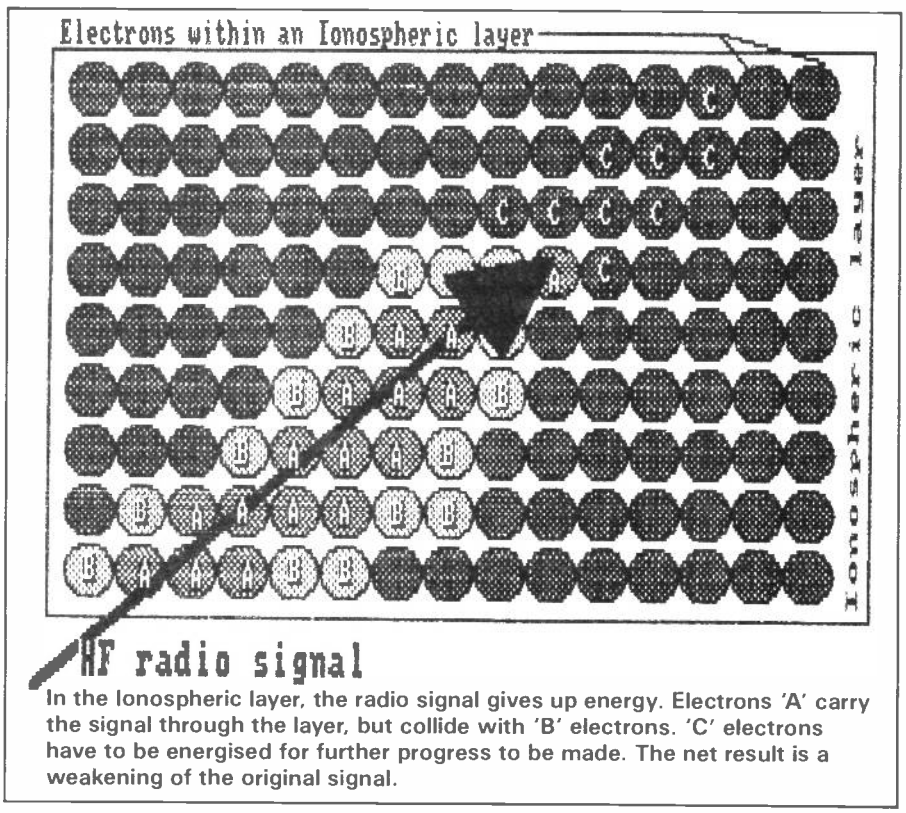
During daylight the E layer reflects signals over a single hop distance of around a thousand miles. Many people believe that the E layer has an attenuating effect, which prevents further hops. Whilst attenuation occurs in all the radio reflecting layers, it is not specifically the reason for single E hops at HF frequencies in the daytime. Frequencies below 4MHz are absorbed by the D layer in daylight, whilst frequencies above this suffer attenuation. Only high angle radiation can pass through the D zone and be reflected by the E layer during the day. Due to the high angle of radiation, D zone absorption and ionospheric attenuation, there's precious little left of a radio signal to make the same journey on a second hop, back up to the E layer.

Sporadic E — (Es)

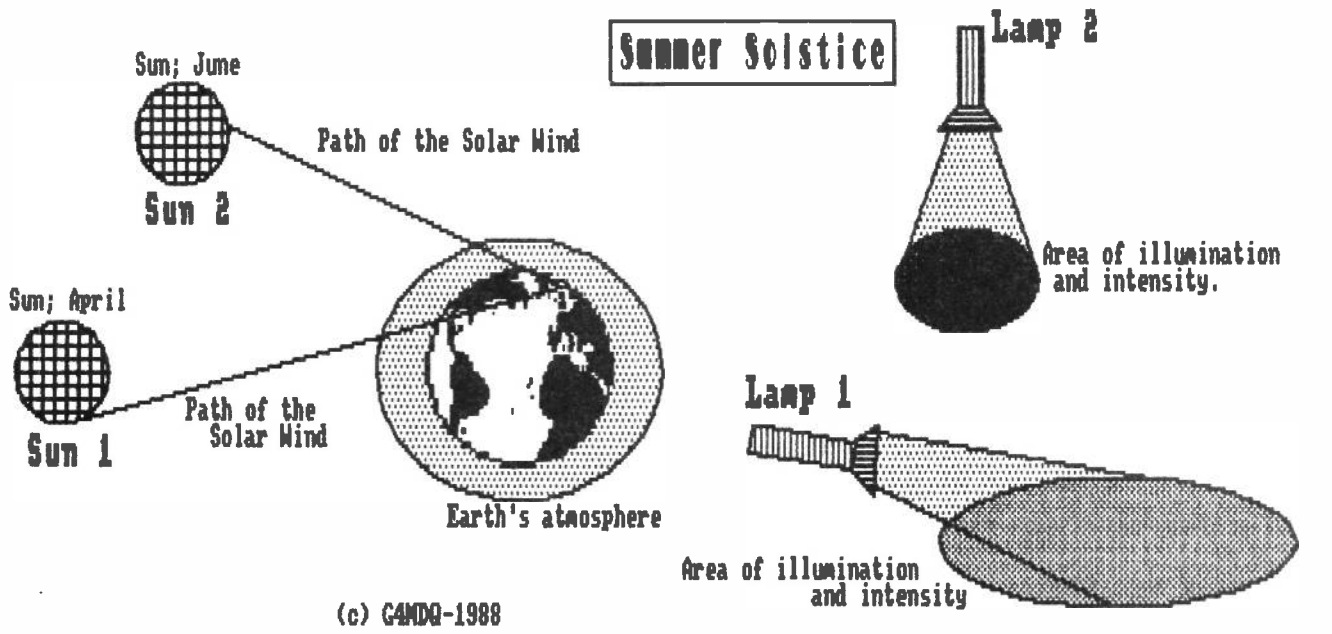
Sporadic E still isn't too well understood. The earth's atmosphere is in a constant state of flux, inflating and contracting as it is ionised by the solar wind. intense ionisation has the effect of swelling out the upper atmosphere, increasing it height. This fact was forgotten by NASA, who were forced to make a 'Controlled Re-entry' of their *Skylab* spacecraft in the seventies because atmospheric drag on the craft was much greater than they had anticipated. This is also the reason why you only get Predictions for Polar Orbiting weather satellites. Their exact position in space isn't known because the upper atmosphere is continually modifying their orbits.

It's only my own pet theory, but I believe that Sporadic E clouds are parts of the E layer which, when expanding under influence of the solar wind, are 'torn off' due to unequal expansion of the layer as a whole. These random 'clouds' of highly ionised material form in sheets around half a mile thick, and between fifty to two hundred miles in diameter. Some wander for many thousands of miles, possibly dragged by high altitude shears, whilst others remain stationary. They can survive for hours or only minutes and are responsible for causing absolute chaos on the VHF bands!

Sporadic E, or Es as they are known are capable of reflecting radio signals into the VHF range, but reflections at upper HF and low VHF — eg. ten, six and four metres, are much more common and longer lasting. There is a dispute over whether they can reflect at UHF frequencies howerver. Single hop reflections are similar to E layer distances, around eight hundred to a thousand miles, but in the peak times



In the Ionospheric layer, the radio signal gives up energy. Electrons 'A' carry the signal through the layer, but collide with 'B' electrons. 'C' electrons have to be energised for further progress to be made. The net result is a weakening of the original signal.



The Summer Solstice
At position 'Sun 1' the sun is crossing the equator on its way into the northern hemisphere of the Earth. Light and the solar wind have to travel through the thickest parts of Earth's atmosphere. Like 'Lamp 1' the area illuminated by

for Es (the summer months) multiple hops can be achieved, reflecting from more that one Es 'cloud', increasing the range to over two thousand miles! I've never been moved to join in the fun during an Es opening. (I Guess I'm really an SWL at heart) but listening to the chaos, and amateurs gabbling their way through a QSO at maximum words per minute to get onto the next piece of DX, provides hours of harmless fun!

Around equatorial regions, Es is essentially a daytime phenomenon, but around Polar regions Es often persist through the night. Charged particles in auroral zones are attracted to the Es clouds, adding further to their ionisation. I believe that now we have six metres our knowledge of Es will improve tremendouslyt. Expect many transatlantic contacts via Es this coming summer on six!

F Layers

At the top of the earth's atmosphere lies the two F layers. F1 being the lower of the two at an average height of one hundred and fifty miles, and F2 at two hundred miles. These are the layers which provide the DX contacts, both by day and by night and as these layers are at the top of the atmosphere, they receive more UV radiation, and for a much longer time than any other of the radio reflecting zones.

Ionisation slowly tapers off during the night, reaching a minimum just before dawn. During the night the two layers merge into one F layer, at a reduced height of about one hundred and seventy-five miles. Due to the thinness of the atmosphere at the F layers (oh, alright then: the electron density!) — recombination is a much slower process as the atoms have much further to hunt for replacement electrons. This enables the F layer to retain some ionisation through the night, albeit reduced from its daylight level.

Come the dawn, the F layers are the first to be UV irradiated, and within a short time the two F layers are reformed and ready for action. There is always some ionisation happening in the F layers, but if this isn't very much, then the maximum frequency which can be reflected by the F layers will be quite low. The more ionisation the layer receives, then the higher the frequency which can be reflected back to earth.

Attenuation

When a radio signal enters the Ionosphere, and particularly when it passes into an ionised Zone such as the D, E or F layers, it gives up energy to the electrons within the area. This sets them in motion which enables them to convey our signal through the zone.

But electrons set in motion by our radio signal, and which vibrate in synchrony with it, are also having problems of their own. They are continually bumping into other electrons not associated or vibrating with our signal, and patches of ionisation. Like a good evangelist, the vibrating electrons will try to persuade non-vibrating electrons to join in the fun! This robs them of energy, which has to be replaced from our radio signal.

If this energy lost by the electrons is not replaced by the radio signal, then any further progress through the zone is stopped. This can happen when the signal has no more energy to give, as when operating in poor condition. Assuming reasonable conditions, the signal re-supplies the depleted energy of the electrons, and can therefore continue its progress through the zone. The net effect is that the reflected radio signal finally leaves the ionospheric layer weaker than when it first entered it, see **Fig. 6**.

The amount of attentuation varies from very little, to complete absorption on the aerial and angle of radiation, the state of ionisation and the selected frequency. Attenuation in the ionosphere (specifically the D layer) varies in inverse proportion to the frequency — the higher the frequency the less the attenuation. This is why you should aim to operate at, or as close to the MUF as possible, because that way your signal suffers the least amount of attenuation.

Uniden 580 XLT Review

What exactly is the 580XLT and what do you get for your money? HRT reports . . .

The early days of scanners were characterised by gruesome affairs which looked more like a cross between a Gavioli fair organ and a piece of kit furniture rather than a functional piece of radio gear. As time went by, both the technology and (thankfully) the designs improved to the point where handy scanners, with their portability and ever increasing frequency coverage, were in the ascendant. Scannerists were no longer tied to large base stations and were able to get out and about at last.

The Uniden 580 XLT has broken with this tradition somewhat as it offers the user a 13.8v base station which is also small enough to comfortably fit into all but the most poorly designed of car interiors — so whilst the leading edge technology buffs are standing out in the rain watching their Nicads go flat, you can sit comfortably in the car listening happily away. So, the first question is, what do you get for your £200 outlay?

General View

The Uniden (neě Bearcat) 580XLT is a 100 channel scanner operating in the ranges of 29 to 54MHz, 118 to 174MHz and 407 to 512MHz. It is capable of either AM or NBFM operation but both mode and frequency increment selection are automatically made depending upon the frequency in use — neither are directly operator accessible. The radio weighs in at 2lbs 5ozs and measures 7" (W) × 2" (H) × 7½" (D), which is about the same size as some of the slimmer broadcast car radios seen today. The case consists of two 'U' shaped sheet steel covers which are covered with a textured black plastic coating, giving an effect not unlike that of crackle finish paint. The front panel consists of a dark grey plastic moulding with the LCD escutcheon and controls finished in black and the various key legends being printed in off white.

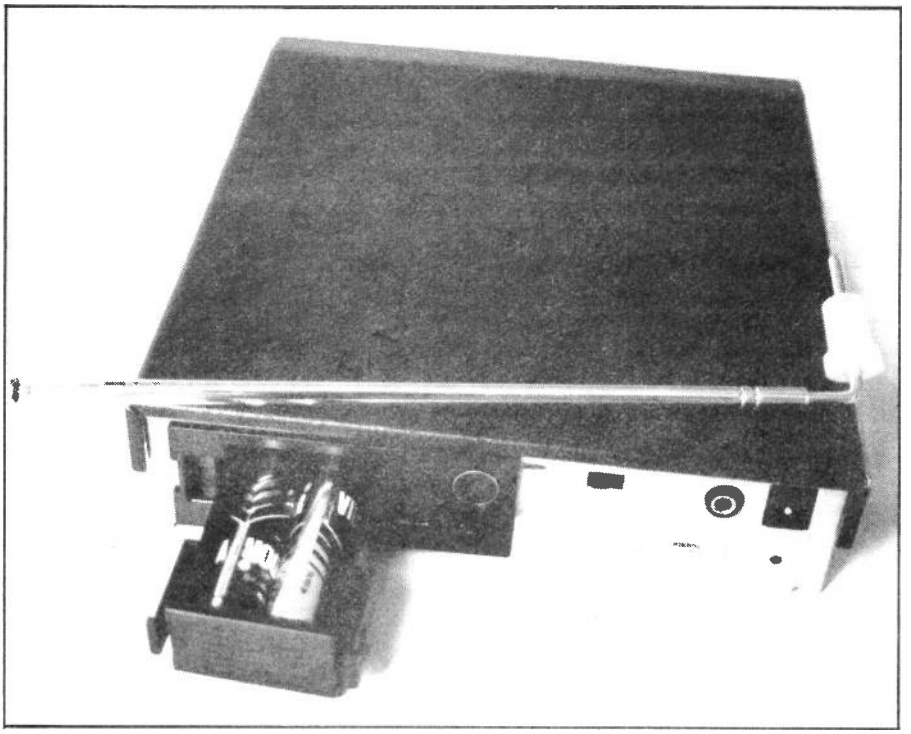
The most noticeable aspect of the front panel however is the slight upward tilt of some 15 to 20 degrees which not only makes operation of the radio much easier in a car installation but also allows use at table top height without having to lie with your head on the desk just to read the display! There is also a flip down stand fitted to the underside of the case which tilts the whole set slightly upwards and at the same time prevents it sliding around due to two rubber feet fitted to the stand extrusion, the stand simply flips back up out of the way when not required.

Working from left to right, the front panel layout consists of an integral volume, squelch and on/off switch; the large (5 × 1.2cm) LCD with four control buttons beneath; nine square function buttons and on the right, a numeric keypad. The volume/squelch control annulus is backlit in orange as is the LCD screen and the SCAN, MAN, PRI & HOLD buttons below it. The backlighting facility is not switchable and although the case did get a little warm in the vicinity of the bulb over prolonged operating periods no other problems were found. In fact the display legibility was very good over a wide range of viewing angles both in daylight and at night, other radio manufacturers take note.

Unlike the hard plastic used for the other controls, the buttons to the right of the LCD were reminiscent of the soft rubber kays used on some computer keyboards. I have always referred to these as 'dead fish' keyboards because of their unpleasant feel, however the 580XLT's keys do the job perfectly well regardless of my personal foibles, are of a sensible

size and (with the aid of suitable bleeps) let the operator know when they have been pressed home.

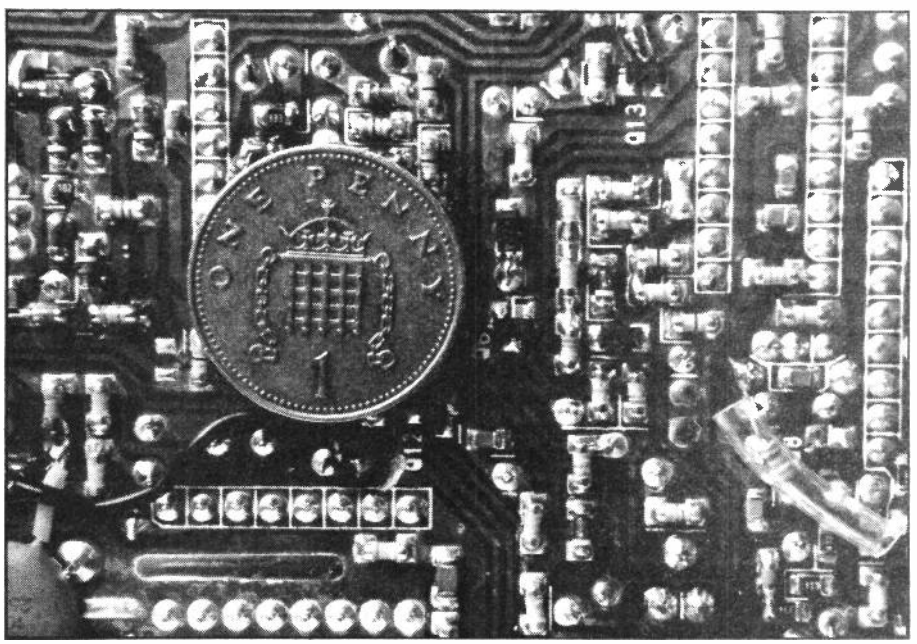
Other features of the 580 include a 3", 3 watt loudspeaker fitted to the underside of the case and on the rear panel there is the DC power socket, antenna socket, extension speaker socket, memory lock switch and the memory back-up battery holder. A four section 20" telescopic whip, plus a mobile mounting bracket and attachment screws are also supplied with the set, the radio being fitted to its bracket by means of two large knurled knobs which pass through the bracket and screw into the side of the case, in the manner of CB rigs. The only real gripe which I have concerning the hardware design is in relation to the choice of aerial socket, which is a car radio type — my feeling is that bearing in mind the 29 through to 500MHz coverage of the set a BNC fitment would have been much better, especially at the higher fequencies.



Getting To Grips

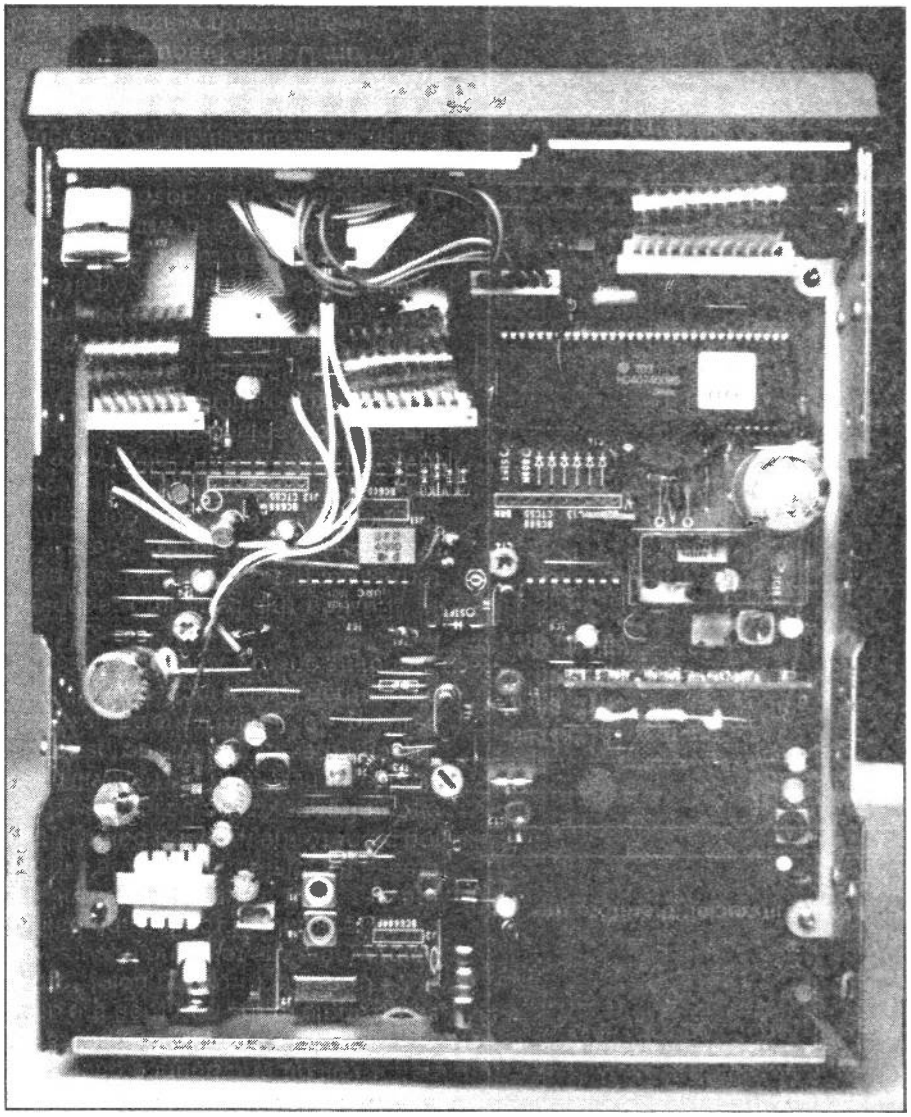
Before getting started it is necessary to install the two AA cells required for memory back-up in the rear panel mounted holder. Alkaline type cells are claimed to have a life of around six months in this application and when the time comes to change them, an on board capacitor maintains the back-up facility for up to 30 minutes — enough time for even the most gack-handed to swop cells!

Frequency entry is achieved by a process of putting the set into the manual (MAN) mode, nominating a memory number between 1 and 100 and then entering the frequency required followed by pressing 'E' on the numeric pad to finally enter the desired data. For example, to program channel 20 with S20 the sequence would be: MAN, 20, MAN, 145.500, E and the process is complete. Assuming that the radio is already programmed, it will commence scanning as soon as it is switched on although there are a number of other facilities which are available should the user require a different operating technique. Memory channels can be stepped through manually one at a time by pressing the MAN button repeatedly, although if you happen to be at channel 01 and you want to get to channel 99 it could take you a while as the radio will only step *upwards* in this mode, you can't determine the direction of travel for yourself. Once in the manual mode however any channel can be selected simply by typing in its number on the numeric pad and then pressing the MAN button again, whereupon the radio will immediately go to that channel.



Memory Arrangement

Having 100 memory channels on board can become something of a nightmare to organise if you don't take a systematic approach to 'what goes where', and it's here that the page system employed by the set comes to the rescue. Instead of offering one huge single block of 100 channels, the '580XLT divides these into five banks or 'pages' of 20 channels each. So for example you could put all your favourite 2m frequencies in bank 1, 70cm fre-



quencies in bank 2 — and so on through to bank 5. Once this has been done, each bank can be included or excluded from the scanning process as desired, so if you only want to scan the 70cm frequencies, all of the other four banks can be missed out.

The extreme top left-hand corner of the LCD shows which memory banks are currently available for scanning, with the appropriate number blinking momentarily to indicate that it is being scanned at that precise moment. During the scan no frequency information is shown on the display but the channel numbers are shown tumbling merrily away to confirm scan action, just to further reinforce the point, 'SCN' also appears on the LCD. As soon as a channel becomes active the scan stops, the frequency is shown and reception commences.

Each channel can also be programmed to have a 2 second delay following loss of signal, or be locked out (omitted) from the scan process; the delay facility can be very useful when listening to transmissions consisting of short overs punctuated by short gaps, whereas lock-out can be handy if you wish to avoid having the set latch-up on beacons or repeaters when scanning for other signals. In either case an appropriate annunciator will appear on the LCD as a memory jogger and because it is possible to lose track of just how many locked out channels there are in a particular bank, all channels within a bank can be unlocked by holding down the 'L/O CLEAR' button for more than 2½ seconds — after which a double beep will confirm cancellation of lock out.

A further facility which the set offers is that of being able to momentarily monitor a priority channel; enabled simply by pressing he PRI button, this allows the set to check for activity on whatever frequency happens to be programmed into channel number 01, regardless of whether bank 1 (which contains channel 01) happens to be active at the time.

Selection of which banks are to be scanned must be made when the set is already in the scan mode, and although this may seem to be a rather strange way to go about it. In practice it works well, for it means that should the operator wish to cease scanning one memory bank in favour of another the 'new' bank can be selected by pressing the appropriate number on the numeric pad whilst the 'old' group can be deleted from the scan by the same process — scanning continuing all the while.

Search Mode

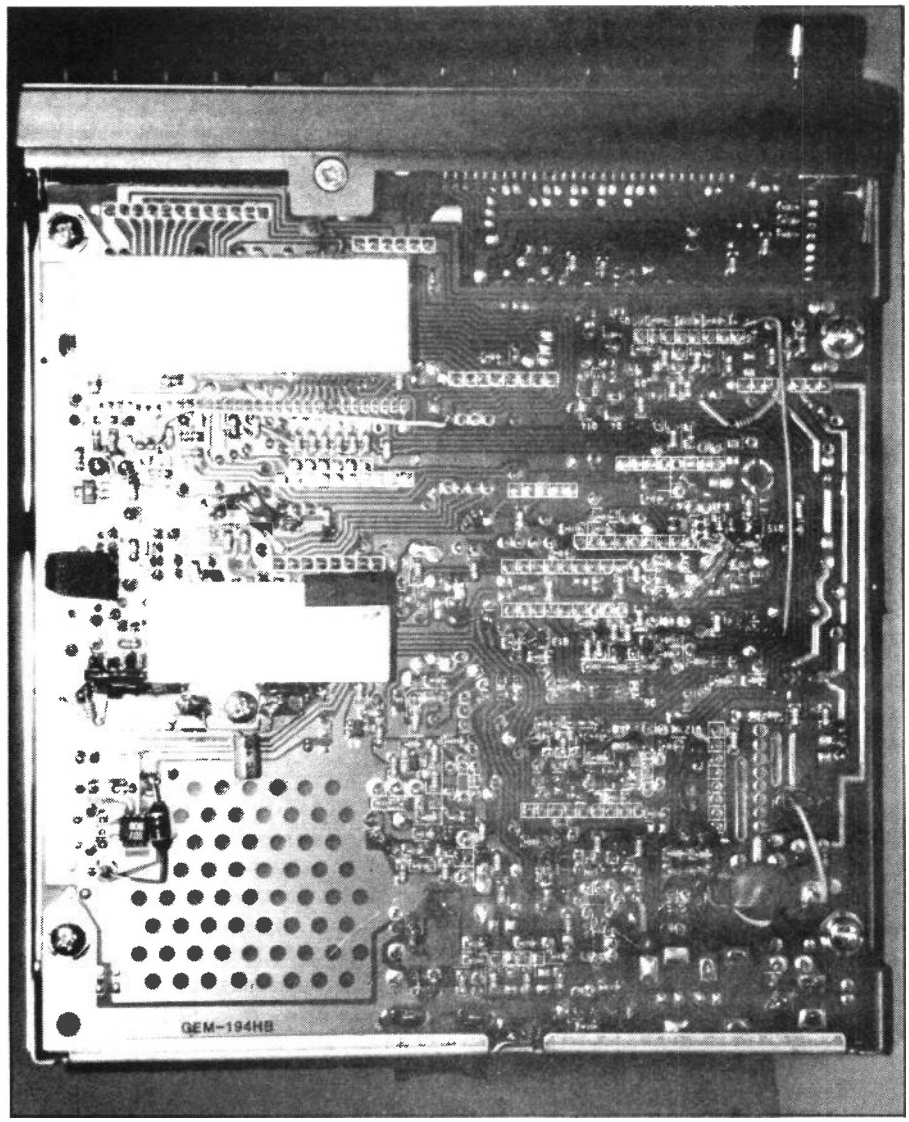
Quite a few newcomers to the world of scanners end up being rather disappointed when, instead of virtually every frequency bursting into life, they discover that activity can be quite sporadic. Indeed some scanners require their owners to have second sight in that they will only accept specific input frequencies to scan, so if you are 25kHz off something interesting you'll never know it. Fortunately some scanners, including the 580XLT, will allow the user to search a block of frequencies which are not held in memory — stopping on an active frequency either until the signal ceases or the operator intervenes. The only restriction placed upon the search function is that the search limits must lie wholely within one of the three blocks of spectrum covered by the radio so, for example, it is not possible to scan 53.500 to 130MHz as this requires a 'jump' between the 29-54MHz and 118-174MHz bands.

To enter search mode the radio is first put into manual mode by pressing MAN, then the lower search limit (LMT) is keyed in followed by the upper search limit; pressing the SRC (search) button initiates the search. For example the key sequence to search 144.500 to 145.800MHz would be as follows: MAN, 144.500, LMT, 145.800, LMT, SRC. If an active frequency is encountered, pressing the HOLD button will retain it and if 'E' is pressed it can be stored in the

current memory channel. Once the frequency has been temporarily retained by pressing HOLD, it is possible to step up or down frequency from it using the HOLD button to go up frequency or the LMT button to QSY downwards. The user can escape from search mode by pressing the MAN button at any time.

Service Search

In addition to the previously described search modes and facilities, the Uniden 580XLT also offers the ability to make 'service searches', that is to say it can call up a block of ready programmed frequencies for police, fire, aircraft, weather satellite and marine band allocation searches. The snag is that the radio is programmed to handle United States allocations and not ours, so leaving aside the fact that it is technically illegal to listen to all but broadcast and amateur frequencies in the UK, only the aircraft and marine allocations would be of any use over here. Looking inside the set it is interesting to note that there is a silver sticker attached to one end of the main CPU chip — could this therefore mean that the service search channels are on a re-programmable Eprom?



Channel Steps and Performance

With the exception of the service search bands, which appear to have the appropriate step sizes ready programmed, the 29 to 54MHz and 118 to 174MHz bands have a minimum step size of 5kHz whilst the 406 to 512MHz band uses 12½kHz spacing — although the ½kHz does not appear on the display. Whilst neither option should cause an immediate problem from the viewpoint of 25kHz amateur band spacing, it is nevertheless a fact that 12½kHz spacing is used in congested areas and this will cause the user to miss out on some activity. Ironically, this situation is further exacerbated by the quite respectable adjacent channel performance which meant that I was unable to persuade the set to pick up my 2m handheld operating at close quarters only 12½kHz off frequency!

As with all but the most imaginatively priced scanners, the Uniden did have problems with image response, in my location this was manifested by the sudden and uninvited appearance of a local constabulary ragchew smack in the middle of air band, however this was the only instance which I ran across during the review period and as is often the case it is a question of pot luck as to whether or not the operator ends up with unfortunate frequency combinations.

With regard to sensitivity, performance was quite acceptable and when used with its standard telescopic whip aerial the set was found to be on a par with both 70cm and 2m handhelds used under similar conditions with their standard 'rubber ducks'.

Conclusions

For many people the name of the game when it comes to scanners is ever increasing frequency coverage, but for others the objective is to listen to specific bands for specific purposes — which 'type' you are will colour your attitude to the latest offering from Uniden.

For the 'DC to light' merchant the set offers less coverage and fewer options per pound at its current price of £225 than other handy portables recently available; but for those interested in 50MHz, 144MHz and 430MHz, plus air and marine bands thrown in, the set has a different appeal. For the latter group its design, legible display and standard of construction will outweigh its other shortcomings and should therefore secure it a place on the shelves of those who enjoy long term monitoring both from home and in the car.

My thanks go to Nevada Communications Ltd of Portsmouth for supplying the review unit.

AUTOMATIC BATTERY CHARGER

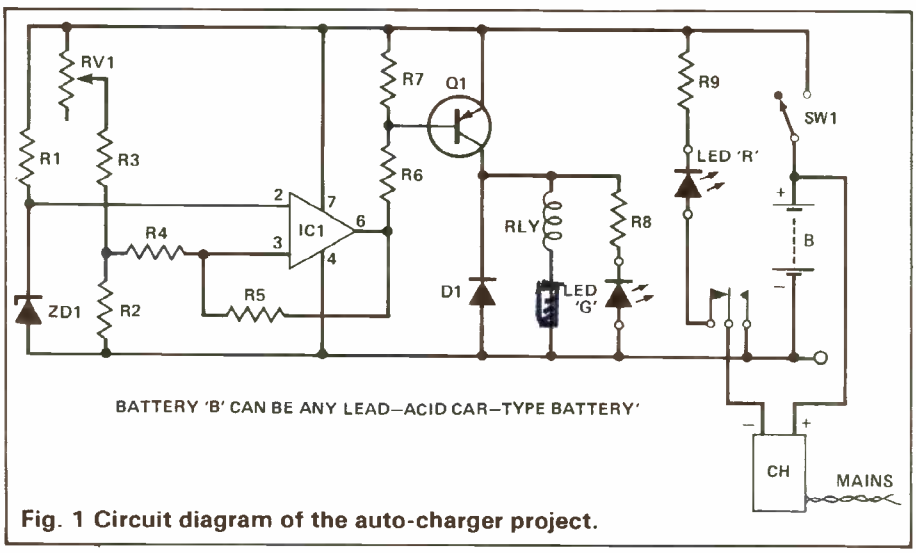


Fig. 1 Circuit diagram of the auto-charger project.

Sick of sagging PSUs? This simple circuit from G4AVT will take care of all your lead-acid battery charging problems!

A car battery is often used in the shack to power modern 12 volt HF and VHF rigs. Keeping the battery "well up" to voltage with a battery charger is important for best transmitter performance and this involves supervision of the charger, switching it "On" and "Off" at the appropriate moments.

The device described here does this automatically and consists of a voltage dependent switch which cuts off the charging current when the battery reaches 13½ volts and brings it in again when the battery falls to 11½ volts. The unit is self contained and requires no modification to the charger, a trickle charger of 2 to 3 amps output would be suitable and it is this type which the project is designed for.

Such an arrangement applies particularly to the modern "Sealed for Life" type of battery, which when used with simple chargers of the transformer plus rectifier variety (see **Fig 5**) can exceed the specified charging voltage. These batteries are designed to internally absorb the gasses generated by the charging process, however the absorption capability can be overwhelmed if the charging rate exceeds that recommended – resulting in profuse gassing, lowering of the electrolyte and a shorter battery life.

How It Works

The heart of the circuit, **Fig. 1**, is an IC741C operational amplifier used as a Schmitt Trigger, in its 8 pin DIL form it is widely available at a remarkably low price. The output at pin 6 switches a low power transistor so that its collector goes high or low thereby operating the relay, its contacts switching the charger "in" and "out" of circuit as needed. Two LEDs indicate the status of the circuit and the sequence of operation is shown at **Fig. 4.** The height of the segment between the trip voltages is about 2 volts in this case, and is set by the ratio of the potential divider resistors R4 and R5. The operating position of the segment (11½v and 13½v) depends upon the ratio of resistors R2 and R3 with RV1 for adjustment purposes. The zener diode provides a reference voltage for the 741C input and D1 is a silicon diode used to bypass the reverse voltage transient which occurs across the relay coil on field collapse at switch off.

Construction

The prototype used plain drilled copperless 0.1in. matrix board, but of course any suitable construction

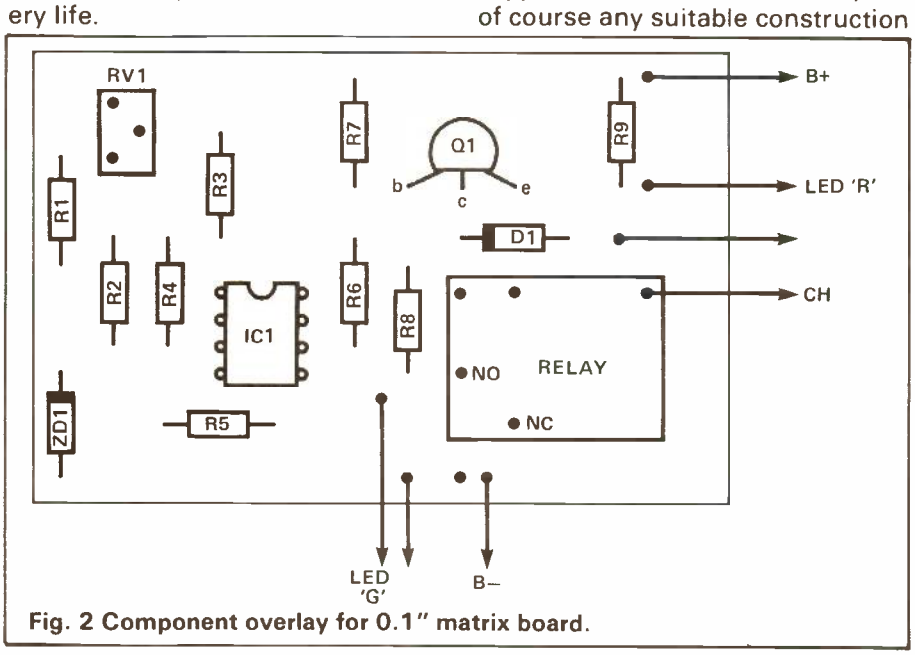


Fig. 2 Component overlay for 0.1" matrix board.

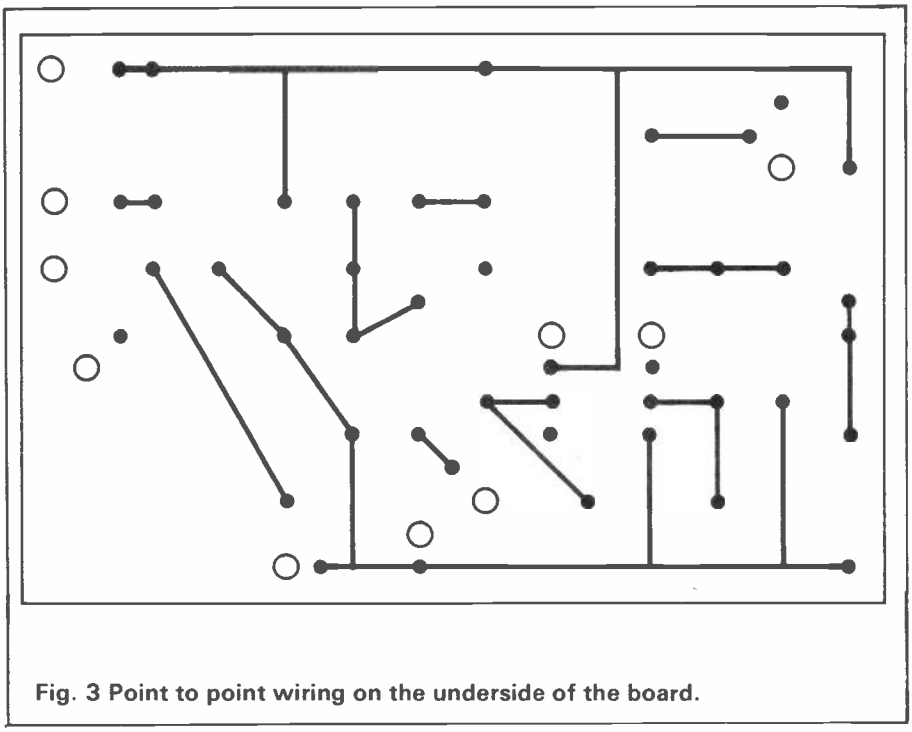


Fig. 3 Point to point wiring on the underside of the board.

technique may be employed. The components layout is shown in **Fig. 2,** and these are not minimally spaced so is less prone to unintended shorts and bridges for the less skilled at precise close soldering. Bare tinned 24 gauge copper wire was used for wiring up but in several cases the component leads are sufficiently long for this purpose. Note that the wires to the relay contacts should be as heavy a gauge as practicable as they carry the main charging current. Constructors wishing to use the printed circuit technique should have no difficult using the underside wiring diagram **Fig. 3**. Holes will need to be drilled through the board and the box bottom to take fixing screws and nuts. Best positions for the toggle switch, LED holders and insulated terminal (which accepts the charger lead) should be chosen with the completed board in position. Holes in the case walls will be needed for battery positive and negative leads and for access to RV1 for adjustment purposes.

Setting Up

The procedure is simple. You will need a voltmeter and before starting, have the battery charged to 13½ volts. Put SW1 in the "off" position and set RV1 half-way, then connect the device to the battery observing the correct polarity. Now switch on and the green LED will light. Adjust RV1, slowly reducing the resistance in circuit until the green LED goes out. Set this point precisely as it is fairly critical. The charger, switched off at the mains, should now be connected to the battery and all connections should be checked before switching it on – to the charger – the cycle is now in progress.

In Use

It is always important that both the device and the charger are switched off before altering the connections, to avoid relay chatter and possible damage. When the device is in the "non charging" part

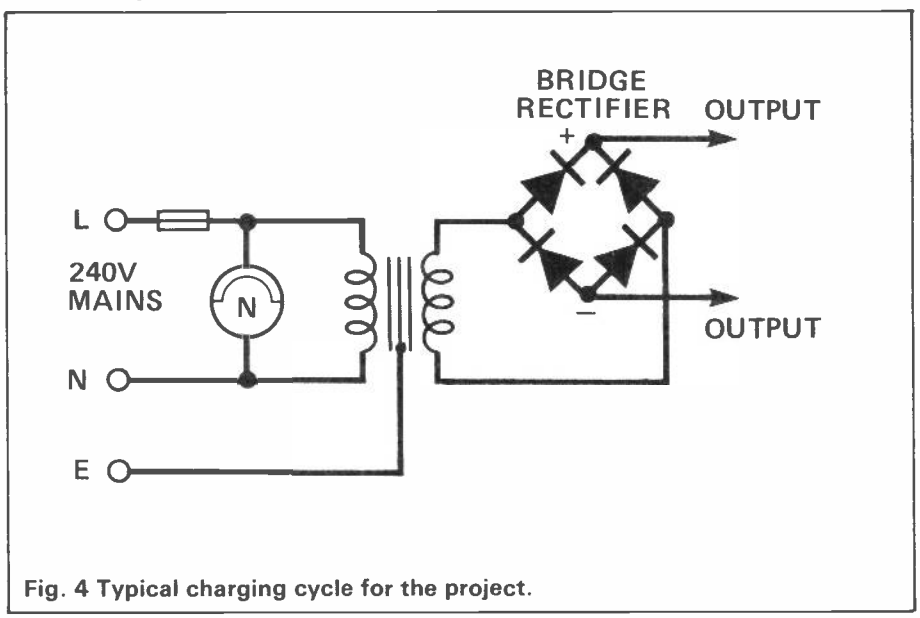


Fig. 4 Typical charging cycle for the project.

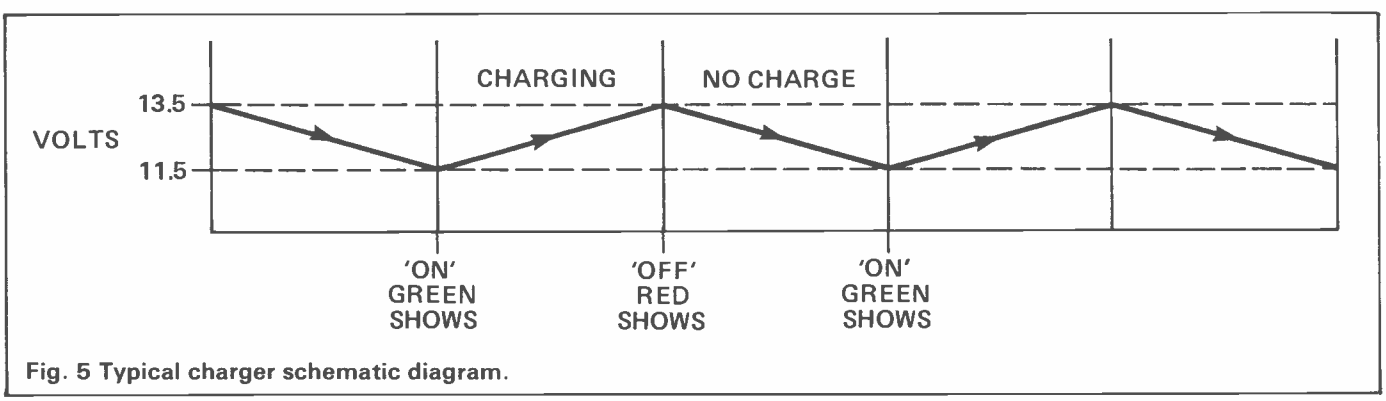


Fig. 5 Typical charger schematic diagram.

COMPONENTS LIST

RESISTORS

R1	4k7
R2, 4	6k8
R3	8k2
R5	100k
R6, 7	1k
R8	1k8
R9	680R
RV1	4k7 submin preset

All fixed resistors 0.5W 1%

SEMICONDUCTORS

Q1	2N3702
IC1	741 op-amp
D1	1N4001
ZD1	5v6 500mW Zener

LED R, G one Red & one Green

MISCELLANEOUS

Relay, 12v SPDT 320R, 10A @ 240v contacts, PCB mounting Maplin type YX97F. 8 pin DIL IC socket. 2 LED holders. Miniature toggle switch. Insulated terminal.

of the cycle (ie. red LED on) the state can be changed by operating SW1, (ie. switch 'off' then 'on' again) when charging will commence and the green LED will be on.

Other Uses

The writer has used the unit with a car battery for some six months or so to power an FT757 transceiver. Two other units have also given complete satisfaction in connection with a burglar alarm system and then a battery operated lawnmower!

Listening On...

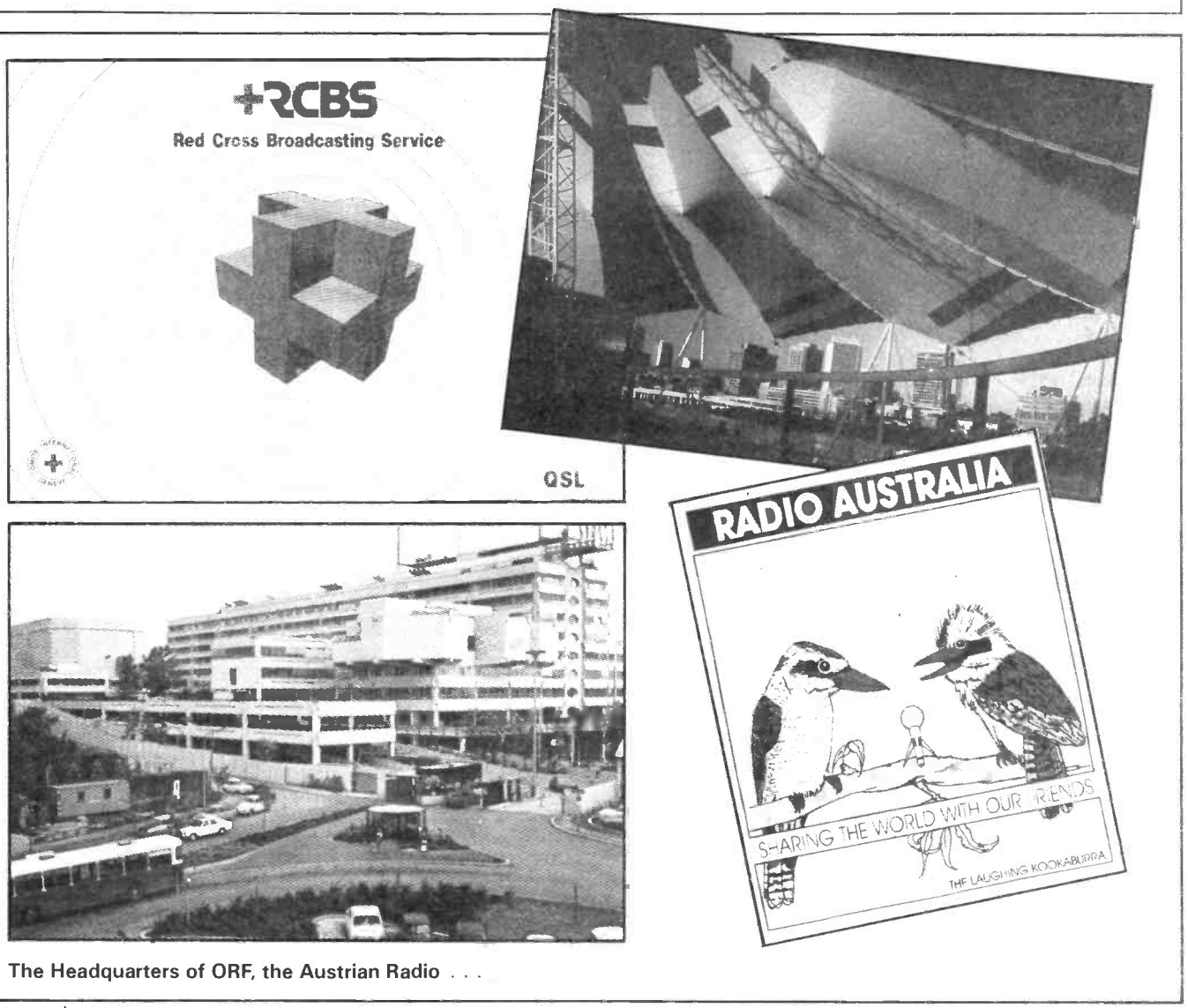
From Belgium to Australia, from Alaska to Madagascar — our man is there with an ear to the air . . .

As the weather has improved from spring into high summer, so has the radio weather, the propagation. The new sunspot cycle, Cycle 22, has started with a bang, providing some excellent propagation, not just for short wave amateur DXers, but also for the broadcast band enthusiasts as well.

For example, Alaska, never an easy country to hear on the broadcast bands, has been coming in stongly recently with the sole SW broadcaster there, KNLS "The New Life Station", putting in a strong signal as late as 2300 GMT on 117000kHz, when they end their broadcasts in Russian. More rare, at least in Europe, are the Central and South Pacific countries. RFO (which stands for Radio Television Francaise d'Outre Mer) broadcasting from Papeete, the capital of Tahiti, has been heard on several mornings around 0800 GMT in Tahitian and French. They are about 1kHz above their nominal frequency, on about 11826kHz, this from an old 20kW AM transmitter. Rarer still is Radio Kiribati, which uses a 500 watt SSB transmitter on 14802kHz. This is occasionally reported in Europe around 0600-0700 GMT, but only when propagation conditions are excellent. The rather old frequency usage is because it is used to relay the programmes of Radio Kiribati from the captial, Tarawa, to Christmas Island, several hundred miles away, but still part of the Republic of Kiribati (formerly the Gilbert Islands).

Amateur band DXers will have heard that the Saharan Arab Democratic Republic (or RASD, from the name in Spanish) is now accepted as a new country, or rather it has been decided that recent operations from there will count as the former Spanish Sahara territory, as reported in QRZ in *HRT*. One of the operators of amateur station S0RASD is also the Minister of Information of the republic, and it is he who is also in charge of the broadcast station there. This station is called the National Radio of the Saharan Arab Democratic Republic, and it broadcasts on 1355kHz medium wave. This is 4kHz away from the offical medium wave channel of 1359kHz, and often a 4kHz hetrodyne, or whistle, can be heard if one tunes to this frequency. Radio Berlin International is usually the strongest station on the latter frequency, but if the hetrodyne is par-

The Belgian Radio and Television was the host for this year's European DX Council convention and conference, held in May in Antwerp.



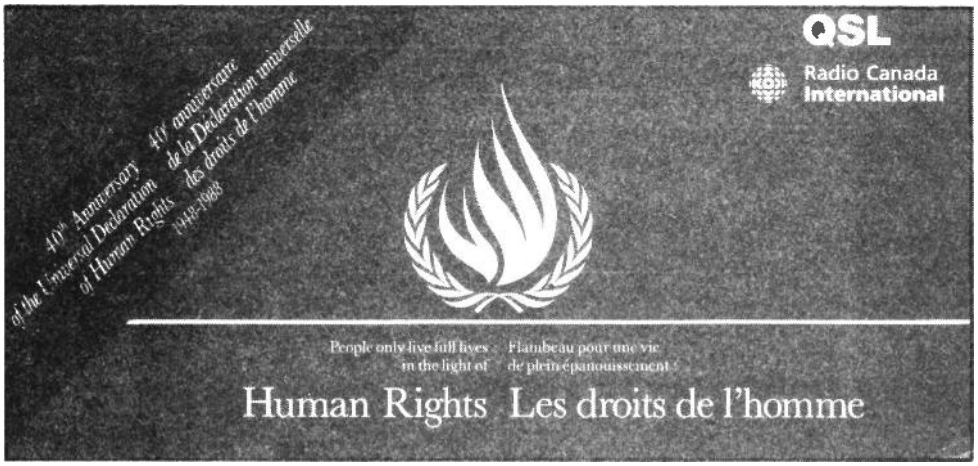
The Headquarters of ORF, the Austrian Radio . . .

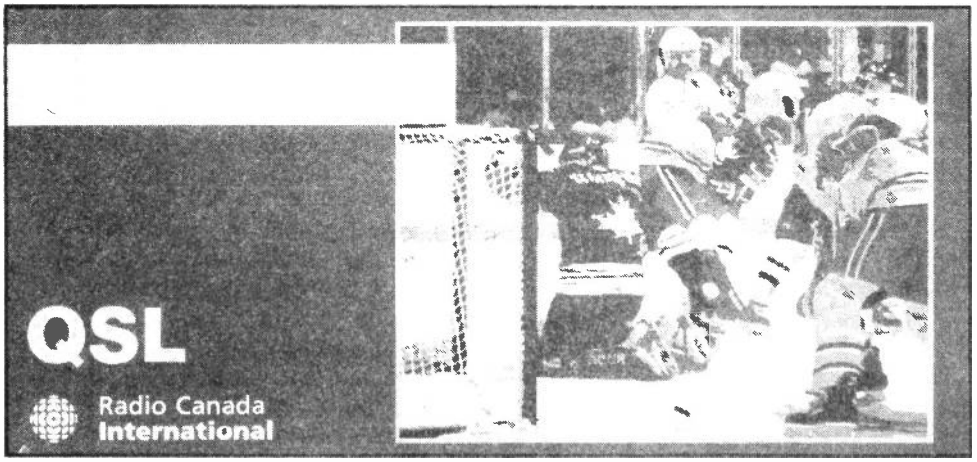
Radio Auastralia is broadcasting special programmes about the Bicentennial throughout the year. This is the World Expo 88 in Brisbane, which is open until the end of October. if you can't visit it, the next best thing is to listen to Radio Australia!

ticularly strong, try tuning between 1359 and the next channel down, 1350kHz, to try to receive the National Radio of the RASD. Those listeners with loop or frame aerials may well be able to get much better signals if they can successfully null out the interference from Radio Berlin International. The RASD station broadcasts from about 2000-0000 GMT only, in Spanish, Arabic and local dialects, and some listeners have reported occasional announcements in French or English.

It was reported some time ago that the BBC were constructing a new relay station on the Seychelles, primarily intended for listeners in East Africa, where reception of BBC programmes, particularly the World Service in English, has been patchy, to say the least, for many years. I now understand that the station is all but completed, as I write this, and by the time this appears in print it could well be on the air with test transmissions. In any event, the BBC was planning to have the Seychelles relay in full use by the late autumn or early winter. The full schedule will appear in Listening On . . . when it becomes available. Radio Netherlands, which already has relay stations on the island of Bonaire in the Netherlands Antilles and on Madagascar, is reported to be looking into the possibility of improving reception in the East Asia area by means of a new relay station. According to a report on their Media Network programme early in June, a fact-finding survey has recommended that a new relay station be built in that area, possibly in Brunei, the Philippines or Thailand. At present, the plans are in a very early stage and the main stumbling block, as is so often the case, appears to be the tremendous cost of building a high-power transmitting station, manning it with local engineers and running it thousands of miles from the home country. If Radio Netherlands did build a relay in Brunei, a small independent Sultanate on the island of Borneo, this would be very interesting to the broadcast band DXer, as at present it is virtually impossible to log this country in Europe, since Brunei's only radio station operates on medium wave and VHF only.

The BBC relay on the Seychelles will, no doubt, also make *that* country much easier to hear for broadcast band DXers, but it is by no means the only short wave broadcaster there. Apart from the national broadcaster, RTV Seychelles, which is only on medium wave, the Far Eastern Broadcasting Association (FEBA) operate two 100kW and one 25kW short wave transmitters from there. FEBA is a small Christian broadcasting organisation, with headquarters in Worthing, Sussex, of all places, but which transmits from near Victoria, on the island of Mahe in the Seychelles. In common with most other religious broadcasters, FEBA not only makes





Radio Canada International have recently been sending out these two QSL cards for correct reception reports. They commemorate the Winter Olympics held in Edmonton in February this year, and the 40th anniversary of the signing of the Universal Declaration of Human Rights.

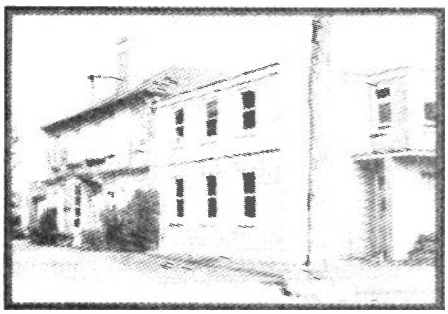
its own programmes, but also carries programmes made by independent producers based in such countries as India and Sri Lanka. In fact, they broadcast in no fewer than 25 languages to some thirty countries around the Indian Ocean, in Southern Africa and the Middle East, in such tongues as Mundari, Oromo and Kannada. In Britain, FEBA Seychelles is most often heard between about 1500 and 1630 GMT, when they broadcast on 15325, 11865 and 9590kHz. There is a locally-produced news bulletin in English at 1600 on the last two of those frequencies. Much of FEBA's staff in the Seychelles are volunteer ex-patriates from the UK working for a period of a few months as missionaries-cum-engineers or broadcasters.

Another very small broadcasting station, and one not so often heard in Britain is the Red Cross Broadcasting Service. With studios in Geneva, RCBS uses the transmitting facilities of the Swiss Broadcasting Corporation, but is quite independent of them. The reason it is not so frequently heard is simply that it does not broadcast very often — in fact on only a few days per month, and then not always on the same days, so it is quite hard to chase! I have recently received their schedule for the next few months, part of which should still be valid by the time this is read, so here goes:

0740-0800 GMT in English to Australia and New Zealand on 9560, 13685, 17830 and 21695kHz on 1st, 4th, 29th August and 1st September.
1040-1100 GMT in English to India on 11935,13685, 15570 and 17839kHz on the same days.
1100-1240 GMT in English, French, German and Spanish for Europe on 7210kHz on 28th August.
1310-1330 GMT in English to Asia on 13685, 15570, 17830 and 21695kHz on 1st, 4th, 29th August and 1st September.
1700-1840 GMT in English, French, German and Spanish to Europe on 7210kHz on 1st and 29th August.
and 1710-1730 in French and English to Africa on 9885, 11955, 15430, 15255 and 17830kHz on 1st, 4th, 29th August and 1st September.

The 1310 GMT transmission is also broadcast simultaneously by transmitters in China on 11695 and 15135kHz. At one time these transmissions were intended as test transmissions, to be used in cases of natural or man-made disasters, but now the Red Cross Broadcasting Service broadcasts a news-magazine programme about the work being done by the various Red Cross (and Red Crescent) agencies around the world, especially in Africa.

One of the big items in the broadcast band DXers' calendar, and one which is held in May every year, is the



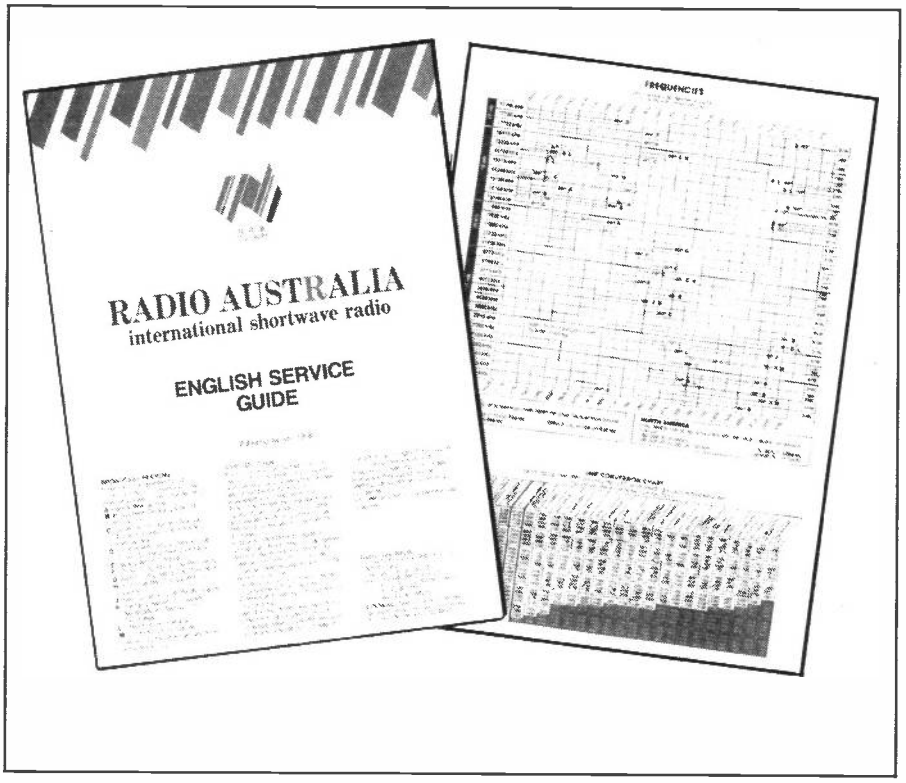
The Far East Broadcasting Association's HQ may be in Worthing . . .

. . . but John Fear, seen here about to broadcast English news for listeners in South Asia . . .

. . . does it from the Seychelles.

European DX Council, or EDXC, conference. This year, the 1988 EDXC conference took place in Antwerp, under the auspicies of the BRT, the radio and TV organisation of the Flemish-speaking community in Belgium. The events at the conference were widely reported by the DX and media programmes on Radio Sweden and Radio Netherlands as well as the BRT itself. It seems as if this year there was quite a tussle between the hard-core short wave enthusiasts and the high-tech satellite and computer fans. This year short wave won, as a demonstration of satellite broadcasting by the BBC failed, due to the non-existence of a vital component. A satellite TV link with the Voice of America also did not come off because of the high cost of the link, which was cancelled. On the other hand, the conference was officially opened by short wave, with the opening address being sent by Radio Sweden from Stockholm and received — successfully — on a simple short wave receiver in Antwerp. Later on during the conference, Radio Australia sent a live greeting to the delegates also by short wave, which was perhaps even more impressive. Although a very small station in international terms, the BRT International Service has a lively and enthusiastic English-language section, headed by Hans Vossen. He was interviewed at the EDXC conference by Jonathan Marks of neighbouring Radio Netherlands and stated that the BRT's new Director General has put extra funding for the international service as a high priority. Nevertheless, BRT International is already well heard in Britain thanks to a high power medium wave transmitter operating on 1512kHz. This is heard with English programmes daily at 1730-1800 and 2100-2130 GMT. They area also carried on 5910kHz, although with much weaker signals in south-western England (the short wave frequency could be much more useful for listeners a little further away from Belgium, though — for example in Scotland or Ireland).

Next year's EDXC conferece, to be held in May 1989, will be in Vienna, with ORF, the Austrian Radio, organising things. If you are able to get there, it should be a most interesting meeting, providing, as it does, an almost unique opportunity to meet not only many other broadcast band



DXers and short wave listeners, but also the broadcasters themselves.

Although BRT International are hopeful of increasing their funding, other stations are not so fortunate. Anyone who has followed the continuing story of Radio Australia's future, which has been unwinding weekly on that station's Communicator programme, may have been wondering if the station will continue to exist at all, given some of the gloomy reports. However, it seems as though the 24 hour per day English-service will remain, although in the ABC as a whole almost one thousand staff will lose their jobs over the next few years. Despite cut-backs, Radio Australia's new transmitting site in Brandon, Queensland, should be operational by now. Initially, it will be using three old 10kW transmitters salvaged from their Lyndhurst site which closed down a year or two ago, until funding permits the purchase of new transmitters. The Brandon site will be used for programmes in English and Tok Pisin beamed to Papua New Guinea and the Solomon Islands, and Radio Australia hope that they should be able to put in an equally strong single-hop signal from Brandon, using just 10kW, than they have been doing so far from 100kW transmitters at other not so favourable sites. The higher power transmitters will then be able to be used for other more distant target areas. Don't forget Radio Australia's Bicentennial features throughout 1988, broadcast on Wednesdays at 0730-0800 GMT on 9655kHz.

Radio Canada International, which broadcast special features from the winter Olympics back in February, is now sending out special QSL cards to those who reported on these broadcasts. Also this year being the 40th anniversary of the Universal Declaration of Human Rights, Radio Canada International is broadcasting a series of information and promotional features pertaining to human rights throughout 1988. They have also printed a special QSL card to celebrate this anniversary too. Radio Canada International's main English-language services for Europe are now heard at 1830-1900 GMT (except Saturdays and Sundays) on 5995 and 7235kHz from transmitters in Daventry, and on 11945, 15325 and 17875kHz direct from Sackville, Canada; and again at 2000-2030 GMT (2000-21000 on Saturdays and Sundays) on 5995 and 9670kHz from Daventry and 11945, 15325, 17820 and 17875kHz from the Candadian transmitters. With the sunspots as they have been recently (which is where we came in), even the 17MHz frequencies have been providing excellent reception these light evenings.

RADIO Tomorrow

10 Aug S Bristol ARC: 6m activity evening. Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. Details: Len Baker G4RZY on Whitchurch 834282
Willenhall DARS: CW night on the air.

11 Aug Pontefract DARS: On the air night 8pm. Carleton Community Centre, Carleton Rd, Pontefract.
Salop ARS: Natter night.
Yeovil ARC: 'JFet Voltage Amplifiers. Part I' by G3MYM. 7.30pm. at The Recreation Centre, Chilton Grove, Yeovil.

12 Aug Loughton DARS: Drinks at 'Gardners Arms', Loughton Coventry ARS: Night on the air.
Maltby ARS: VHF activity night.

14 Aug **Flight Refuelling ARS: Hamfest '88. Stalls, Craft fair and family entertainment. Free creche available, free parking. Entrance fee 50p (chilldren free). No charge for charities and local hobbies groups — booking forms available. 10am — 5pm at The Flight Refuelling Sports & Social Club grounds, Merley, Wimborne, Dorset. Details from John Fell, 14 Rectory Ave, Wimborne, Dorset, BH21 3EZ on (0202) 691649**
Derby Rally. Lower Bembrose School, St Albans Road, Derby. Trade stands, flea market, Monster Junk Sale in early afternoon. Refreshments. Talk in on 2m. Details from Martin Shardlow, 19 Portreath Drive, Darley Abbey, Derby DE3 2BJ and on (0332) 556875.

15 Aug Welwyn-Hatfield ARC: On air night. Knightsfield Scout HQ, opp. Ingles, Welwyn Garden City.
Braintree DARS: '2MT Writtle — the Birth of Broadcasting' by Tim Wander G6GUX. 7.30pm. Braintree Community Association Centre, Victoria Street (next to Bus park), Braintree.

16 Aug Fylde ARS: Informal meeting. The Kite Club, Blackpool Airport.
Rugby ATS: 2m DF. 7.30pm. Cricket pavilion, BTI Radio Station, 'B' building entrance, A5 Trunk Rd, Hillmorton, Rugby.
Delyn RC: Home made wine evening (!).
Midland ARS: Summer outing.
S Powys ARC: Social evening.
Wolverhampton ARS: Night on the air.
Worksop ARS: Barbeque

17 Aug Cheshunt DARC: Natter evening. Church Room, Church Lane, Wormley, Nr. Cheshunt, Herts. 8pm.
Chichester DARC: Club meeting.
S Bristol ARC: Dx Broadcast TV activity evening with Ron Gardner Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. Details: Len Baker G4RZY on Whitchurch 834282

18 Aug Pontefract DARS: On the air night 8pm. Carleton Community Centre, Carleton Rd, Pontefract.
Yeovil ARC: 'JFet Voltage Amplifiers. Part II' by G3MYM. 7.30pm. at The Recreation Centre, Chilton Grove, Yeovil.

19 Aug Coventry ARS: Night out operating portable.
Maltby ARS: TV & video night with G4BVV, G0EIB & Co.

21 Aug **Red Rose Rally. Bolton Sports & Leisure Centre, Bolton. Details from David on 0204 24104.**

22 Aug RSGB City of Bristol Group: RSGB Video Presentation evening. 7.30pm. Small Lecture Theatre, Queens building, University of Bristol
Todmorden DARS: Natter night. 8pm. Queen Hotel, Todmorden
Felixstowe DARS: Social evening.

23 Aug Rugby ATS: Talk by Crime Prevention Officer, PC Wright. 7.30pm. Cricket pavilion, BTI Radio station, 'B' building entrance, a5 Trunk Rd, Hillmorton, Rugby.
Wolverhampton ARS: Club project.
Worksop ARS: Natter night
Verulam ARC: Bring and Buy sale at RAF Assoc HQ, New Kent Rd, off Marlborough Rd, St. Albans. 7.30pm for 8.00pm.

24 Aug S Bristol ARC: 'Worked all Bristol' award in an evening, G4WAW Club station. Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. Details: Len Baker G4RZY on Whitchurch 834282

25 Aug Pontefract DARS: On the air night 8pm. Carleton Community Centre, Carleton Rd, Pontefract.
Yeovil ARC: Natter night 7.30pm. at The Recreation Centre, Chilton Grove, Yeovil.

26 Aug Loughton DARS: Drinks at 'Gardners Arms', Loughton
Coventry ARS: Canal trip.
Maltby ARS: HF activity night.
Salop ARS: HF special event station on the air.

28 Aug RSGB City of Bristol Group: RSGB Video Presentation evening. 7.30pm. Small Lecture Theatre, Queens building, University of Bristol.
BARTG: 1988 BARTG Rally. Exhibitors, car boot sale, etc. Talk-in on S22, Free parking, 10.30am — 5pm. at Sandown Park Racecourse, Portsmouth Rd, Esher — on A307 just S. of Kingston upon Thames. Details from Peter Nicol G8VXY, 38 Mitten Avenue, Rubery, Rednal, Brimingham B45 0JB. Tel: 021-453-2676 Prestel MBX 219995485
Delyn RC: Open night.
Torbay ARS Rally. STC Social Club, Paignton, Devon. Details from G3KZJ, QTHR.

30 Aug Wolverhampton ARS: Natter night.
Worksop ARS: Official club meeting

31 Aug Cheshunt DARC: Natter evening. Church Room, Church Lane, Wormley, Nr. Cheshunt, Herts. 8pm.

S Bristol ARC: Teach-in 'Make your own PCBs'. Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. Details: Len Baker G4RZY on Whitchurch 834282

1 Sep Pontefract DARS: Finals on SSB Field day. 8pm. Carleton Community Centre, Carleton Rd, Pontefract.
Yeovil ARC: 'Inductance' by G3MYM 7.30pm. at The Recreation Centre, Chilton Grove, Yeovil.
Horsham ARC: Talk 'Radio navigation in WW2' by G0APZ 8.00pm. The Guide Hall, Denne road, Horsham, Sussex. Details from Phil Godbold on Steyning 814516.

2 Sep Coventry ARS: Canal trip.

3/4 Sep **SSB Field Day**

4 Sep **Dunstable Downs RC: 5th National Amateur Radio Car Boot Sale. 10am onwards at the Shuttleworth Collection, Old Warden Aerodrome, Nr. Biggleswade. Details from Tony Kelsey-Stead G0COQ on (0582) 508259**
Vale of Evesham RAC: Treasure Hunt
Telford Radio Rally & Exhibition. Telford Racquet Centre, Telford. All usual facilities and stands, including snacks, bar and restaurant. Morse tests also taken through booking with RSGB. Talk-in via GB75TRG on S22 and SU22. Admission 10.30 disabled, everyone else 11am. Details from John G8ARS (0952 727719) or Martyn G3UKV (0952 255416)
Preston ARS: 21st Annual Mobile rally at The University of Lancaster. Trade stalls, large Bring & Buy, Club and repeater groups. RSGB stand and bookstall. Licensed bar, snack bar & restaurant. Talk-in on S22. Rally opens at 11am. with entry at 10.30am. for disabled persons. Admission by programme 50p includes free draw for colour TV. Free parking. Details from Godfrey G3DWQ on (0772) 53810.

5 Sep Todmorden DARS: Talk on Antennas by G8PG. 8pm. Queen Hotel, Todmorden
Welwyn — Hatfield ARC: Talk 'World War II Radio'. Lemsford Village hall, Brocket Rd, Lemsford.
Strourbridge & DARS: Natter/On-air night. Robin Woods Centre, Beauty Bank, Stourbridge.
Braintree DARS: Construction evening. 7.30pm. Braintree Community Association Centre, Victoria Street (next to Bus park), Braintree.

6 Sep Fylde ARS: Talk 'Fuel economy with central heating' by R. Bishop G4PNI. The Kite Club, Blackpool Airport.
Rugby ATS: 2m DF. 7.30pm. Cricket pavilion, BTI Radio station, 'B' building entrance, A5 Trunk Rd, Hillmorton, Rugby.
Stevenage ARS: HF night on the air
Worksop ARS: Natter night
South Powys ARC: Conversion of ex-computer power supplies

7 Sep Cheshunt DARC: Portable on Baas Hill.
Wirral ARS: Low cost construction contest.
S Bristol ARC: AGM Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol. Details: Len Baker G4RZY on Whitchurch 834282
Willenhall DARS: Night on the air (HF)

8 Sep Pontefract DARS: Committee meeting. 8pm. Carleton Community Centre, Carleton Rd, Pontefract.

9 Sep Loughton DARS: Rainbow & Dove Field weekend planning night. Loughton Hall, Rectory Lane, Loughton, Essex.

11 Sep Stevenage ARS: Lincoln Hamfest
Coventry ARS: Treasure hunt and barbecue

13 Sep Rugby ATS: Preparation for 3rd annual acution & barbecue. 7.30pm. Cricket pavilion, BTI Radio station, 'B' building entrance, A5 Trunk Rd, Hillmorton, Rugby.
Dorking DRS: Talk 'Power Supplies' by Chris G1PXH at 'The Falkland Arms'.
Worksop ARS: Talk, 'Photography on the Cheap' with Colin G4RUD

14 Sep Cheshunt DARC: Natter evening. Church Room, Church Lane, Wormley, Nr. Cheshunt, Herts. 8pm.
Willenhall DARS: Project night.

15 Sep Mid-Sussex ARS: Talk 'Design & Construction of Solid State & Valve Linear Amplifiers' by John G3WZT.

18 Sep Pontefact DARS: On the air night 8pm. Carleton Community Centre, Carleton Rd, Pontefract.

19 Sep Todmorden DARS: Natter night. 8pm. Queen Hotel, Todmorden
Welwyn—Hatfield ARC: On Air to Andorra (with luck!). Knightsfield Scout HQ, opp. Ingles, Welwyn Garden City.
Stourbridge & DARS: Talk 'Packet Radio' by G8JTL Robin Woods Centre, Beauty Bank, Stourbridge.
Braintree DARS: Talk 'PMR & VHF Repeaters' by Malcom Salmon, G3XVV. Braintree Community Association Centre, Victoria Street (next to Bus park), Braintree.

20 Sep Fylde ARS: Informal meeting The Kite Club, Blackpool Airport.
Midland ARS: Surplus sale.
Rugby ATS: 3rd Annual auction & barbecue. 7.30pm. Cricket pavilion, BTI Radio station, 'B' building entrance, A5 Trunk Rd, Hillmorton, Rugby.
Worksop ARS. Natter night
South Powys ARC: Social evening

21 Sep Cheshunt DARC: Talk. 'Aerial Basics' by G3TIK. Church Room, Church Lane, Wormley, Nr. Cheshunt, Herts. 8pm.
Wirral ARS: Equipment sale

22 Sep Mid-Sussex ARS: Informal meeting
Pontefract DARS: Talk 'QRP' by Rev. George Dobbs. 8pm. Carleton Community Centre, Carleton Rd, Pontefract.

24 Sep Pontefract DARS: Raynet exercise — 'Went Valley hike' 8pm. Carleton Community Centre, Carleton Rd, Pontefract.

25 Sep **RSGB HF Convention at Befry Hotel, Nr. Oxford.**
Harlow Rally

26 Sep RSGB City of Bristol Group: Talk 'Linear accelerators Part 2'. 7.30pm. Small Lecture Theatre, Queens building, University of Bristol.

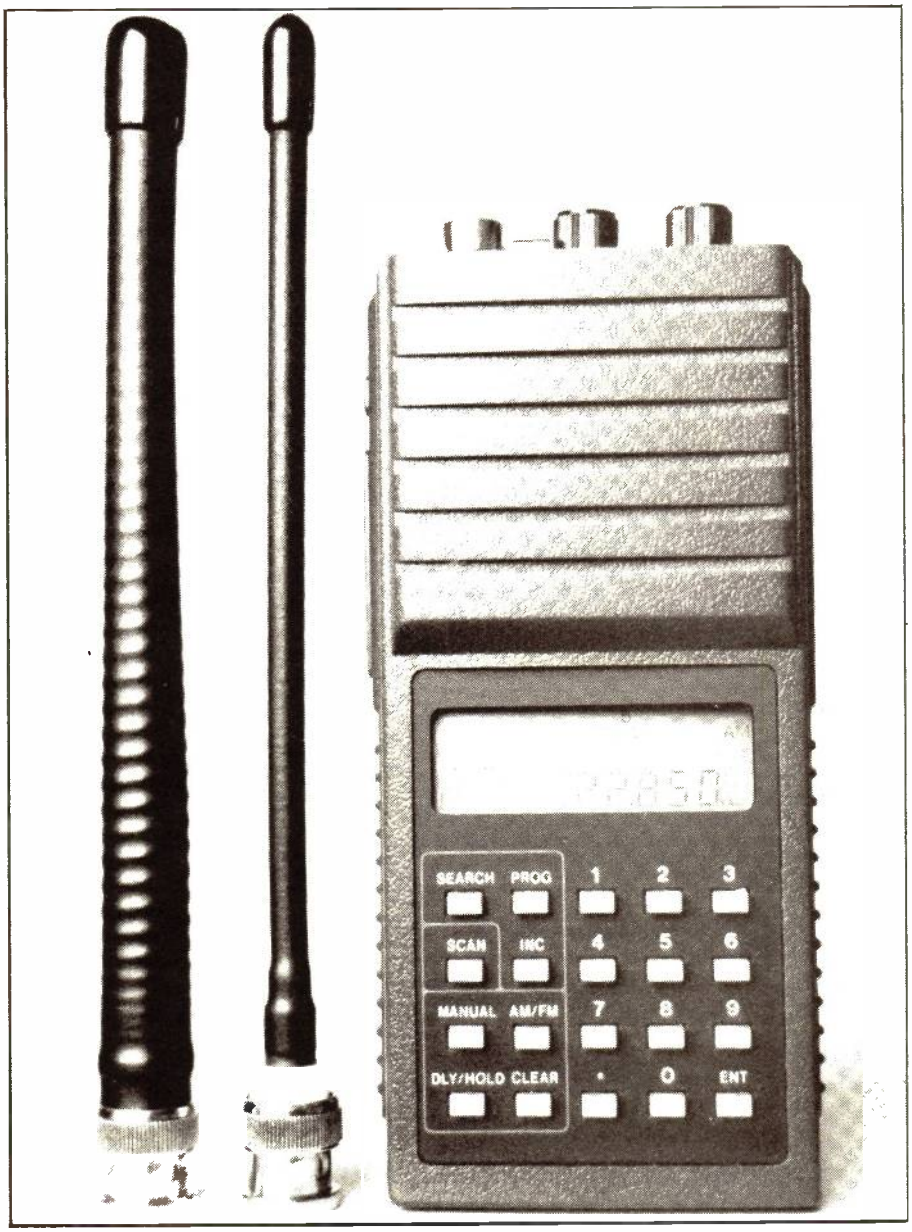
27 Sep Stevenage ARS: Committee meeting.
Dorking DRS: Illustrated talk 'Amateur radio in the USSR' by Al Slater G3FXB at Ashcombe School.
Worksop ARS: Talk, 'Simple Transceiver for Top Band' with Peter G4BVV

28 Sep Cheshunt DARC: Natter evening. Church Room, Church Lane, Wormley, Nr. Cheshunt, Herts. 8pm.

29 Sep Mid-Sussex ARS: Talk 'Weather Radar for Civil Aircraft' by Phil Stride G2BUY.
Pontefract DARS: On the air night 8pm. Carleton Community Centre, Carleton Rd, Pontefract.

30 Sep Coventry ARS: Night on the air and Morse tuition

AR800E Handy Scanner REVIEW



This handy scanner will reach parts (of the spectrum) which other scanners cannot reach — Chris Lorek puts it through its paces.

Handheld scanners have always been popular with UK radio listeners who are keen to 'never miss a thing', be they in the house or out and about on foot or mobile. At just under £200 the AR800E covers up to a maximum frequency of 950MHz, meaning that as well as the 2m and 70cm amateur bands it is the first handheld capable of receiving cellular frequencies. A few months ago it was reported that in Luton Crown Court, Judge David Rodwell ruled that car telephones fall outside the 1985 Telecommunications Act, suggesting it may now not be illegal to listen in on carphones using a scanner, very interesting!

Designed for the UK

The set covers 75-105MHz, 118-136MHz, 140-174MHz, 406-495MHz, and 830-950MHz, with selectable FM or AM throughout the range. This means that you are not restricted to AM only on the Aircraft band range — many two-way radio services in the UK operate on AM rather than FM, the latest UK frequency re-allocations adding to these. Another feature of the set is a selectable channel step size of 5, 10, or 12.5kHz to conform again with UK usage of 12.5kHz steps, on the 900MHz band 25kHz steps are automatically selected but with a 12.5kHz offset from the indicated frequency, again conforming to UK usage in this part of the spectrum. I'm sure there are many frustrated owners of American model scanners out there operating on FM only with the restriction of 5kHz steps!

Multi-mode Memories

Twenty memory channels are provided, each storing frequency,

mode, scan delay and lockout status. Direct channel entry into the required memory is possible by entering the frequency using the keyboard (followed by a press of the 'AM/FM' button to change from the default FM mode if required) then the memory channel number. Any of the memories may have a 'delay' programmed in to provide a two second pause before the scan resumed after loss of carrier, this allows monitoring of simplex conversations without the set whizzing off to scan other channels in between 'overs'. To prevent the scan locking up on busy repeaters or beacon channels, any of the memory channels may be locked out of scan mode as required, manual selection being performed by repeated presses of the 'Manual' button, the set stepping through all channels one by one.

A 'Search' mode is provided to let you scan between any two frequencies in the appropriate sub band, the search in this case may be programmed to halt when the set's squelch raises and not resume ('Hold' mode), or to continue scanning two seconds after the squelch closes ('Delay' mode). If the search stops on an interesting frequency, this may be entered directly into memory by a push of the 'Ent' button followed by the desired memory channel number. A front panel LCD (Liquid Crystal Display) panel shows the reception frequency, step increment, memory channel, mode, scan status and low battery indication.

Top view of the AR800, the large gap below the volume and squelch control belies its transceiver style case.

Top Panel

Top panel rotary controls are fitted for on/off/volume and squelch and alongside these are latching buttons for the LCD backlight and keyboard disable, together with 2.5mm and 3.5mm jack sockets for earphone and charger leads respectively. A BNC socket allows you to connect either the VHF 'rubber duck', UHF flexible whip or an external aerial when required. The set weighs 540g, and comes in a dark blue/grey plastic case measuring 130mm(H)×61mm(W)×44mm(D). It looks very similar to a two-way radio without an attached battery pack and indeed blanked-off panels are present where one would expect to find a PTT bar. Interestingly it is virtually identical in appearance and function to the Regency HX-850E handheld but with the added bonus of 900MHz coverage. The two set-top aerials are suppled together with a large steel belt-clip (which sported rather sharp edges) and a plug-in wall charger for the built-in nicad pack — however as is so often the case these days, the charger pins are not a satisfactory fit in UK 2 pin sockets. A short operating instruction sheet is provided with the unit, the review sample was supplemented by a set of explanatory 'help' notes expanding on this but no circuit or servicing information is supplied.

The mains charger — pins are not really designed to fit UK two pin sockets.

In Use

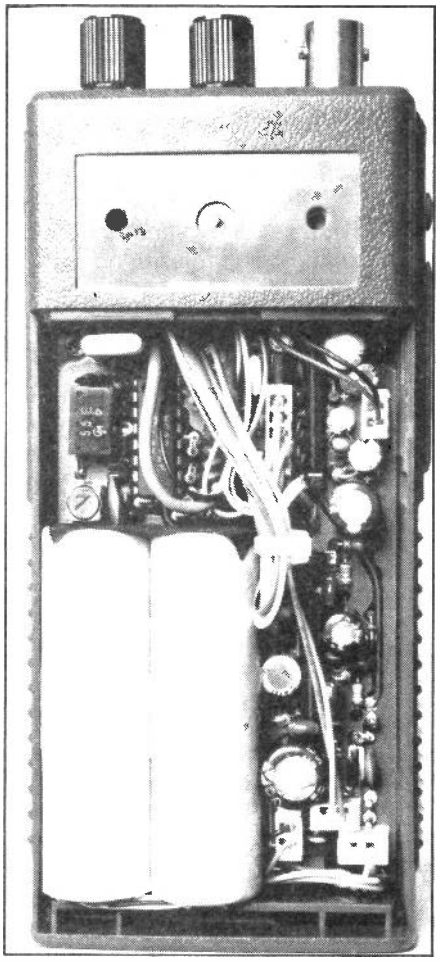
Following an initial charge of the nicads, I busied myself programming in the local 2m and 70cm repeater channels to get a 'feel' of how the set performed. I was pleased to find it was nicely sensitive on VHF — an area where many handheld scanners fall down badly for some reason. Operating the set whilst it was connected to an external discone aerial showed it was capable of pulling in many distant repeaters on 2m, but was rather less sensitive on UHF than a 70cm-only handheld, I also found that on UHF it often stopped scanning on what appeared to be strong buzzing noises. Further investigation showed that this was due to image reception of TV signals 42.8MHz higher than the indicated frequency.

This is of course a local problem, the video carrier of my regional IBA transmitter for instance was received

strongly on an indicated 452.45MHz in search mode, with strong AM sidebands on adjacent frequencies. Programming UHF channels 42.8MHz below the required frequency where possible, restored normality at the expense of an incorrect frequency readout. I must however say that this is a common problem with handheld scanners, the Regency HX-2000 (reviewed *HRT Jan 87*) for example giving an identical effect. Even so, I was pleased with the ability to enter such a wide range of frequencies, the shortcomings were easily forgotten!

The set fitted comfortably in the palm of my hand when walking around, and fitted nicely in my inside pocket or on my belt without feeling I was carrying a lead weight around. I found the belt clip a bit sharp a the edges, inspecting a further receiver sample showed it to be the same, this may have just been a 'batch' problem but I would advise caution. The internal nicads were capable of giving several hours worth of monitoring time before a recharge was necessary, a small 'BATT' indicator being displayed on the LCD panel warning that it was time to plug the charger in.

In common with other scanners there were a small number of 'birdies' present on some of the VHF frequencies causing the search to halt occasionally, however in normal use I found few problems. By pre-setting the 'search' frequency range, I could quickly change between scanning the memory channels for activity or searching out interesting conversations, a single button push switching between the two modes. The squelch sometimes had an annoying 'chatter' when receiving signals at the squelch threshold setting, causing the set to 'pop' repeatedly , I often had to re-



Internal shot of the radio, NiCad pack on the left with conventional descrete components used in the construction.

LABORATORY RESULTS

Sensitivity Input level required to give 12dB SINAD

Freq. (MHz)	Sig. Level
80	0.355 uV pd
90	0.368uV pd
100	0.951uV pd (AM)
120	0.637uV pd (AM)
130	0.508uV pd (AM)
140	0.286uV pd
145	0.290uV pd
160	0.415uV pd
170	1.130uV pd
410	0.355uV pd
430	0.805uV pd
450	0.597uV pd
470	0.565uV pd
910	0.603uV pd
930	0.697uV pd
950	0.791uV pd

Maximum Audio Output Measured at 1kHz on the onset of clipping

Load	Output
3 ohm	75mW
8 ohm	80mW
15 ohm	64mW

Current Consumption	
Scanning, Squelch closed	72mA
Receive, Mid Volume	84mA
Receive, Max Volume	116mA

Squelch Sensitivity	
Threshold	< 2dB SINAD
Maximum	15dB SINAD

Adjacent Channel Selectivity Measured as increase in level of FM interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD red. level to cause 6dB degradation in 12dB on-channel signal.

Spacing	Level
+ 12.5kHz	33dB
– 12.5kHz	31dB
+ 25kHz	63dB
– 25kHz	59dB

Blocking Increase over 12dB SINAD leve of FM inerfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal.

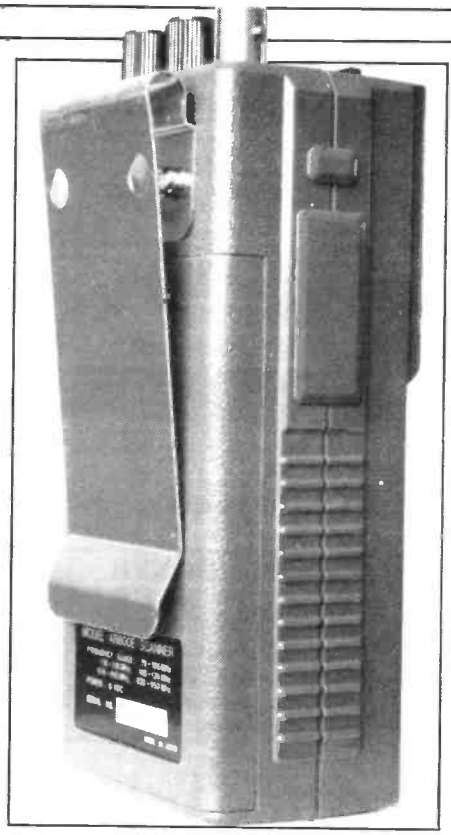
Spacing	Level
+ 100kHz	77dB
+ 200kHz	79dB
+ 1MHz	82dB
+ 10MHz	85dB

Intermodulation Rejection Increase over 12dB SINAD level of two interfering FM signals giving identical 12dB SINAD on-channel 3rd order intermodulation product

Spacing	Level
25/50kHz	51.5dB
50/100kHz	52.0dB

Image Rejection Increase in level of signal at first IF image frequency over level of on-channel signal to give identical 12dB SINAD singals

Freq.	Level
80MHz	19.0dB
145MHz	32.0dB
435MHz	– 1.7dB
935MHz	1.5dB



Rear view of the AR800 showing the belt clip — watch the sharp edges though!

adjust this control to give my ears the occasional rest.

LCD

The LCD was rather difficult to read when viewed from above as the set would normally be positioned when monitoring, and I often had to tilt the set at an angle to see what I was listening to. In my case this was only a minor consideration, as I often had the set placed where it could not be seen, but this could be a limitation for some listeners. There was enough audio available from the internal speaker for use in noisy street surroundings, and some to spare when operating indoors or while mobile, however I often used an earphone for private listening when shopping and the like to avoid getting odd looks whenever the set suddenly burst into life!

Although I've been a little critical, I must say that I together with many of my amateur friends who used the scanner were quite amazed by its versatility and small size, I believe one or two of them have now even become proud owners!

Laboratory Results

The measured sensitivity shows that the set should be capable of pulling in most signals, although this started 'tailing off' a little towards 174MHz and at around 435MHz. The squelch threshold sensitivity allowed the set to stop on very weak signals if required. The measured image rejection was, not surprisingly, very poor in common with most handheld scanners, this having the effect of the set receiving two fequencies at the same time which were separated by twice the receiver intermediate frequency. The adjacent channel selectivity was good, as was the strong-signal blocking performance from out-of-band signals which was better than I would have expected for a set in this price range.

My thanks to to Lowe Electronics Ltd. for the loan of the review model.

RETAIL NETWORK

Counties and regional classifications

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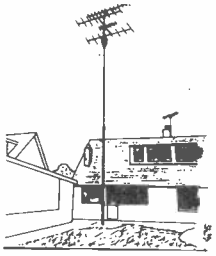

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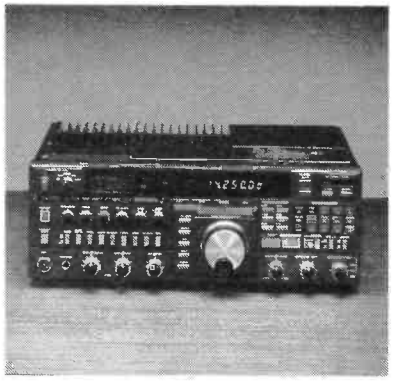

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