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# practical Wireless

FEBRUARY 1992 £1.60



**A Practical Guide To Making  
Printed Circuit Boards**

**Build The PW Challenger  
3.5MHz Receiver**

**Making It Even Smaller By  
Doug DeMaw W1FB**

**The Global GDO Mk.II Dip  
Meter Reviewed**

ISSN 0141-0857



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**Getting Started - The Practical Way**  
**Special Offer, CB High & Low, Newsdesk '92,**  
**Club News, Maths For The RAE and much more!**

# YAESU

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# Same Again Sir?

In the battle of the stations, the FT-990 all-mode HF transceiver is the clear winner. Based on the same remarkable performance, ease of operation and the features of the FT-1000. The FT-990 is an extraordinary achievement, compare the advantages yourself. Feel the silky smooth tuning, hear the dual digital SCF (Switch Capacitance Filter) provide unsurpassed reception quality never before obtained. Be heard with the CPU controlled RF FSP (RF Frequency Shifted Speech Processor) for the extra pile-up "PUNCH." See the lightweight and compact FT-990 with built-in AC switching power supply. The FT-990 is a true champion HF rig without compromise. Leave it only to Yaesu to offer powerhouse performance that leaves the rest far behind.



**FT-990**  
**HF All-Mode Transceiver**

- ✓ **Dual VFOs With Direct Digital Synthesis (DDS):**  
Two ten-bit DDS plus three eight-bit DDS.
- ✓ **High Dynamic Range:**  
108dB. RF circuit design with quad FET first mixer similar to the FT-1000 as only Yaesu's unsurpassed tradition can provide.
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- ✓ **Dual Digital SCF Filter and IF Shift, IF Notch:**  
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- ✓ **Automatic Mode-Dependant AGC Selection.**
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- ✓ **CPU Controlled RF FSP (RF Frequency Shifted Speech Processor):**  
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Option provides instant playback of 16-second receive memory, plus two 8-second or 4-second "CQ contest message" on transmit.
- ✓ **Built In Switching AC Power Supply:**  
Reliable performance with significantly reduced size and weight.
- ✓ **Band Stacking VFO System:**  
Each VFO register memorises your most recent operating frequency, mode, bandwidth and clarifier information for instant return to your favourite frequency and mode.
- ✓ **Accessories/Options:**  
ICXO-2 (Temperature Compensated Crystal Oscillator), XF-10.9M 202-01 (2nd IF SSB Narrow 2.0kHz), XF-44SC-251-01 (3rd IF CW Narrow 250Hz), SP-6 (External Speaker), MD-1C8 (Desk Microphone), YH-77ST (Headphones).

*Performance without compromise*

# practical Wireless

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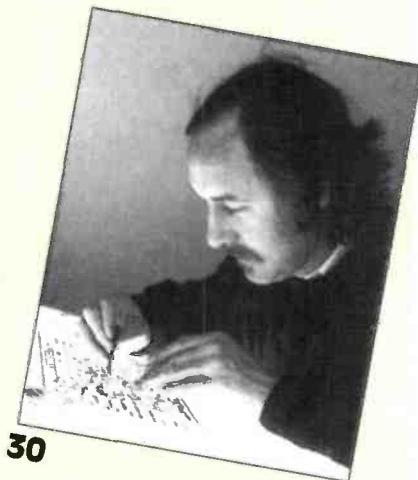
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Don't miss your flight to Dayton  
Hamvention, see page 21 for more  
details.

Morse Weekend.  
Contact the Editor for more details of our  
proposed special weekend.

We would like to wish everyone

## A HAPPY AND PROSPEROUS NEW YEAR

Now the shop has re-opened, we can offer you full demonstration facilities, with spares and service back-up on all 'STANDARD' equipment. We are also main agents for KENWOOD, YAESU, ICOM, ALINCO, and on the commercial side many of the well known brands such as Communique, Cleartone, Maxon, plus marine mobile and portable equipment so the next time you want to re-fit your luxury cabin cruiser, give me a call!

73 'de NORMAN



### STANDARD EQUIPMENT HAND HELD EQUIPMENT

	Inc VAT £
C528 Dual band 144MHz/430MHz transceiver (extended coverage)	379.00
C150 VHF FM 144MHz transceiver	230.00
C112 VHF FM 144MHz mini transceiver	230.00
C412 UHF FM 430MHz mini transceiver	293.75
C168 VHF FM 144MHz miniature hand held transceiver	269.00
C468 UHF FM 430MHz miniature hand held transceiver	279.00
C500ENB Dual band 144MHz/430MHz transceiver** including CNB111 nicad battery	335.000

### C150/C528 ACCESSORIES

CLC151 Carrying case C150 with CNB151 Battery	11.00
CLC152 Carrying case C150 with CNB152 battery	11.50
CLC528 Carrying case C528 with CNB151 battery	11.00
CLC521 Carrying case C528 with CNB152 battery	11.50
CMP111 Speaker microphone	35.25
CMP113 Tie-pin microphone	29.38
CMP115 Speaker microphone (small size)	34.08
CMB111 Mobile bracket	10.58
CMC150K Mobile charger for CNB150/151/153	14.69
CHP111 Headset with P.T.T. switch	34.00
CNB151 Nicad battery pack (7.2V - 700mAh)	42.00
CNB152 Hi-power battery pack (1.2V - 600mAh)	62.00
CBT151 Empty battery case for dry cells	10.75
CSA160E Desk top rapid charger for C150/C528 (replaces CSA150)	68.15
CWC150 AC charger CNB151 battery	13.25
CWC151 AC charger CNB152 battery	17.50
CTN150 CTCSS tone squelch unit	46.00
CTN520 CTCSS tone squelch unit	46.00
CTD150 DTMF unit for C500	35.75
CAW150 Power cable for mobile use	6.15
CAX02 Battery contact covers	4.11

### C164/468 ACCESSORIES

CAX03 Burton cover	4.50
CAX160 Remote battery adaptor	27.50
CAW150 Mobile power cable	8.80
CCA160 Charging sleeve	9.50
CTN160 CTCSS module	46.00
CMP111 Standard size speaker/mic	35.25
CMP115 Small speaker/mic	34.08
CHP111 Headset boom mic	34.00
CMP113 Tie-pin mic and earphone	29.38
CMB111 Mobile bracket	10.58

### MOBILE/FIXED EQUIPMENT

C5608D Dual band UHF/VHF 45W mobile transceiver RX coverage 100MHz - 1GHz	650.00
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### C5608D ACCESSORIES

CAW560 Dual microphone cable	24.50
CAW561 2 metre microphone extension cable	15.50
CAW562 4 metre microphone extension cable	17.90
CTN5680 CTCSS tone squelch unit	46.00
CTD5680 DTMF touch tone unit	46.00
TA208 Slim-line extension speaker (4-8 OHMS/5W)	13.50

### C112/412 ACCESSORIES

CLC412 Carrying case	10.75
CMP111 Speaker microphone	35.25
CMP113 Tie-pin microphone	29.38
CMP115 Speaker microphone (small size)	34.08
CMB111 Mobile bracket	10.58
CNB412 Nicad battery pack - Slim-line (7.2V - 400mAh)	42.00
CNB414 Nicad battery pack (1.2V - 600mAh)	62.00
CWC150 AC charger CNB412 battery	14.00

CCA412 Charging adaptor	9.70
CSA160E Desk top charger	68.15
CMA412 Mobile adaptor	19.95
CKP412 Keypad	25.00
CTD412 DTMF unit	46.00
CTN412 CTCSS tone squelch unit	46.00

### C500 ACCESSORIES

CLC500 Carrying case C500 with CNB111 battery	11.00
CLC501 Carrying case C500 with CNB120 battery	11.50
CMP111 Speaker microphone	35.25
CMP113 Tie-pin microphone	29.38
CMP115 Speaker microphone (small size)	34.08
CNB111 Nicad battery pack (3.5W - VHF/3.0W - UHF)	42.00
CNB120 Nicad battery pack (5W)	57.50
EBATT Empty battery case for dry cells	11.00
CSA111 Desk top charger CNB111 and CNB120 battery	62.50
C10/230-1 Plug-in charger CNB111 battery	15.50
CWC20 Plug-in charger CNB120 battery	16.30
CAD111 Charging adaptor for battery only	8.50
CAW120B Mobile adaptor for direct use from car battery	8.50
CMC01 Mobile charger car battery to CNB111 battery	16.00
CMB111 Mobile bracket	10.50
CHP111 Headset with P.T.T. switch	34.00
CTN500 CTCSS tone squelch unit	46.00
CTD500 Touch tone unit for use with remote control	39.00

### C164/468 ACCESSORIES

CLC160 Carry case for use with CNB160	11.75
CLC161 Carry case for use with CNB161	11.75
CLC162 Carry case for use with CNB162/163	11.75
CNB160 Nicad battery pack (6V @ 300ma)	40.00
CNB161 Nicad battery pack (7.2V @ 700ma)	43.00
CNB162 Nicad battery pack (1.2V @ 600ma)	70.00
CWC150K Wall charger for CNB160/161/163	14.69
CWC151K Wall charger for CNB162	17.50
CSA160E Desk top rapid charger for all nicads	68.15
CAW150 Mobile power supply cable	6.15
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CMU160 Memory unit - 30 channels	15.00
CMU161 Memory unit - 200 channels	18.50

### TONNA 144-146MHz 2m BEAM ANTENNAS

20804 4 element 8.9dbi gain "N" 0.93m long	32.00
20808 4 element crossed 8.9dbi gain "N" 0.93m long	41.00
20809 9 element 13.1dbi gain "N" 3.47m long	39.00
20089 9 element portable 13.1dbi gain "N" 3.47m long	39.00
20818 9 element crossed 13.1dbi gain "N" 3.47m long	65.00
20822 11 element crossed 14.1dbi gain "N" 4.62m long	95.00
20813 13 element 14dbi gain "N" 4.43m long	55.00
20817 17 element 15.3dbi gain "N" 6.57m long	69.00

### TONNA 144-432MHz 2m/70cms BEAM ANTENNA

20899 9 and 19 element "N" 3.65m long OSCAR	65.00
---	-------

### TONNA 430-440MHz 70 cms BEAM ANTENNAS

20909 435MHz 9 element 13dbi gain "N" 1.24m	33.00
20919 435MHz 19 element 16.2dbi gain "N" 2.82m	40.00

20438 435MHz 19 element crossed 16.2dbi gain 2.82m	48.00
20921 432MHz 21 element 18.2dbi gain "N" 4.6m	53.00
20922 438MHz ATV 2 element 18.2dbi gain "N" 4.6m	53.00

We also stock:-  
Diamond-Jaybeam-Cushcraft aerials +  
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Microphone and aerial plugs and sockets.

### SCANNERS

#### AOR 6.12.91 PRICE LIST

AR2000 Hand held receiver, 500kHz to 1300MHz	269.00
AR2500 Base, mobile, SSB 5-550MHz, 800-1300MHz. Computer control via RS232 port	419.00
AR2800 Base, mobile, SSB, 500kHz to 600MHz, 800 to 1300MHz. Built in nicad pack	395.00
AR3000(A) All mode base, mobile 100kHz to 2036MHz, no gaps. RS232 for computer interface	765.00
AR2002 25 to 550, 800 to 1300MHz NWF/MAM. N.B. Currently being discontinued	399.99
ARI500 New hand held, available late Jan 92. 100kHz to 1300MHz, as AR2000 plus SSB	300.00 Approx.

### OTHER EQUIPMENT

WX2000 Weather facsimile terminal and printer (complete). Expected Jan 92, price not fixed yet, but approx	900.00
MMI Mobile bracket for AR3000	11.00
ACEPAC3 Multi function for AR3000, IBM PC (software)	119.00
AR24 Commercial MSK 2400 baud modem	249.00
AR2400 As above but FSK version available on request	425.00

### YUPITERU HAND HELD SCANNERS AND ACCESSORIES

(All include nicads and charger 240V PSU)	
MVT-7000 200kHz-1300MHz WFM/NFM/AM 200 memories	289.00
MVT-5000 25-550 & 800-1300MHz NFM/AM 100 memories	249.00
VT12511 108-142MHz VHF AM air 25kHz steps	169.00
OP-50 Leatherette case for MVT 7000	13.95
JUP-1 (Spare) case and belt clip for 5000	5.11
JUP-2 (Spare) DC lead for MVT 7000/5000/125	2.95
JUP-3 (Spare) 4 x AA nicads for MVT 7000/5000	6.00
JUP-30 (Spare) 3 x AA nicads for VT-12511	4.50
JUP-4 (Spare) Charger/PSU for MVT7/5/125	14.95

### YUPITERU MOBILE/BASE SCANNERS AND ACCESSORIES

MVT-8000 200kHz-1300MHz WFM/NFM 12V inc. PSU	299.00
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JUP-40 (Spare) 240V AC PSU for MVT-6000	14.95

\*\*WHILE STOCKS LAST

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# KENWOOD



## GEAR UP

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### FM DUAL BANDER TM-732E

In the fast-moving world of mobile communications, Kenwood's new TM-732E FM dual-band transceiver is a winner. Despite its compact design, the TM-732E packs a host of advanced features such as dual receive (including VHF+VHF and UHF+UHF), built-in DTSS and pager functions. The detachable front panel has a high-visibility LCD display to provide instant intelligence on operational status. And on-the-move operation is

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Enjoy all advantages of these superior features: ■ Detachable front panel for maximum freedom of choice during installation (requires optional PG-4K/PG-4L kit) ■ Dual receive on same band (VHF+VHF or UHF+UHF) with one antenna ■ Audible frequency identification ■ Multi-function microphone ■ Built-in DTSS with pager function ■ Tone alert system ■ Separate speaker terminals for each band (switchable) ■ Automatic band change (ABC) ■ Multi-scan functions ■ 50 split memory channels or 64 simplex memory channels plus 1 call channel (switchable)

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TS-850S.....1399.000	FT-767GX.....1599.00
TS-450S.....1150.00	IC-765.....2550.00
TS-140.....880.00	IC-751A.....1535.00
TS-690S.....1325.00	IC-726.....1015.00
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FT-1000.....2995.00	IC-725.....779.00

Free 24 hour delivery

## NEW MFJ ANTENNA ANALYSER £99.95

**Model MFJ-207** This self powered analyser will let you measure hf aerial resonance, 1.8-30MHz, and VSWR without the need for any transmitter power. Simply connect to coaxial cable to measure VSWR and resonance. Ideal for rapid aerial design and installation. Great club investment!  
**£99 (£4.50)**



## Mic/TNC Switch

A great idea! Lets you have both TNC and mic permanently connected to rig. Just press to switch over. Suitable for all major brands inc. Yaesu ICOM Kenwood ALINCO etc. Comes with 8 pin plug ready wired.  
**£36.95**



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Models for 80/40/20M SSB/CW	
10 Watt linears single band	129.00
10 Watt dual band linears	199.00

## TONNA BEAMS



VHF/UHF  
All with "N"  
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2M	
20804 4 el	.....32.00
20808 4 el	.....41.00
20809 9 el	.....39.00
20089 9 el	.....39.00
20822 11 el	.....95.00
20813 13 el	.....55.00
20817 17 el	.....69.00
70cm	
20909 9 el	.....33.00
20919 19 el	.....40.00
23cm	
20623 23 el	.....39.00
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80M 20m	.....96.95
40M 20m	.....51.95
20M 10m	.....63.95
50 ohm 100W	

## MICROSET POWER SUPPLIES & LINEARS



### MAST HEAD PRE-AMPLIFIERS

PR-145.....2M 100 Watt 16db gain — 0.9db NF	.....75.00
PRH-145.....2M 500 Watt 18db gain — 0.9db NF	.....109.00
PR-430.....70cms 100 Watt 15db gain — 1.2db NF	.....85.00

### MICROSET POWER SUPPLIES

PT-107.....7Amp 13.5V fully protected (non meter)	.....49.00
PT-110.....10Amp 13.5V fully protected (non meter)	.....69.00
PC-110.....10Amp 13.5V fully protected with meter	.....89.00
PT-120.....20Amp 13.5V fully protected (non meter)	.....119.00
PC-120.....20Amp 13.5V fully protected with meter	.....149.00
PT-135.....30Amp 13.5V fully protected (non meter)	.....149.00

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R-25.....2m 1-4W in 30W max out SSB/FM	.....79.00
RV-45.....2m 3-15W in 45W max out SSB/FM	.....99.00
R-50.....2m 1-7W in 50W max out SSB/FM	.....99.00
SR-100.....2m 4-25W in 100W max out SSB/M	.....159.00
SR-200.....2m 10-50W in 200W max out SSB/FM	.....289.00
VUR-30.....2m/70cms 1-6W in 20/30W max FM	.....229.00
RU-20.....70cms 0.8-3in 15-20W max out SSB/FM	.....119.00
R-432-90.....70cms 6-12in 80-90W max out SSB/FM	.....389.00

## Electronic Keyer £69.95



**Model MFJ-407B** is a budget price electronic keyer that is remarkable value. Operating from internal or external source it provides conventional or iambic keying at speeds from approx 5-50 WPM. Controls include tone, speed, weight and volume. (Needs paddle key).

## AMERITRON HF LINEARS

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This linear is incredible value. We have put it through its paces and it really stands abuse. 3 rugged 811A tubes provide up to 600 Watts output from 160-10m. A hunky mains transformer and full metering is included. Used by DX-peditors it has to be amazing value at **£699 inc VAT**

**AL-80AX 1KW** from 160-10m 3-500z tube. **£1099.00**  
Other Ameritron linears are available. Send SAE today.

## MFJ Products from Stock! 300W HF ATU



The MFJ-948 is a complete 300 Watt aerial matcher in one box. It will match coaxial, balanced feeder, and single wires. A dual needle VSWR/Power meter makes adjustment simple and a 3 way aerial switch completes the package. Fantastic value! **£129.00**

### Other MFJ Products:

MFJ-949D	ATU as above but with 300W dummy load.	149.00
MFJ-901B	ATU less switch load and meter. Super!	69.95
MFJ-264	1.5kw dummy load. DC-650MHz	69.95
MFJ-260B	300W dummy load DC-160MHz	35.95
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MFJ-812B	144MHz 30/300 Watt power meter	31.95
MFJ-110	Fabulous world clock with map	29.95
MFJ-32	Packet radio handbook. Super guide!	4.95
MFJ-1286	Gray Line Graphics Programme for IBM	32.95
MFJ-1281	Easy DX logging programme	41.95
MFJ-1040	1.8-54MHz tx/rx preselector	99.95
MFJ-1020A	Indoor active antenna station. 0-30MHz	84.95
MFJ-1272B	TNC/Microphone interface	36.95
MFJ-722	Superb rx audio filter	89.95
MFJ-752C	Tunable audio filter	109.95
MFJ-207	Antenna analyzer. Brilliant idea!	99.95
MFJ-557	Self contained CW practice key and oscillator	29.95
MFJ-407B	Electronic keyer. 8-5-WPM Self powered	69.95
MFJ-931	Artificial HF ground unit. Ideal for flats etc.	Phone
BY-1	Genuine Bencher Paddle. A precision product	69.95
MFJ-704	HF Low Pass Filter	Phone
MFJ-106B	Dual time deck top clock. LCD Display	Phone

## DIAMOND

### VSWR/POWER METERS

SX-100.....1.6-60 MHz, 30w-300w-3kw	.....97.00
SX-200.....1.8-200 MHz, 5.20-200 watts	.....69.00
SX-400.....140-525 MHz, 5-20-200 watts	.....79.00
SX-600.....1.8-525 MHz, 5.20-200 watts	.....125.00
SX-1000.....1.8-1300 MHz, 5-20-200 watts	.....165.00
SX-2000.....1.8-200 MHz, 5-20-200 watts AUTO	.....95.00
SX-9000.....1.8-160 & 430-1300 MHz, AUTO	.....190.00

### BASE STATION ANTENNAS

CP-4.....10-15-20-40m vertical with radials	.....149.00
CP-5.....10-15-20-40-80m vertical with radials	.....195.00
CP-6.....6-10-15-20-40-80m vertical with radials	.....209.00
D-130N.....Discone 25-1300 MHz, 50 FT cable	.....82.95
CP-22E.....2m 2 X 5/8 6.5dB gain omni directional	.....45.00
D-707.....Active rx. 1.5-1300 MHz 12V	.....99.00

### FIBREGLASS VERTICALS

X-50.....2m/70cms 4.5/7.2db gain 1.7m long	.....59.95
X-300.....2m/70cms 6.5/9db gain 3.1m long	.....95.00
X-500.....2m/70cms 8.3/11.7db gain 5.2m long	.....119.00
X-700.....2m/70cms 9.3/13db gain 7.2m long	.....219.00
V-2000.....6m/2m/70cms 2.15dbi/6.2db/8.4db 2.5m	.....95.00
X-5000.....2m/70cms/23cms 4.5/8.3/1.7 db 1.8m	.....109.00

### MOBILE ANTENNAS AND MOUNTS

NR-2000M...23cms/70cms/2m mobile whip PL259	.....49.95
D-505.....Active rx. antenna 1.5-1300MHz 12v	.....69.00
NR-770R.....2m/70cms whip PL-259	.....35.00
NR-790.....2m/70cms 4.5/7.2 db gain 100 Watts	.....48.00
SG-7900.....2m/70cms whip 5.0/7.5 db supergainer	.....68.00
DP-2HE.....2m 1/4 wave whip PL259	.....6.95
M-285.....2m 5/8th whip PL259	.....15.95
EL-2E.....2m 7/8th deluxe whip PL259	.....33.95
NR-07C.....70cms mobile whip P1259	.....25.00
AM-L.....Gutter mount fold over type	.....12.95
EC-H.....PL259/SO239 cable kit for DP-GL	.....9.95
SP-M.....Heavy duty magnetic mount with cable	.....25.95

## NEW! CX-401 GLOBAL 4 WAY SWITCH SO239 + EARTH POSITION

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**DJ-S1E**

The DJ-S1E for 2 metres provides the ideal answer for those who need a low cost, compact, yet comprehensive handheld. Requiring 6 AA cells, this transceiver features LCD readout, 40 memories, scanning, battery save, programmable steps, 3 power levels, call channel, illuminated dial, rotary tuning and 5 Watts maximum power output (12V DC).

**£179.00**

**DJ-F1E**

The DJ-F1E for 2 metres has all the features of the DJ-S1E but includes full keypad control, 700mAh ni-cad pack and universal AC hdd charger. Acknowledged as the fastest selling handheld, its additional features include DTMF, Pager and Code Squelch, Priority, Reverse repeater, illuminated keypad, auto power off, electronic tuning etc.

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Icom now offer two new handhelds, which combine a 144MHz or 430MHz transceiver with wideband receive capability.

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VHF and UHF frequencies plus simultaneous 2-frequency receive capability are within your reach. Choose from a ham band signal and another from FM broadcasting, TV audio, VHF air band, marine band and more in the AM, FM or wide-FM mode.

This feature also enables simultaneous 2-frequency receiving on the ham band or cross-band QSO with a dual band FM transceiver.

\*specification guaranteed: 50 - 905.

## Complete and compact

These ruggedly-built, splash-resistant handhelds fit snugly into your hand.

## Full 5 Watt output power

By connecting an external 13.5 ~ 16V DC power supply, a full 5 Watts of output power is available. You can choose 3.5W, 1.5W or 500 mW of low output power.

Product shown larger than full size.

## Separate indications and controls

The large easy-to-see function display with lighting shows operating frequencies, S-indicators, and memory or call channels for both bands. Independent volume and squelch controls allow you to change settings in each band separately.

## 24-hour clock with an ON/OFF timer

This function can be used for convenient scheduled QSO and standby receiving, turning the transceiver ON and OFF as specified to conserve battery power.

Appearing simultaneously are the clock and transmit frequency for total monitoring capability.





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- ★ DVS2 speech recorder option
- ★ Computer controllable
- ★ Optional internal or remote A.T.U.
- ★ D.D.S. circuitry
- ★ Optional SSB narrow filter

## FT-990 HF TRANSCEIVER



- ★ Amateur bands 160-10m
- ★ General coverage receiver
- ★ 100W output (25W AM carrier)
- ★ 50 memories
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Based on the remarkable performance and easy operation of the FT-1000, Yaesu's new FT-990, combines the basic technical features of that top-of-the-line model with several recent advances resulting in a spectacular performer at a very reasonable price.

Utilising Direct Digital Synthesisers (DDS) and the extremely quiet receiver circuitry of its big brother, the FT-990 delivers silky smooth tuning, pure local signals and clear reception of even the weakest stations.

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*You might just fall in love!*

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#### BALUNS

CEL-30	1:1	1.7-30MHz	1kW P.E.P.	£18.95	A
CEL-2000	1:1	0.5-60MHz	2kW P.E.P.	£25.50	A

#### HANDHELD ANTENNAS

CH72S	2m/70cm	BNC 0dB/3.2dB	2m/70cm	£12.25	A
CH-6MX	2m/70cm/23cm	+ RX 120/300/800/900MHz		£23.50	A
CH1200WS	23cm	5.6dB		£TBA	A

#### MOBILE ANTENNAS

CA-7HR	40m	monobander		£33.95	B
CA-14HR	20m	monobander		£33.95	B
CA-21HR	15m	monobander		£33.95	B
CA-50HR	6m	monobander		£33.95	B
CA-285	6m/2m	dualbander		£20.75	B
B22	2m/70cms	dualbander (black)		£26.85	B
CA2x4MB	2m/70cm	4.5dB/7.5dB	2m/70cm	£38.50	C
CA2x4KG	2m/70cm	6.0dB/8.4dB	2m/70cm	£40.75	C
CX-702	6m/2m/70cms	tribander		£46.95	B

#### DUPLEXERS

CF-305	50/144	duplexer UHF conn		£25.00	B
CF416B	144/430	duplexer UHF/N conn		£26.00	B
CFX-514	50/144/430	triplexer UHF conn		£36.75	B
CFX-431	144/430/1200	triplexer UHF/N conn		£36.75	B

#### MOUNTS

TBR	Adjustable	trunk mount		£11.50	B
RS-9	Mini	trunk mount (black)		£6.25	A
RS17	Mini	trunk mount		£12.75	A
RS16	Mini	gutter mount		£12.75	B
CKL-3LX	Mini	cable cassy for RS16/RS17		£16.25	B

#### MINI MOBILE ANTENNAAS

B10	2m/70cms	mini dualbander (black)		£16.95	B
CHL21J	2m/70cm	0dB/2.15dB	2m/70cm	£14.75	B
CHL23J	2m/70cm	2.15dB/3.8dB	2m/70cm	£17.35	B

#### BASE ANTENNAS

CA350DB	6m/10m	2.15dB/6.5dB		£139.00	D
CA2x4MX	2m/70cm	8.5dB/11.9dB		£102.12	C
CX-725	6m/2m/70cm	2.15/6.2/8.4dB		£76.63	C
CX-902	6m/2m/70cm	6.5/9.0/9.0dB		£79.95	C

#### FILTERS

CF-30MR	HF cut off	32MHz	1kW P.E.P.	£38.75	B
CF-50MR	6m cut off	54MHz	1kW P.E.P.	£38.75	B
CF-30H	HF cut off	32MHz	2kW P.E.P.	£80.75	A
CF-30S	HF cut off	32MHz	150W cw	£19.35	A
CF-50S	6m cut off	57MHz	150W cw	£20.35	A
CF-BPF2	2m	band pass	150W cw	£31.65	A

#### METERS SWR/PWR

CM-420	2m/70cm	15-50W	mini	£36.75	B
CD-120	1.8-200MHz	15/60/200W		£76.60	B
CD-160H	1.6-60MHz	20/200/2000W		£90.85	B
CD-270D	140-525MHz	15/60/200W		£79.65	B

#### COAX SWITCHES

CSW-20	2-way	DC-1000MHz	SO239	£26.50	A
CSW-20N	2-way	DC-1500MHz	N	£45.95	B

#### ACCESSORIES

CEP-M2	Earphone	3.5mm	jack	£1.28	A	
CES-M2	Mini clip	on speaker	3.5mm	jack	£5.62	A
CHM-M4	Mini mic	+ PTT	2.5mm	jack	£9.15	A

Prices for postage on all the above items are coded as follows:

A = £1.95	D = £11.00
B = £4.75	E = £16.50
C = £6.60	

### POWER SUPPLIES FOR ALL REASONS

The Daiwa range of power supplies is proving very popular for all types of applications, both for the professional user and the hobbyist alike.

From the smallest 9A continuous PS120MkII, via the extremely popular 24A PS304, to the top of the range 32A continuous RS40X. All the Daiwa range of PSU's feature variable voltage from at least 3-15V and switchable voltage 1 current metering. Both the PS304 and RS40X have a cigar lighter socket, convenient for powering your handheld.

Also available from Daiwa are some good quality SWR/PWR meters and coax switches.



#### POWER SUPPLIES

PS120 M2	3-15v	Variable	9A/12A max	£69.95	C
PS304	1-15v	Variable	24A/30A max	£129.95	D
RS40X	1-15v	Variable	32A/40A max	£109.00	D

#### COAX SWITCHES

CS201	2 Way	SO239	DC-600MHz	1kW	£13.95	A
CS201G2	2 Way	N	DC-2GHz	1kW	£27.50	A



#### SWR METERS

CN101	1.8-150	MHz	15/150/1500W	£59.95	B
CN103N	150-525MHz		20/200W N	£69.95	B

#### LINEAR AMPLIFIER

LA208H	2m	1.5-5W	in	30-80W	out	£159.95	C
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## SECOND-HAND EQUIPMENT

Below is a selection of second-hand equipment available from our H.Q. showroom - contact individual branches for details of their current second-hand stock.

#### HF TRANSCEIVERS

				inc V.A.T.
FT1000	Shack	HF200W	General RX dual VFO	S/S 2650.00
FTONE	Shack	HF100W	General RX/TX ham	S/H 895.00
FTONE	Shack	HF100W	Comes with all options	S/H 1195.00
FT980	Shack	HF100W	General RX/TX ham	S/S 895.000
FT107 (12V)	Shack	HF100W	Transceiver	S/H 499.00
FLO00	Shack	HF500W	L/amplifier	S/S 1299.00
FL2500	Shack	HF1KW	L/amplifier	S/H 299.00
IC275	Mobile	HF100W	General RX/TX ham	S/H 625.00
FT102	Shack	HF100W	Transceiver	S/H 639.00
FT70G	Mobile	HF10W	Transceiver	S/H 379.00
FT400C	Shack	HF100W	10ch. xtal comm.	S/S 199.00

#### VHF/UHF TRANSCEIVERS

FT711RM	Mobile	UHF	70cm 25W	S/S 295.00
FT290R	Port	VHF	2mt 3W nicads	S/W 249.00
FT2700RH	Mobile	VHF/UHF	dualband 25W	S/H 325.00
FT23R	Port	VHF	3/5W Handheld	S/H 169.00
HL1K/6	Tokyo	VHF	1KW Tube L/amp	S/S from 699.00

#### VHF/UHF TRANSCEIVERS continued

				inc V.A.T.
LPM144-3-100	Bnos	VHF	L/amplifier	S/S 235.00
MMLA32/50	M/modul.	UHF	L/amplifier	S/H 99.00
FTV107	Yaesu	Transverter	2mt 10W	S/H 169.00

#### RECEIVERS

FR101	HF RX	Comes with FM + VHF converters	S/H 249.00
FRG9600	Scanner	VHF/UHF 60-905MHz RX	S/H 379.00
NRD525	JRC	HF/SW General RX m/mode RX	S/S 859.00
MX7000	Scanner	VHF/UHF 25-1300MHz RX	N/O 349.00
FRG7	HF/SW	General RX 150KHZ-30MHZ	S/H 149.00
FRDX500	HF	Hamband RX	S/H 159.00

#### DATA/COMPUTER

FIF232C	Yaesu	RS232	Radio interface	S/S 59.00
FIF80	Yaesu	RS232	Radio interface	S/S 25.00
MMT4001	T/unit	RTTY, CW	comes with keyboard	S/S 159.00
MM1000		ASCII	to morse conversion	S/S 49.00
RM1	modem	RS232-TTL	interface	S/S 69.00



- Up to £1000 instant credit, a quotation in writing is available on request, subject to status.
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# REOPENED!

Many amateurs and short wave listeners in London and the South East were saddened when KW was forced to close back in October. However, KW has reopened, under new ownership and management — breathing fresh life into the world of hobby radio.

We'll still be stocking a wide range of equipment and accessories, carefully preselected to give you quality and value for money — and to make sure if things do go wrong, WE CAN BACK IT UP! We'll have everything you need from morse keys to datacoms and can supply complete stations from mains plug to antenna.

Our policy is try before you buy and that is why all our demonstration equipment is up and running, waiting for you. If you really want to be sure, bring in your old rig for comparison! (We'll be happy to let you trade it in!)

By the time you read this, the show-room should be full of the latest HF transceivers, VHF mobiles and handhelds. We'll also have receivers, scanners, PSUs, SWR bridges, etc etc. A quick look at our brand list will show roughly what we do — if it's not there — ask! We're here to help! The map shows where we are, and we're easy to find, and we're open six days a week.

I look forward to seeing you very soon and to welcoming you to the biggest and brightest emporium in the country!

73 TOM CROSBIE G6PZZ

## KENWOOD



TS 450S.....£1298	TS 850S.....£1399
TS 450SAT.....£1150	TS 850SAT.....£1547
TS 690S.....£1325	TS 950SD.....£2995

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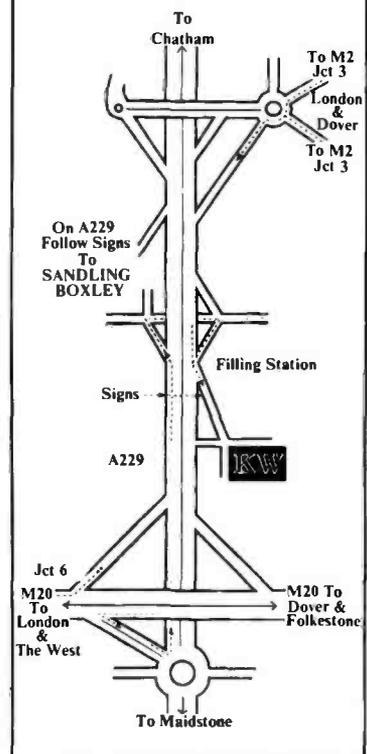
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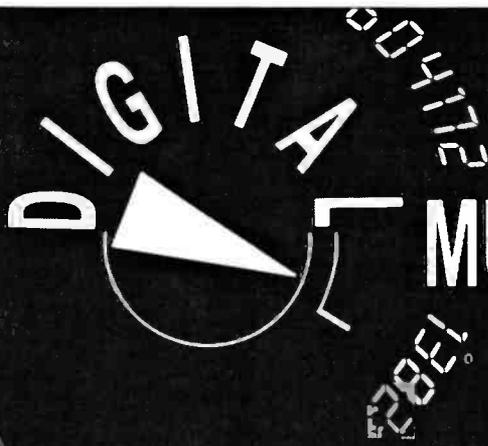
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**Autoranging.** Features diode-check, auto polarity. Easy-to-read LCD display, low-battery indicator. Measures AC/DC volts, DC current and resistance. Fuse protected. Requires 2 "AA" batteries. 22-166 ..... **£29.95**

**MINI DMM**

**£22.95**

**Mini DMM.** With built-in test leads. Measures 1000 VDC, 750V AC, 200mA DC current. Resistance to 2 megohms. Built-in transistor checker NPN/PNP hFE, 1.5 and 9v battery checker. Requires 9v battery. 22-9022 ..... **£22.95**

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- FT-736R Quad band base with 2/70+6m fitted, just how many are left?? ..... £PHONE
- FT-767GX A complete Ham Shack in one box, HF/2/6/70, ATU/PSU ..... £PHONE
- FT-5200 Remote head dual-band mobile ..... £PHONE
- FT-26R Successor to the FT-23 series. Wide band receive included! ..... £PHONE
- FT-76R As above, but on 70cm FM. Wide band receive included! ..... £PHONE
- FT-470R Dual band handie, FNB10 NiCad/charger special offer.....£319



IC-735

**KENWOOD**

- TS-950SD Top of the range HF base station from Kenwood ..... £PHONE
- TS-850S The budget alternative to the 950 ..... £PHONE
- TS-450S Still using an FT-707? Forget it! I'll give you £350 TRADE-IN! ..... £PHONE
- TS-690S The same modern design HF all mode Gen. Cov. But with 6m ..... £PHONE
- TM-741E Five pages of super mods for this one - only from Martin Lynch ..... £PHONE
- TM-241E 50W on 2m with modified wide band receive ..... £299
- TH-77E Dual band handie very compact ..... £PHONE



FT-767

**ICOM**

- IC-970E/H The best 2m/70cm/23cm Base station ..... £UNPRINTABLE
- IC-735 Several immaculate trade-ins available, save over £250! ONLY ..... £749
- IC-725 The tough alternative to "BUDGET" HF operating ..... £PHONE
- IC-726 As with the IC-725 but with 6m fitted ..... £PHONE
- IC-R7100HF Latest wide band receiver - with Icom approved HF conversion.....£1120
- IC-W2E New dual-band Handie, December prices were good, but January? ..... £UNBEATABLE
- IC-2SRE 2m + scanner, expensive, but usual ICOM technology and build quality ..... £PHONE
- IC-4SRE As the IC-2SRE but this time on 70cm transceiver and W/B scanner ..... £PHONE
- IC-P2E The latest sub-miniature 2m handie from Icom in stock ..... £PHONE
- IC-P4E As per the IC-P2E but on 70cm ..... £PHONE
- IC-R1 Sub miniature pocket scanner. Ex-demo's from only ..... £PHONE



TS-850

**ALINCO**

- DJ-560E Dual band handie with NiCads/charger/CTCSS/DTMF W/B RX ..... £299
- DJ-F1E 2m Pocket TCVR with AM Airband RX! FREE case ..... £PHONE
- DJ-S1E As above without K/B or NiCads and charger ..... £PHONE
- DJ-X1E Latest miniature wide band scanner - in stock! ..... £PHONE
- DR-599E New dual band mobile remote head high power.....£PHONE



FT-1000



IC-R7100HF



TS-950SD



IC-725



FT-736R

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**73 MARTIN G4HKS**

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24 hour Sales HOT LINE 0860 339 339 (after hours only.)  
FAX order line open 24 hours.

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OR SELLING...  
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NOW!**

In addition to new transceivers and accessories, don't forget I still have the largest selection of used equipment available in the UK. I am very willing to take your equipment in part exchange - Phone with your requirements NOW!

# Keylines

In my opinion, the heart of the radio hobby today is still the local club. Without the various clubs spread throughout the land, radio enthusiasts would be in trouble.

Behind each club, there's usually at least two or three very hard working people - the committee. They struggle to bring in interesting speakers, arrange events and encourage new members. They often struggle even harder to extract annual subscriptions from members!

What makes the work of the club committee even more remarkable, is that very often they've been in the job for many years. They're usually re-elected, because either no-one else wants the job, or because members are more than happy to let someone else do the organising. Apathy rules, okay?

## Helping The Committee

Helping the committee to run the club, is something we should all be doing, but we often don't do it very well. In the east Dorset area, I know of one very keen and dedicated amateur who is involved with the running of two clubs - if one wasn't enough!

How many clubs do you know, where the office of honorary secretary and treasurer are combined? I know of at least two clubs in the UK where one person (in the case I'm thinking about, a

lady is involved) has three jobs, and these dedicated people need all the help they can get!

So, this year I am going to make it my personal crusade to help clubs. I intend to support the hard-worked officials and keen members, as much as possible. In fact, we have already started, and as a result *PW* is being overwhelmed with club news, and information on what you are organising.

## Bursting At The Seams

Our re-introduced 'Club News' page has proved so popular, that it's bursting at the seams every month. So much so, that Steve Hunt, our art editor, has had to really shrink the typeface to get all the information on the page.

Although we are very pleased to try to get all the information in, the very small print isn't easy to read and the page looks very plain. This uninviting look is a great disadvantage to a page that provides an excellent insight into what's going on throughout the UK (and abroad).

The page has become so full of information, that clubs are now reporting new members have been attracted by the information printed on the page. This is exactly what we are aiming at - new blood!

But, if the page is so densely-packed that it requires a magnifying-glass,

potential readers may be put off the page. So, to avoid having to provide a magnifying glass (as I jokingly suggested in last month's 'Receiving You') we've come up with another idea.

## Club Co-operation

In return for the co-operation of radio clubs and groups, we have decided that 'Club News' will be allocated two pages whenever necessary. However, that doesn't mean you can all write more news! It does mean though, that if you all keep the information to the briefest notes possible, we will be able to use larger print.

**Please try to provide just enough material about your club until the next *PW* is published. Clubs or groups that don't have regular meetings, or are spread throughout the UK, Europe or the world, will be mentioned whenever possible.**

I don't want to be forced to introduce any form of 'turn and turn about' system.

**There's room for everyone if you keep it short!**

We are also planning to include photographs featuring local clubs. So, if you want to see **YOUR** club members and QTH on the pages...get those shutters snapping!

## Club Photographs

The club photographs

should be sent to *PW*'s News editor, Sharon George. The more interesting the pictures are, the better. I've already been promised a photo of a prominent member from a club in the English Midlands, working 'stroke P' (/pachyderm?) on 144MHz, while on an elephant ride (I'll believe it when I see it!).

Pictures on a page densely packed with text can put some people off. It's unfortunate if readers are put off the club news section. Many groups tell me that they get ideas for their clubs, from other people's published activities. The old argument that radio enthusiasts only want to read about their own club's activities, seems to be a myth.

Don't forget, that cheery photo of your club 'Natter Night', or the hilarious constructional effort from your recent 'Desert Island Radio' contest, could bring you new members. The pictures could also start a few 'club twinning' arrangements up and down the country (why not abroad?), and that, surely can't be a bad thing can it? You never know, you could even talk to each other on the bands!

73 DE  
Rob Mannion  
G3XFD

# Services

## Queries

We will always try to help readers having difficulties with a *Practical Wireless* project, but please note the following simple rules:

- 1: We cannot give advice on modifications to our designs, nor on commercial radio, TV or electronic equipment.
- 2: We cannot deal with technical queries over the telephone.
- 3: All letters asking for advice must be accompanied by a stamped, self-addressed envelope (or envelope plus IRCs for overseas readers).
- 4: Make sure you describe the query adequately.
- 5: Only one query per letter please.

## Back Numbers & Binders

Limited stocks of many issues of *PW* for past years are available at £1.65 each including post and packing.

Binders, each holding one volume of *PW* are available price £5.50 each (£1 P&P for one, £2 for two or more).

Send all orders to the Post Sales Department.

## Subscriptions

Subscriptions are available both for the UK and overseas. Please see current issues for the latest prices.

## Constructional Projects

Each constructional project is given a rating to guide readers as to its complexity.

**Beginner:** A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently.

**Intermediate:** A fair degree of experience in building electronic or radio projects is assumed, but only basic test equipment is needed to complete any tests and adjustments.

**Advanced:** A project likely to appeal to an experienced constructor and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Definitely not recommended for a beginner to tackle on their own.

Components for our projects are usually available from advertisers. For more difficult items a source will be suggested in the article.

The printed circuit boards are available, mail order, from the Post Sales Department.

## Mail Order

All *PW* services are available Mail Order, either by post or using the 24hr Mail Order Hotline (0202) 665524. Payment should be by cheque (overseas orders must be drawn on a London Clearing Bank). Access, Mastercard or Visa please.

# Receiving You



Send your letters to the editorial offices in Poole. They must be original, and not duplicated in any other magazine. We reserve the right to edit or shorten any letter. The views expressed in letters are not necessarily those of *Practical Wireless*. The Star Letter will receive a voucher worth £10 to spend on items from our Book, PCB or other services offered by *Practical Wireless*. All other letters will receive a £5 voucher.

## Dear Sir

I am writing about the Morse-Master, published in *PW* June 1991. I have now completed two and find they work well at 5V. I've eliminated the battery pack and now use my shack supply of 13.8V running into a 5V regulating circuit using a 7805 regulator. The 5V circuit is easily built on a piece of Veroboard. As I send c.w. to friends who are learning Morse, three evenings a week, it is more convenient than using batteries.

Keep up the good work *PW* and my best wishes to you and your staff. By the way, I'm the chap who drops into your office during the spring bank holidays. Hope to see you again soon for circuit boards.

**E. A. Parr GOEMX**  
Earlsdon  
Coventry

**Editor's comment:** Thanks for the modification tip Mr Parr, we're always interested to hear about modifications to *PW* projects. I hope your friends pass their Morse exam soon. Perhaps we might even see them taking their Morse Test during our proposed Morse Weekend in the late spring/early summer (further details in January 'Keylines').

## ★★★ STAR LETTER ★★★

### Dear Sir

I am presently taking the RAE course at Rayleigh in Essex. I am finding it very enlightening, if at times hard going, having left school some 25 years ago!

I have though, been doing a lot of listening on my scanner, and one thing I have noticed is the frequent use of Q-codes on 144MHz. In the RSGB's *RAE Manual* and elsewhere, I've read that the use of Q-codes on 'phone is bad operating practice. It is to be avoided unless reception is poor, or there is a language difficulty. Have Q-codes now become accepted for general use on 144MHz?

**Alan Radley**  
Thundersley  
Essex

**Editor's reply:** You have posed an interesting question Alan. My family have often said that radio amateurs use too much jargon. Perhaps the Q-code has turned into jargon, rather than being a useful c.w. 'shorthand' for often used terms and statements. What do you think readers, do we abuse the Q-code on the air (not just on 144MHz) and in conversation or not?

## PW October 1992 Issue

We particularly need reader's letters with memories of *PW* for the Diamond Jubilee issue. Get writing - it's your special celebration too!

### Dear Sir

I have been interested in radio for many years. During this time I have collected and read many articles written by F. C. Judd G2BCX. Possibly, like many others who have an interest in radio, I have learnt a lot from Mr Judd, especially his excellent articles on antennas.

The main point of my letter is who is F. C. Judd? Would G2BCX consider writing an article about himself, and his expertise on radio. I am sure this would be of interest to all your readers.

**John Bidgood, Eastleigh, Hants**

**Editor's reply:** I've no doubt that Fred Judd G2BCX will be quite flattered by your letter John! Again, we have another coincidence, because Fred has recently announced his retirement from antenna design work requiring roof and ladder climbing. We will be featuring G2BCX in a 'Radio Personality' spot soon, to pay tribute to this very prolific writer. Despite the fact that he's retiring from antenna work requiring climbing, etc., (he admits to being in his mid 70s) Fred will continue to write for *PW* on a regular basis.

### Dear Sir

Ref. my recent letter. I'm glad I wrote to *PW* for help. I cannot begin to thank you enough for your 'phone call telling me of the ad' placed in your magazine. Thanks to you I have found the Mizuho MX-14S 14MHz rig I was desperately searching for.

After your call, I phoned the number you gave me which belonged to Terry Wood G4MIZ. Not only was he surprised that a radio amateur from the USA was calling him on the 'phone, but he had only just put the ad' in the day before!

About six weeks ago before this search started, I ordered what was the last new MX-14S for sale in England from Waters & Stanton. To my dismay, the radio was stolen in the mail and all that arrived at my door was an empty box. My money was refunded, but I was still in search of a Mizuho. Without your call I could have been looking for ever. In fact I even made calls to Japan, with no luck!

I've had my licence for about 18 years, and am still fascinated by the hobby. My main mode of operation is QRP s.s.b. My family originates from England, and we have traced the family tree back to about 1600. Anyway my wife and I love England, and we are there every year or two or whenever we can get away.

Maybe next time we are there, I can show you my appreciation by taking you out to lunch or dinner. What you did was beyond the call of duty. If there is anything I can do for you here in the USA please call or write.

Thanks again, and it was a pleasure talking to you on the 'phone. I work all the h.f. bands and will look for you on the air. My best wishes to everyone on *Practical Wireless*.

**Bill Ruppert WB9BQG, Glenview, USA**

**Editor's reply:** It was a great pleasure to help you Bill. The opportunity only came by an amazing coincidence, when (quite by chance) Bill's original letter asking for help, arrived on my desk as I was reading potential adverts for 'Bargain Basement'. I read the letter and felt very angry that his original transceiver had apparently been stolen between the UK and the USA. I had intended to publish his letter asking if anyone else had a Mizuho transceiver for sale. However, I realised this wasn't necessary when I read the next letter. It was from G4MIZ who wanted to sell his Mizuho! To cut a long story short, I immediately rang Bill, quite forgetting the time difference! A very sleepy WB9BQG answered the 5am alarm call (sorry Bill!) but he woke up very quickly when he heard the news! We don't normally short-circuit 'Bargain Basement' in this way, but I feel sure readers will understand the circumstances were exceptional.

**Dear Sir**

I am a radio amateur and a CB operator. For some time now CB in this area has been under a blanket of very bad interference. My TS530 amateur bands rig has an overlap on the 28MHz allocation, so I am able to receive down to 27.935MHz (into the CB UK section) - so I thought I'd listen - although I realise I cannot resolve f.m.

I was astonished to find that there is more s.s.b. activity on this overlap than on the amateur section! No wonder our UK CB allotment is in bad shape. Are these stations legal? I realise other countries don't use 27.601MHz to 27.99MHz for CB - and possibly use these frequencies for something else?

Could *PW* enlighten readers about this? Is there any way these southern European countries can be stopped? This brings in another question as these countries will have allocations on the CEPT CB frequencies. If I bought a CEPT frequency CB, would I be clear of this s.s.b. activity?

**Hector Cole G3OHK**  
Workington  
Cumbria

**Editor's reply:** Hector has come across a very great problem. You've only got to listen between 26 and 28MHz to realise that there is much illegal activity on s.s.b. from within the UK. I recently had an (unsigned and un-addressed) request from a "very keen

and dedicated" (quote) illegal s.s.b. operator, suggesting that *PW* included articles and band reports, etc., for them in future! As regards Europe, with the possible exception of Italy, I think that s.s.b. operation on 27MHz CB is illegal. However, down here in the south, there seems to be a very active group using a.m. and s.s.b. From my own experience, there also seems to be a plentiful supply of illegal a.m. and s.s.b. CB equipment (including 100W linear amplifiers) openly on sale at car boot sales throughout the country. Unfortunately, because radio amateurs are not allowed to buy the strictly illegal multimode CB transceivers, they remain in circulation. If we were allowed to purchase and convert such transceivers to 28MHz, a useful source of relatively cheap equipment would be established, helping to reduce another nuisance at the same time. But even though we could help, apart from reporting the activity to the Radio Investigation Service, our hands are tied I'm afraid Hector!

We are delighted to receive your letters, but do try to keep them short. It helps us, and makes it easier to get more letters in!

**Dear Sir**

I have been a reader of *Practical Wireless* for more years than I care to remember. Now, although the magazine's appearance may have improved dramatically from F. J. Camm's original format, the one thing certainly not improving by any stretch of the imagination, is the increasing number of bad printing errors and mistakes made in the magazine.

Have you ever considered what effect these have on anyone trying to construct anything from your articles? It has got so bad, that one dare not lift up the soldering iron to begin any of your projects until **at least** six issues later than the issue carrying the last part of a particular project, to ensure that all the **errors, mistakes** and **updates** have been seen. Are these **genuine** mistakes, or perhaps some conniving plan to guarantee sales of future issues?

As this letter is highly unlikely to be published in *PW*, I feel I should say I think you should spend more time, energy and money trying to eliminate these mistakes. Try to improve the quality of *PW* for your readership, instead of squandering it all on some worthless logo, which all of us are likely to end up paying for when you will inevitably push the cover price up afterwards.

**Dr Angus Johnson**  
Kirton-by-Leen  
Nottinghamshire

**Editor's reply:** The 'buck' stops at the editor's desk I'm afraid Dr. Johnson and I can only apologise. The entire team is striving to stop any errors (no matter how small) creeping in. The only way, so it seems, to stop errors occurring with constructional projects, is to increase the lead time. So, it's with that in mind we have held over one major project, the *PW* 'Churchill' s.s.b. base-station, until we have built at least two prototypes. This project has already been under development for two years. The wait will be worth it I feel. However, this sort of (very necessary) approach does mean that probably only one big project with several smaller ideas, can appear every year. In between, we shall continue to offer simpler constructional articles, which have all been built and tested. Also, now that we are completely self-contained with p.c.b. artwork and placing, etc., the chances of errors are reduced. Finally, the change to a better paper and higher quality presentation is necessary to present an easier read, with much improved clarity on drawings, p.c.b. overlays and photographs.

**Competition Corner**

**Win A Ramsey Electronics FTR-146 Transceiver!**

You could win the kit transceiver built and reviewed in the January 1992 issue of *Practical Wireless*, by *PW*'s editor G3XFD, and kindly donated by **Raycom Communications**. Just imagine what you or your radio club friends could do with this handy little rig! To win, all you have to do is estimate correctly just how long it took Rob to build the FTR-146. The only clues we're going to give you is that it took longer than 15 hours, but didn't take longer than 35 hours! The winner will be the entrant estimating the exact, or nearest, time taken to build the FTR-146.

**Just enter your estimation of the time taken to build the kit, and complete the tie-breaker in no more than 20 words.** Send your entry in with the coupon below, complete with the corner flash. The first two runners-up will receive one-year subscriptions and the second pair of runners-up will receive six-month subscriptions. **The editor's decision is final, and no correspondence will be entered into.**

"I'd like to win the Ramsey FTR-146 transceiver because....."

Name .....

Address .....

.....

.....

.....

.....Hours

.....Mins

## Scarborough ARS Diamond Jubilee

To celebrate the Diamond Jubilee of the Scarborough ARS, an Award Certificate is being made available, each certificate being signed by the President and Chairman.

The award is to commemorate the founding of the society in 1932 and is available to all radio amateurs and short wave listeners.

All contacts must be made between January 1 and 31 December 1992. Log extracts are acceptable but must indicate contacts or reception reports confirming the following:

One contact with the society's HQ station, G4BP and five contacts with members of Scarborough ARS.

Contacts may be by any mode, on any band but contacts via repeaters will not be accepted.

All claims will be verified by the Awards Manager and the society's decision will be final. Claims must be accompanied by £2 sterling, \$3 or 5 IRCs.

Applications are to be made to:

**Awards Manager, G4BP**  
c/o 10 Lowdale Avenue  
Scarborough  
North Yorkshire  
YO12 6JW.

## The 1992 Radio Listener's Guide

This is the fourth and latest edition of the *Radio Listener's Guide* - a unique 58-page book for anyone who listens to radio.

Within the guide, easy-to-use maps show the frequencies for all the radio stations in the UK. These include Radios 1, 2, 3, 4 and 5, BBC local, independent and community radio stations. Foreign stations broadcasting in English are also listed.

This year, the guide also includes articles by the BBC, the Radio Authority, The Voice of the Listener, Sony and Blaupunkt, and for the first time, it also lists stations transmitting from the Republic of Ireland.

You can use it in the car, caravan or at home. Find stations quickly and easily - at home and while on the move. Tune to your favourite radio stations while travelling, or tune to one of the many stations you never knew existed.

The *1992 Radio Listener's Guide* costs £3.25 (including postage) and is available from the publishers at the following address:

**The Radio Listener's Guide**  
FREEPOST, PDQ Publishing  
PO Box 41, Didcot, Oxon OX11 8BR.  
Tel: (0235) 816229.

Also available from *PW Book Service*.  
More book reviews on page 31.

## COMPETITION WINNERS

### June 1991 Spot the Difference Competition

Winner: B. Johns, Renfrewshire Scotland.

Runners-up: Miss P. West, Paignton, Devon. Fred Ward, Littleover, Derby.

### July 1991 Wordsearch Competition

Winner: Janet Martyn, Crowborough, East Sussex.

Runners-up: Cyril F. Hutchings, Wellington, Somerset. G. M. Christie, Stromness, Orkney.

### August 1991 Spot the Difference Competition

Winner: B. Srinivas, Andhra Pradesh 533001, India.

Runners-up: J. Sneddon, Lothian, Scotland. A. L. Holohan, Leeds, West Yorkshire.

### September 1991 Wordsearch Competition

Winner: Ken Thompson, Blaine, WA, USA.

Runners-up: John Lynch, Croydon, Surrey. Peter Hunter, Bowthorpe, Norfolk.

### October 1991 Spot The Difference Competition

Winner: Lea Avadya, Istanbul, Turkey.

Runners-up: S. F. Lane, Port Talbot, West Glamorgan. Mr D. Sweeney, Liverpool.

## Can You Help?

**Alan Stokes of 3 Alison Road, West Derby, Liverpool, Clubmoor, Liverpool L13 9AD, is searching for a cassette compartment door for a Pye TR-0726/05 radio/cassette recorder and an on-off switch for a Philips AR-060 radio recorder.**

**David Cross (South Oxfordshire area) on (0491) 32292 between 6 and 6.30pm is looking for a home for several boxes of loose radio and TV valves, which are in uncertain condition.**

**Mr J. G. Williams, 'Alltwen', 44 Mayfield Drive, Buckley, Clwyd, North Wales CH7 2PN, is looking for a circuit diagram, manual and any other details of the Trio JR-310. He will gladly refund any costs incurred.**

**Raymond Davidson G7FHD, 23 Wicklow Street, Middlesborough, Cleveland TS1 4RG, needs some help to identify an old frequency counter-timer. The only identifying marks are 'Counter Timer 901' on the front panel, with a small panel on the rear stating '901M 80S 3809'. Can readers solve this mystery for G7FHD?**

## Theft

On Saturday 16 November, at the Tesco Stores car-park, Culverhouse Cross, Wenvoe, Cardiff, a Yaesu FT-230R 144MHz v.h.f./f.m. only 5/25W transceiver, serial No. 2F.041377 was stolen. The theft occurred between 11.45am and 12.15pm. The car was parked slightly away from others in the area, and was broken into by use of a screwdriver in the door locking key hole, which was forced. The offence was reported to the supermarket manager and the **Ely police station, Cowbridge Road West, Cardiff, tel: (0222) 222111 Ext. 218.**

An individual was noted in the area, walking an Alsatian dog. He was short, stocky and wearing faded-blue denim, no coat or hat. Any FT-230R offered for sale should therefore be checked.

## Street Alarm

New from Maplin Electronics is 'Street Alarm', a very compact personal alarm with an extremely tough black plastic case. Thanks to its slim size, it can be carried easily by hand or attached to a belt using the very rigid clip moulded into its housing.

A large pink button, which is recessed to prevent accidental operation, is pressed to operate an extremely powerful 130dB siren, guaranteed to draw attention to passers by. To de-activate the alarm, the button is simply pressed again. The unit is powered by a PP3 9V alkaline battery (not included) which will provide up to six months of normal usage.

Overall dimensions are 90mm x 60mm x 32mm. Weight 114g with battery.

The Street Alert Alarm (ZC37S) costs £19.95 inc. VAT. **Maplin Electronics on (0702) 552911 for enquiries.**

## In Need Of An Elmer!

We recently received a "Help! I'm in great need of an Elmer" letter from 22-year old David Jones, of Bury, Lancashire.

He's been interested in radio and electronics for about seven years, but would now like to get on the air, instead of just listening.

He finds the 'maths' side of the RAE difficult, and would therefore be most grateful if someone in his area could help.

If anyone can offer their help to David, please write to him, c/o 'Newsdesk' at our editorial offices, and we'll pass all correspondence on to him.

Please send in all of your news items to Sharon George at the editorial office in Poole.

## New Radio Club

Situated in the heart of rural Wales, in the beautiful Victorian town of Llandrindod Wells, a new radio club has recently been formed. They are known as the Mid-Wales ARC. Affiliation to the RSGB is at this moment in hand, and tentative steps are being taken towards having their own repeater station set up locally.

The club have high hopes of a very successful team, but are still open to any advice and/or assistance from whatever source. Anyone travelling in their part of the world, will be made most welcome, if they wish to call in and visit.

For any further details, please contact:

**Len Rees**  
**'Dunblair'**  
**Tremont Road**  
**Llandrindod Wells**  
**Powys LD1 5EB.**

## Radio Link Special Event Station

On Saturday 29 February 1992, from 8.30am to 5pm, three members of Radio Link will be operating an amateur radio special event station, from the Eagle Shopping Centre manager's office, in Copecastle Square, Derby, with a callsign of GB1ECD (Great Britain One Eagle Centre Derby).

The amateur radio station will operate on 144MHz, and various local personalities will visit the station during the day. The members hope to make contact with amateur radio stations within a 113km (70 mile) radius of Derby.

The company, CIN Properties Limited, who own the Eagle Shopping Centre, have sponsored Radio Link's daily request programme over the last two years.

Radio Link was formed in April 1974, and this voluntary organisation and registered charity now provides a hospital radio service to the following hospitals:

Derby City Hospital  
Derbyshire Royal Infirmary  
Derbyshire Children's Hospital  
Kingsway Hospital  
Nightingale Continuing Care Unit

Radio Link's studios are based under Ward Two of the Derby City Hospital, Uttoxeter Road, Derby.

For further information, contact:

**John Huddlestone G1UJX**  
**Secretary/Press Officer**  
**c/o 8 Wilmot Avenue**  
**Chaddesden**  
**Derby DE2 6PL.**

## Cushcraft

Cushcraft Corporation have recently appointed Shropshire-based Specialist Antenna Systems Ltd., as their UK distributor. They will promote this high-quality range of amateur antenna products, together with a large range of commercial products, previously not seen in the UK. For further details, contact:

**Specialist Antenna Systems Ltd.**  
**Radfords Field**  
**Maesbury Road**  
**Oswestry, Shropshire SY10 8EZ. Tel: (0691) 670440.**

## Contact With China!

Julian G0LXX, from Clifton in Nottingham, made contact with Wang at the club station of BY8AC on 7 April 1990.

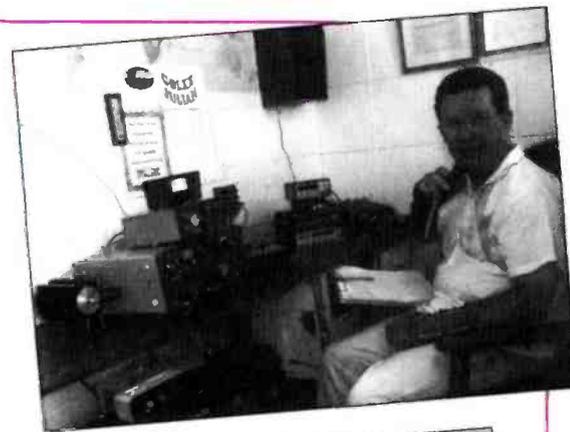
A result of this contact, is that many children in the Clifton area and students in the Chengdu region have become pen-pals.

The callsign BY8AC is that of the amateur radio society of the Chengdu Children's Palace, and was set up in 1985, there are more than 10 operators. Wang, in his letter to Julian, says that almost every middle school has an English club, because it is considered important for the future.

There are more than 200 members of the English club at Wang's school, 'No. 5 Middle School' in Chengdu. The subjects of study are Chinese, Maths, English, Physics, Chemistry, Biology, Politics, Geography, History and PE. Altogether, 38 lessons per week, Monday to Saturday.

Chengdu City is the largest city in Western China. Population about 9.3 million. It is the capital of Sichuan Province, which is the Big Panda's homeland. Chengdu is a very old city, with a history going back over 3000 years.

Julian is one of the founder members of the South Nottingham ARC, and is very active on the h.f. bands. He's a very popular radio amateur with an infectious laugh!



## Tracing A Winner!

At the recent Bridgend rally, the winning ticket in their prize draw, unfortunately, had no buyers name or call-sign written on it. The winning ticket was Yellow 106.

They are trying to trace the winner, so if anyone can help them please contact **Charles Sedgebeer** on (0656) 860434.

**Newsdesk**  
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**Aylesbury Vale RS** meet 1st & 3rd Wednesdays, 8pm at the old Village Hall, Hardwick. Further details about the club from **Geoff** on (0290) 817496 or **Martyn** on (0908) 560026.

**Barnsley & District ARC** meet Mondays in the radio club room and shack, at the rear of the Darton Hotel, Station Road, Darton, Barnsley. For further information, ring **Ernie G4LUE** on (0226) 716339.

**Basingstoke ARC** meet 1st Mondays, 7.30pm at the Forest Ring Community Centre, Sycamore Way, Winklebury, Basingstoke. For further details, please contact **John Randall G3OAZ**, 243 Paddock Road, Basingstoke, Hants RG22 6QP.

**Bedford & District ARC** meet Thursdays, 8pm in the Allen Club, Hurst Road, Bedford. More details from **Gavin Carmichael**, 15 Evesham Court, Avon Drive, Bedford MK41 7AJ. Tel: (0234) 365660.

**Bradford ARC** meet 2nd & 4th Thursdays, 8pm at the Polish Ex-Service Club, Shaarbridge Road, Bradford, West Yorkshire. On January 9 they have a natter night, the 23rd is 'A Visit To Sydney' - a slide show by ex VK2FUV and February 13 is a Display and Discussion - bring your home-brew equipment. **Charles Bolt G0ACX** on (0247) 494694.

**Braintree & District ARC** meet 1st & 3rd Mondays, 8pm at the Community Centre, Victoria Street, Braintree. On January 20, the club will be entertaining the Braintree Air Training Corp Amateur Radio Society. **D. Andrews**, 22 Arnhem Grove, Braintree, Essex CM7 5UD. Tel: (0376) 27431.

**Brighton & District ARC** meet 1st & 3rd Wednesdays, 7.45pm at the Roast Beef Bar, Brighton Racecourse, Elm Grove, Brighton. More details from **Harold Lunson G3WR**, 17 Tongdean Rise, Brighton, East Sussex BN1 5JG. Tel: (0273) 501100.

**Bromsgrove & District ARC** meet Fridays at Avoncroft Arts Centre, South Bromsgrove, Worcester. January 10 is 'Operating Awards' by J. Harvey G4IVJ. More details from **Joe Poole G3MRC** on (0562) 710010.

**Bromsgrove ARC** meet at Lickey End Social Club, Alcester Road, Burcot, Bromsgrove. **Mr D. Edwards G4ZWR**, 2 Mason Close, Headless Cross, Redditch, Worcs B97 5DF. Tel: (0527) 546075.

**Chelmsford ARC** meet 1st Tuesdays, 7.30pm at Marconi College, Arbour Lane, Chelmsford, Essex. On February 4 they have 'First Aid for Radio Operators'. More details from **Roy & Ela Martyr G3PMX & G6HKM**, 1 High Houses, Mashbury Road, Great Weltham, Essex CM3 1EL. Tel: (0245) 360545.

**Conwy Valley RC** meet 1st Thursdays,

7.15pm at The Studio, Penrhos Road, Colwyn Bay, Clwyd. February 6 is a talk on 'Medical Electronics' by Chris Barnes GW4BZD. For further details, contact **Merlyn Jones GW4NNL**, 72b Princes Drive, Colwyn Bay, Clwyd LL29 8PW. Tel: (0492) 530725.

**Coulson ATS** meet 2nd Mondays, 7.45pm at St. Swithun's Church Hall, Grovelands Road, Purlay, Surrey. On January 13 they have Andy Boyne G4RFX on the 'History and Development of the Harrier Aircraft'. **Andy Briers G0KZT** on 081-668 7004.

**Coventry ARC** meet Fridays, 8pm at Baden Powell House, 121 St. Nicholas Street, Radford, Coventry. For further details phone **Jon** on (0203) 610408.

**Derby & District ARC** meet Wednesdays, 7.30pm at 119 Green Lane, Derby. January 15 is 'The Work of the Amateur Radio Observation Service' by Geoff Griffiths G3STG, the 22nd is 'Modular Kits for the Constructor' a talk and demonstration by Darek G3ZDM of Jandek, the 29th is a Video show, February 5 is a Junk Sale and the 12th is a Visit to Drakelow Power Station, near Burton-on-Trent. More details from **Richard Buckley G3VGV**, 20 Eden Bank, Ambergate, Derby DE5 2GG. Tel: (0773) 852475.

**Derwentside ARC** meet Wednesdays, 7.30pm in the Steel Club, 36 Medomsley Road, Consett, County Durham. Regular talks by amateurs and non-amateurs. Construction work overseen by Don G4LGA. Further details from **Geoff Darby G7GUJ**, 60 Pine Street, Grange Villa, Chester-le-Street, County Durham DH2 3LX. Tel: 091-370 2032.

**Dragon ARC** meet 1st & 3rd Mondays, 7.30pm at the Four Crosses Hotel, Menai Bridge. January 20 is 'Repeater Linkage' by Brian Davies GW4KAZ and February 3 is 'Electrical Distribution & Earthing' by Tony Rees GW0FMQ. **Tony Rees GW0FMQ** on (0248) 800963.

**Dunstable Downs RC** meet Fridays, 8pm at Chews House, 77 High Street South, Dunstable, Beds. Further details from **Wendy Jefferson** on (0582) 451057.

**Echelford ARC** meet in the Community Hall, St. Martin's Court, Kinston Crescent, Ashford, Middlesex, 7.30pm. On January 9 they have a natter night, the 23rd is 'Ham Radio In Sri-Lanka' by Doug Goodison G0LUL and February 13 is 'Linear Amplifiers' by John Stockley G8MNY. Further details from **P. Townshend G6PMT** on (0344) 843472.

**Fareham & District ARC** meet Wednesdays, 7.30pm in Portchester Community Centre, Westlands Grove, Portchester, Fareham, Hants. Details from **Rod Smith G0ERS** on (0705) 373572.

**Fylde ARC** meet 2nd & 4th Thursdays, 7.45pm at South Shore Lawn Tennis Club, Midgeland Road, Blackpool. **Eric Fielding G4IHF** on (0253) 726685.

**GB3HZ Repeater Group** meet at Chiltern Communications, Lincoln Road, Cressex Industrial Estate, High Wycombe, Bucks, 8pm. Details from **Francis Rose G2DRT** on (0494) 814240.

**Gloucester ARC** meet at St. Johns Ambulance HQ, Heathville Road, Gloucester at 7.30pm. January 15 is Construction Group, the 22nd is Packet Self-Help Group and the 29th is Home-Brew Clinic. More info from **J. Beekingham** on (0452) 528533 Ext. 2733.

**Great Lumley AR&ES** meet Wednesdays, 8pm at Great Lumley Community Centre, Great Lumley, Nr. Chester-le-Street, Co. Durham. For more details, contact **Barry G1JDP** on 091-388 5936.

**Halifax & District ARC** meet 1st & 3rd Tuesdays, 7.30pm at the Running Man Public House, Pallon Lane, Halifax. On January 21 they have 'Sky At Night' by J. Hosty. For further details, contact **David Moss G0DLM**, Beechwood Lodge, Leeds

Road, Lightcliffe, Halifax, West Yorkshire HX3 8NU. Tel: (0422) 202306.

**Hambleton ARC** meet in Room A5 of Northallerton Grammar School at 7.30pm. For more details, contact **Nigel Robertshaw G0NHM** on (0609) 776608.

**Horndean & District ARC** meet 1st Thursdays, 7.30pm at Horndean Community School, Barton Cross (off Catherington Lane), Horndean, Hants. February 6 is Hampshire Fire Service Communications. For more information, contact **Stuart Swain**, 35 Mavis Crescent, Havent, Hampshire PO9 2AE. Tel: (0705) 472846.

**Horsham ARC** meet at the Guide Hall, Denne Road, Horsham, West Sussex, 8pm. Further details from **Peter Stevens G8SUL**, 11 Nutwood Avenue, Brockham, Betchworth, Surrey RH3 7LT. Tel: (0737) 842150.

**Ipswich RC**. Contact **Mrs S. Elden G8HYE**, 124 Larchcroft Road, Ipswich IP1 6PD.

**Keighley ARC** meet at The Cricket Club, Ingrow, Keighley, 8pm. January 16 is 'ELF', a talk by G30TE, the 23rd is a natter night, the 30th is their AGM, February 6 is a natter night and the 13th is 'Scout Tour Of America' by G7HHD. Further details from **Kathy Conlon G1IGH** on (0274) 496222.

**Kettering ARC** meet Tuesdays, 7.30pm at the Electricity Sports & Social Club, Eksdale Street, Kettering. January 14 is a Slide Show of DId Kettering by Terry Green G7AJS and February 4 is 'BBC Transmitters & Transmissions', a talk by Mike Higgins (Senior Transmission Engineer BBC Radio). All enquiries to **Len G7EHM** on (0536) 514544.

**Kidderminster & District ARC** meet alternate Tuesdays, 8pm at The Queens Head, Wolverley, Worcestershire. For more details contact **Geoff Philpotts G7JIR**, 62 Erkeley Close, Stourport-on-Severn, Worcs DY13 0AH. Tel: (0299) 379293.

**King's Lynn ARC** meet Thursdays, 7.30pm at the 19th King's Lynn Scout HQ, North Runcton. Further details from **Derek Franklin G0MQL** on (0553) 841189.

**Lothians RS** meet on the 2nd & 4th Wednesdays, 7.30pm in the Orwell Lodge Hotel, Polwarth Terrace, Edinburgh. Further details from **Mel Evans** at 56 Southhouse Road, Edinburgh EH17 8EU or telephone 031-664 5403.

**Loughton & District ARC** meet in Room 14 of Loughton Hall, 7.45pm. For more details contact **Mike Pilsbury G4KCK** on 081-504 4581.

**Maidenhead & District ARC** meet at The Red Cross Hall, The Crescent, Maidenhead, 7.30pm. January 21 is 'Great Egg Race' and February 6 is 'Making Printed Circuit Boards'. Details from **Neil G8XYN** on (0628) 25952.

**Mansfield ARC** meet at the Polish Catholic Club, off Windmill Lane, Woodhouse Road, Mansfield. Further information from **Mary G0NZA** on (0623) 755288.

**Morecambe Bay ARC** meet every other Tuesday, 7.30pm at the Trimpell Sports & Social Club, with Morse instruction each Tuesday during club meetings. For more details, please contact **J. Burrow G0NYD**, 36 Longfield Drive, Cragbank, Barnforth, Lancashire LA5 9EJ. Tel: (0524) 733212.

**Nelson & District ARC** meet Wednesdays, 7pm at Llancaich School Nelson. They also run a c.w. class at their meetings. Anyone wishing to find out further information is welcome to call in, or otherwise contact **Leighton Smet GWOLBI** at 33 Nant Gwyn, Trelewis, Mid-Glamorgan, Wales CF46 6DB. Tel: (0443) 411736.

**Norfolk ARC** meet Wednesdays, 7.30pm at 'The Norfolk Dumping', The Livestock Market, Harford, Norwich. January 12 is 80m AFS, the 15th is a 'Real

Radio' evening, the 22nd is 'Home-brew Test Gear' by Mike Coan G4EOL, the 29th is an informal & committee meeting, February 5 is 'Construction Techniques' by Gary Parkhurst G3TOZ and the 12th is 'Novice Licence' by David Buddery G30EP. **Jack Simpson G3NUJ** on (0603) 747992.

**North Bristol ARC** hold their meetings at S.H.E., 7 Braemar Crescent, Northville, Bristol. **Chris Budd G0LOJ** on (0454) 616267.

**Nottingham ARC** meet Thursdays, 7.30pm at the Sharwood Community Centre, Mansfield Road, Nottingham. Further details from **Rex Beestall G1LRI** on (0602) 733740.

**Poole RAS** meet 2nd & last Fridays, 7pm at Lady Russell-Coates House, Lower Constitution Hill Site, Bournemouth & Poole College of FE. January 10 is 'Making Printed Circuit Boards' by Tony Emery G3YWG, the 17th is their Annual Dinner, details from **Phil G0KKL** on (0202) 742453, and the 31st is On the Air, construction projects and CW Practice. More details from **Vernon Cotton G3BCI**, 45 Branksome Hill Road, Bournemouth, Dorset BH14 9LF. Tel: (0202) 760231.

**Prudential ARC** is open to all employees and ex-employees of the Prudential companies. Those interested overseas should contact **Aidan McCulloch ZS6KU**, PO Box 2291, Helderkuin, 1733, South Africa. Those in the UK can contact **Dennis Egan GW4XKE**, 4 Hazel Grove, Longmeadow, Dinas Powis, South Glamorgan CF6 4TE. Tel: (0222) 512959.

**Reading & District ARC** meet 2nd & 4th Thursdays, 8pm at The Woodley Pavilion, Woodford Park, Haddon Drive, Woodley, Reading. **Vin Robinson G4JTR**, 4 Hilltop Road, Caversham, Reading RG4 7HR.

**Rochdale & District ARC** meet Mondays at T. S. Frobisher, Greenbank Road, Rochdale. January 20 is 'Converting PMR gear', the 27th is a Construction open night, February 3 is a Theory night - the cat's whisker and the 10th is a Crystal set night. Further details from **Brian** on 061-653 8316 or **Dave** (0706) 32502.

**Rhyl & District ARC** meet 1st & 3rd Mondays. January 20 is a home-brew night, construction of a GDO, **Dave GW4DMR** and February 3 is 'Marine Radio Licence' **Barrie GW7EXH**. For more details, contact **Ken Padley GW7IAR**, 67 Rosehill Road, Rhyl, Clwyd LL18 4TS. Tel: (0745) 338276.

**Salisbury Radio & Electronics Society** meet Tuesdays, 7.30pm at Grosvenor House Centre, Churchfields Road, Salisbury. For further details, contact **Bert Newman G2FIX** on (0722) 743837.

**Sevenoaks & District ARC**. Details from The Secretary, c/o Sevenoaks District Council, Council Offices, Argyle Road, Sevenoaks, Kent TN13 1HG.

**Shefford & District ARC** meet Thursdays, 8pm at the Church Hall, Amphill Road, Shefford, Bedfordshire. For further information, contact **Nigel G1JKF** on (0908) 274473.

**Silverthorn RC** meet Fridays, 7.30pm at The Chingford Community & Adult Education Centre, Friday Hill House, Simmons Lane, Chingford, London E4 6JH. More details from **Andrew Mowbray G0LWS** on 081-529 4489 between 5.30 and 6.30pm weekdays only.

**Solihull ARC** meet 3rd Thursdays in The Shirley Centre, 274 Stratford Road, Shirley, Solihull, West Midlands. On January 16 they have a talk on 'RSGB Affairs' by **John Allen G3DOT**. For more details, contact **Colin Taylor G3USA**.

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MORE CLUB NEWS ON PAGE 21

# ICOM

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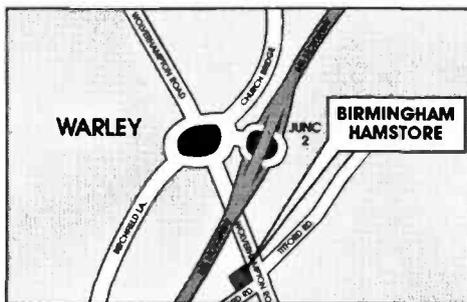
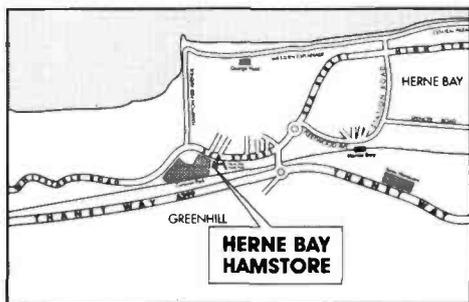
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**South Dartmoor ARC** meet Mondays, 8pm at South Dartmoor School, Balland Lane, Ashburton, Devon. This radio club has a committee of only one adult - the rest being school-age youngsters! Although anyone wishing to join in is welcome. For more details on this Novice-run radio club, contact **Peter Thornhill G6ZKQ**, 21 Elmbank, Buckfastleigh, Devon TQ11 0DX. Tel: (0364) 43433.

**South Dorset RS** meet 1st Tuesdays, 7.30pm in the Wessex Lounge of Weymouth Football Club. On February 4 they have 'More Adventures Of A Wartime RAF Radio Operator' - Ted G3ETA. Geoff Gwilliam G4FJO, 13 Overlands Road, Wyke Regis, Weymouth DT4 9HS. Tel: (0305) 781164.

**South Notts ARC** meet at Highbank Community Centre, Farnbrough Road, Clifton Estate, Nottingham. For further details call **Trevor G4IRH** on (0509) 672734.

**Southgate ARC** meet at Winchmore Hill Cricket Club Pavilion, Firs Lane, Winchmore Hill, London N21. January 9 is a talk on 'Computing In Amateur Radio' by Tony Kempton G1BYS, the 23rd is final planning and preparations for the London Amateur Radio & Computer Show and February 13 is a normal club meeting. **Brian Shelton G0MEE**, 22 Berkeley Gardens, Winchmore Hill, London N21 2BA. Tel: 081-360 2453.

**Spalding & District ARS** meet Fridays, 8pm at The Riverside Centre, The Old Fire Station, Double Street, Spalding, Lincolnshire. Further details from **David Johnson**, 65 West Street, Bourne, Lincolnshire PE10 9PA. Tel: (0778) 425367 (6-7pm).

**Spen Valley ARS** meet Thursdays, 8pm in Old Bank Working Men's Club, Mirfield. Alternate Thursdays are 'Noggin & Natter nights'. Further details from **Ian Barraclough G7DWY** on (0484) 716453, early evening.

**Stevenage & District ARS** meet in Ground Floor Lecture Room, 'D' Block, Ridgmond Training Enterprise, Ridgmond Park, 7.30pm. January 15 is Practical Packet operating, the 22nd is

talk 'DTMF & CTCSS' Tony G0OVO, the 29th is Practical h.f. data modes, February 5 is Round Robin, v.h.f. mobile/base station aeriels and the 12th is a Practical h.f. night on air. More details from **Pete Daly G0GTE**, 48 Lincoln Road, Stevenage, Herts SG1 4PJ. Tel: (0438) 724991.

**Stirling ARS** meet Thursdays, 7.30pm at premises near Throsk, Stirling. Details from **Brian Mulleady GM0KWL**, QTHR or on (0324) 36235.

**Stourbridge & District ARS** meet 1st & 3rd Mondays, 8pm at Robin Woods Community Centre, Scotts Road, Stourbridge. Details from **Dennis Body G0HTJ** at 53 Grove Road, Wollescote, Stourbridge, West Midlands DY9 9AE.

**Stratford-Upon-Avon & District RS** meet 2nd & 4th Mondays, 7.30pm at the Home Guard Club, Main Road, Tiddington, Stratford-Upon-Avon, Warwickshire. January 13 is a Projects evening, the 27th is New Year social and February 10 is a Test Equipment evening. Further details from **Alan Beasley G0CXJ**, 2 Ilmington Road, Blackwell, Shipston-on-Stour, Warwickshire CV36 4PE. Tel: (0608) 82495.

**Stroud & District ARS** meet fortnightly in the Minchinhampton Youth Centre. For more details, please contact **Dave Stallon** on (0453) 886964.

**Sutton & Cheam RS** meet 3rd Thursdays, 7.30pm at Downs Lawn Tennis Club, Holland Avenue, Cheam, Surrey with natter nights on 1st Mondays, in the Downs Bar. January 12 is 3.5MHz AFS CW Contest, the 16th is 'Erecting Masts and Antennas for Contests' by Andy Brooker G4WGZ and the 18th is 3.5MHz AFS Phone Contest. More details from **John Puttock G0BWV**, 53 Alexandra Avenue, Sutton SM1 2PA.

**Taunton & District ARC** meet 1st & 3rd Fridays, 7.30pm in 'The Basement', County Hall, The Crescent, Taunton. Other Fridays informally for a natter and station operation, Morse code classes, etc. January 17 is 'Use of Weather Satellites in Schools' by Mike Platt and February 7 is 'Power Measurements in the Shack' by

Graham Wills G0GTR. For further details, contact **Mr W. Lindsay-Smith G3WNI**, Way Close, Madford, Hemyock, Cullompton, Devon EX15 3QY. Tel: (0823) 680778.

**The Three Counties ARC** meet every other Wednesday, 8pm at the Railway Hotel, Liphook Hampshire. **Kevin Roche G8GOS** on (0420) 83091.

**Thornbury & District ARC** meet at the United Reform Church, Chapel Street, Thornbury, 7.30pm, talks start at 8pm. CW practice sessions are held between 7.30 and 8pm. January 15 is Ted G1ABT on 'D/F & Map Reading', the 22nd is a v.h.f./h.f. activity/natter night and the 29th is a bonus natter night/r.f. activity. More details from **H. Cromack G0FGI** at Rose Cottage, The Naite, Oldbury-on-Severn, Bristol, Avon BS12 1RU. Tel: Thornbury 411096.

**Torbay ARS** meet Fridays, 7.30pm at the ECC Social Club, Highweek, Newton Abbot. January 10/17th/31st/February 7 are Club nights and January 24 is monthly meeting & construction cup judging. More details from **Andy Stafford G4VPM** on (0803) 329055.

**Trowbridge & District ARC** meet at 8pm, in the Territorial Army Centre, Bythesea Road, Trowbridge, Wiltshire, 8pm. More details from **Ian Carter** on (0380) 830383.

**Verulam ARC** meet 2nd & 4th Tuesdays, 7.30pm at the RAF Association Headquarters, New Kent Road (off Malborough Road), St. Albans, Hertfordshire. 2nd Tuesdays are their activity evenings and 4th Tuesdays are their main monthly meetings. On January 28 Mr S. McKeever will give a talk entitled 'Medical Lasers'. More details from **Walter Craine G3PMF**, 5 The Crescent, Abbots Langley, Watford, Hertfordshire WD5 0DR.

**Wakefield & District RS** meet Tuesdays, 8pm in First Floor Rooms, Ossett Community Centre, Prospect Road, Ossett. On February 11 they have rally preparation. **John Bailes G0MVA** on (0924) 260048.

**West of Scotland ARS** meet Fridays, 7.30pm at the Scout HQ, 21 Elmbank Street, Glasgow. For further details, please contact **John Power GM0KTO**, PO Box 599, Glasgow G3 6QH.

**Whitton ARG** meet Fridays, 8pm at the Whitton Community Centre, Percy Road, Whitton, Twickenham. On January 12 they have a 'Humpty-Dumpty' Pantomime. More details from **Rosalind Catley**, 15 Park Close, Hounslow, Middlesex. Tel: 081-894 2950.

**Wiesbaden ARC - DA1WA** - is a club mainly for US military personal stationed anywhere near Wiesbaden, Germany. For more details, contact **Robert Kipp DJ0PU**, Hugelstr. 25, D-6070 Langen, Germany.

**Wigtownshire ARC** meet Thursdays, 7.30pm at the Community Education Office, Stranraer Academy. More details from **Ellis Gaston G0MHPK**, 3 Victoria Buildings, Cairnryan, Stranraer, Dumfries & Galloway DG9 8RA. Tel: (0581) 2202.

**Wimbledon & District ARS** meet 2nd & last Fridays in St. Andrews Church Hall, Herbert Road, Wimbledon SW19. On January 10 they have a general activity evening and the 31st is 'Solomon Isles DXpedition' by Nigel Cawthorne G3TXF. **Chris Frost G0KEB**, 61 Selbourne Avenue, Tolworth, Surrey KT6 7NR. Tel: 081-397 0427.

**Wirral ARS** meet 1st & 3rd Wednesdays, 7.45pm at Ivy Farm, Arrowe Park Road, Birkenhead, Wirral. More details from **Alec Seed G3FOO** on 051-644 6094.

Club News has become so popular, we have had to squeeze it in even more this month. Club Secretaries please keep your details as brief as possible.

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Last year's trip to Dayton '91 was a resounding success, and readers have clamoured for more. So, here we are again, inviting you to come and fly with us to Dayton Ohio, home of the HamVention. Enjoy yourself at the biggest amateur radio show in the world. Reserve your seat now...we really don't want to leave you behind!

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### Want To Know More?

If you want to know more, you can call **Roger Hall G4TNT** on 071-731 6222, for further information anytime during the day, evening or weekends. Alternatively, you can call **PW's Editor, Rob Mannion G3XFD**, during the day Monday to Friday on (0202) 678558. Rob led our party on the Dayton '91 holiday, and he'll be glad to talk about the trip, the excellent food and the wonderful time everyone had at the HamVention. You'll be able to join Rob and enjoy the fun on the '92 trip, if you book now!

Send your cheque for the £75 deposit to: **Dayton '92 HamVention Holiday**, PW Publishing Ltd, Enefco House, The Quay, Poole, Dorset BH15 1PP.

## The Global GDO Mk.II Dip-Meter

*Rob Mannion G3XFD, regards the dip-meter as being one of the really essential items of test equipment for the shack. So, knowing how keen he is on 'home-brewing' and using his own 'dipper', we let him try the newly-imported 'Global' Mk.II model.*

I regard the dip-meter as being an essential piece of equipment to have in the shack. I've had one for many years, and to be honest, my present 'dipper' uses a 6C4 valve!

No doubt many of you will not be impressed with the news that I still 'swear' by my old valved 'dipper'. Despite that, I've no doubt that most of you will agree that the good old-fashioned meter really does provide an excellent dip indication.

Of course, I have built various modern circuits, but I still prefer the valved model. It's a bit of a nuisance having to trail a mains lead about at times, but that's only a small disadvantage in my opinion.

### Suitable Meter

One of the main reasons why I still use my valved 'dipper', is that I can't find a suitable meter to replace it with. One or two meters imported from the far east proved unreliable, and the dip indication was often very poor.

Another drawback of imported dip-meters, which I consider is important (but others may not) is the frequency coverage. My home-brew meter covers from 60kHz to 160MHz. Over the years this wide coverage has proved immensely useful. I can check everything from 85kHz i.f. transformers to inductances for 144MHz.

Commercially made 'dippers' however, rarely work below 1.5MHz. Despite this disadvantage, they certainly look better than my old valved job, and the tuning scales and dials are much easier to use.

So, bearing in mind what I've said, I was interested to hear that the Global GDO Mk.II TR Dip-Meter was being imported by Waters and Stanton. I gladly accepted the invitation to try one of the meters, to see if it would wean me away from my old valved model!

### What's A Dip-meter?

Just in case you ask 'what's a dip-meter', I'll start off with two statements: Firstly, a dip-meter is a calibrated tuneable oscillator, provided with an indicating device (usually a meter). The circuit is so arranged, that the dip-meter indicates when a tuned circuit, is resonant at the same frequency as the instrument is tuned to itself.

Traditionally, the valved types provided a 'dip' (in other words a decrease) in the meter reading, hence the term 'dip' meter. The 'dip' was an indication that part of the feedback energy of the dip-meter's oscillator was being absorbed by a circuit tuned to the same frequency.

Unfortunately, and to confuse matters a little, other circuits can be employed which actually increase the meter reading on resonance! Despite this, such instruments are still called 'dippers', because the actual sensing part of the device still works in the same way.

The only difference with this type of dip-meter, is the indicating circuitry. This is arranged to make the meter movement move towards full-scale deflection (rather than away from full-scale deflection) when indicating resonance.

The second statement I have regarding the dip-meter, is that it can be 'all things to all men'. That's another way of saying that they are extremely versatile instruments and do many different jobs.

A carefully designed and built dip-meter, can provide a great number of services for its user. Apart from providing an indication of a tuned circuit's frequency at resonance, with the 'dip', it can be used as a very basic signal generator.

They can also be used as absorption wavemeters, monitoring receivers, and as a simple form of capacitor tester. You can also use them, by comparison checks, to identify unknown capacitors and inductors. In other words, I don't think you should be without a dip-meter in your shack!

### Questionable Reliability

Unfortunately, in recent years many dip-meters imported from the far east, suffered from questionable reliability. In fact the situation became so bad, that several UK importers withdrew them from sale, because of customer 'returns'.

To get over this problem, Waters and Stanton have started importing the dip-meter again. But before the meters are put on the market, they are thoroughly checked and calibrated.

Each dip-meter is put through a series of tests, before passing onto the final quality-control stage. Only then are the meters released for sale.



## Attractive Instrument

The Global Mk.II has an attractive, well laid-out design. The tuning scale, marked off in colours and figures, is quite easy to read. I found it was a comfortable hand-held size.

Each range coil has a coloured band, which matches to the colour on the thumb-operated tuning scale. On either side of the large tuning scale, a further aid to identify the ranges is provided by the letter associated with each range, being boldly marked on the casing.

The instrument, as supplied, covers from 1.5 to 250MHz. I was pleased to find that it gave good 'dips', and that very few ambiguous readings (false dips) occurred.

The calibration was reasonable, when you bear in mind that the dip-meter is not intended as a precision instrument. I often wonder, when I'm using my own meter, how much more I could have progressed in my early radio days, if I'd had a dip-meter then!

In those days, I spent half my time trying to find out what frequencies I was tuned into. Unfortunately, in the mid-1950s, I hadn't heard of dip-meters. However, I can at least make sure that my young school radio club members know how to use the dip-meter to advantage. They, at least, can save time and frustration when they are winding coils and adjusting antennas.

## Frequency Coverage

In practice, I have found the frequency coverage of my own dip-meter to be a good trade-off. In other words, what my meter lacks in v.h.f. coverage, is made up by the useful low frequency coverage.

My radio club members build medium wave receivers, before building more advanced equipment. They also like to renovate and use surplus 455kHz i.f. strips and other broadcast reception type equipment.

My dip-meter comes in very useful for this work. We can easily identify medium and long wave coils, i.f. transformers, etc., to great advantage.

Unfortunately however, the Global Mk.II dip-meter, in common with the majority of ready-made or kit instruments, doesn't cover below 1.5MHz. I think this omission is strange, because it reduces the instrument's versatility, especially as there's much equipment using i.f. below 1.5MHz.

However, having criticised the lack of low frequency coverage, I was pleased to find the v.h.f. range was more than adequate. The Colpitts type oscillator used in the meter, thanks to the very sturdy silver-plated pins on the coil, proved to be very stable, which was quite a surprise!

On the v.h.f. ranges, there were far fewer ambiguous dips than I expected. The sudden 'drop out', where the oscillator stops unexpectedly, which is so common with transistorised dip-meters, didn't happen once with the meter I used.

The adjustable 'sensitivity' control enabled me to adjust the meter for full-scale deflection on all ranges. I also found that variations in meter-indications, as frequency was increased or decreased, was only a gradual process. Any variations could be easily compensated for by using the sensitivity control.

## Important Feature

Another important feature on the meter, is the inclusion of a modulation facility. A three-position sliding panel-mounted switch, selects either the main dip-meter oscillator, oscillator and modulation or the battery check.

With the modulator switched on, a 2kHz tone is modulated on the dip-meter's signal. This proves

useful because the characteristic tone, makes the dip-meter's carrier easily detectable amongst the mass of heterodynes on some frequencies.

It's very necessary on receivers not equipped with a beat frequency oscillator (b.f.o.). This is because without it of course, you'll only hear a slight hiss from the receiver under test. With the modulation switched on, the job is made much easier.

## Summary

After the test period, which included a session at the school club I help to run, I have only two reservations regarding this dip-meter. One is the fact it does not work below 1.5MHz\* which could add to its versatility, and the other is more of a request regarding frequency range markings.

I'm going to suggest to the manufacturers, that the useful little table indicating the coil reference letter, and the frequency coverage, be transferred to the front panel. It would be much more useful there, especially when the meter is first purchased!

Altogether, I found the Global G.D.O. Mk.II Dip-Meter to be very useful piece of equipment. Unlike many, cheaper, imported meters it worked well, was stable and reasonably accurately calibrated.

I feel that this meter will prove to be very useful in the enthusiast's workshop. With a multimeter and a dip-meter, you're quite well equipped. I wouldn't be without a 'dipper' of some sort or other.

\* Waters and Stanton have replied to my comments, and they report that they are looking into the possibilities of an add-on kit to provide coverage of the lower frequencies on the Global dip-meter.

# REVIEW

## Specifications

<b>Frequency coverage</b>	1.5 to 250MHz
Number of coils	6 (plug-in)
Band A	1.5 to 4MHz
Band B	3.3 to 8MHz
Band C	6.8 to 18MHz
Band D	18 to 47MHz
Band E	45 to 110MHz
Band F	100-250MHz
Internal modulation	Approx. 2kHz sine wave
Crystal oscillator	
test facility	1 to 15MH, in FT-243 holder
Power supply	9V internal battery
Current consumption	2mA maximum
Semiconductors	2 transistors, 1 diode
Circuit	Colpitts type oscillator

My thanks go to Mike Haydon of Waters and Stanton Electronics, for the loan of the review instrument. The Global GDO Mk.II Dip-Meter is available from them at £69 including VAT, plus £5 postage and insurance, at 22 Main Road, Hockley, Essex SS5 4QS. Tel: (0702) 206835/204965.

## A Practical Guide To Making Printed Circuit Boards

To start off our p.c.b. 'theme' in the magazine this month, we've asked the Rev. George Dobbs G3RJV to give us some practical advice. He's aiming to help you make your own p.c.b.s for some of the interesting projects coming up in *PW* this year. And, as usual, George has come up with an appropriate quotation!

*"Water, water, everywhere and the boards did shrink...."*  
Samuel Taylor Coleridge 1772-1832.

If you take a quick look into almost any piece of electronic equipment these days, you'll realise that printed circuit boards are now the standard way to construct an electronic circuit. A printed circuit board (p.c.b.), sometimes called an etched circuit board, is formed by chemically etching away parts of a copper foil which is cemented to an insulated sheet.

The copper left after etching provides the actual wiring between the components in the circuit. Usually the components are placed on the non-copper side of the board, with their leads going through small holes in the board and copper leads. After mounting, the components are soldered to the copper foil tracks.

### Neat And Convenient

Etched circuit boards are a neat and convenient way to mount circuits. The components are held firmly in place and the wiring can be neat and direct.

They are also very useful for small or large batch production of the same circuit. Copies of the board can be made, which not only help the duplication of the circuit, but also produce an accurate copy of the master board.

### Appropriate Method

Most amateur constructors only want to make one copy of a circuit board, so any method appropriate to the task can be used. Many amateur constructors like to use a p.c.b., even for one-off projects, because they are a reliable and tidy method of construction.

It's very simple to design and build p.c.b.s for even the simplest amateur project. Many designs in books and magazines provide printed circuit board layouts, and it's easy to copy these layouts for a

one-off board.

All the materials required, are available from amateur radio suppliers. The chemical process is simple and, with a few basic precautions, very safe.

### The Requirements

The basic requirements for making your own p.c.b. projects is a stock of copper-clad board. The usual material is an insulated board, with a thin layer of copper, usually 0.0027in thick, cemented on one or both sides. However, initially we will deal with single-sided boards.

It really pays to use good quality board. I would use nothing other than good glass fibre board. Cheaper Paxolin or phenolic board is available, but the epoxy-based glass fibre board offers the best quality. It also has the added advantage of being slightly translucent. This means that the copper track will be visible (especially if held up against a bright light) from the top of the board. This is helpful when adding components.

### Etch Resist

The next basic requirement is an 'etch resist' material. This is placed on the board, prior to chemical etching. Portions of the board covered with the etch resist material, retain the copper during the etching process.

There are many types of etch resistant material which the amateur can use for one-off boards, and several methods of applying the material to the board.

The final basic requirement is a chemical etchant. There are several suitable chemicals, but for amateur use Ferric Chloride is the easiest to

obtain, and probably the easiest to use provided you follow some simple rules.

### The Design

The amateur constructor may have to design the layout from a circuit. Alternatively, they may already have a suitable p.c.b. layout from an article in a magazine or book.

If an existing design from an article is being used, after checking that it's an actual size print, you should make a photocopy to save causing harm to the original. If the printed design is larger or smaller than actual size, there's no problem either.

Fortunately it's easy, these days, to find a 'zoom' photocopier at a local copy shop to produce an actual size drawing. This copy will then be used in the same way as an original design.

### Not Difficult

Designing your own p.c.b. from a circuit is not difficult, and your technique and final results will improve with practice. But, unless you own a sophisticated computer aided (CAD) printed circuit board system, the job is first done by trial and error with a pencil and eraser.

The materials I use are a sharp pencil, a soft eraser, a ruler and a ball-point pen. The design is laid out on 0.1in graph paper. This is the standard spacing for printed circuit board work. With metrication of school work, this type of graph paper is becoming more difficult to obtain, although good stationers or graphics shops

should hold stocks.

When you're ready to begin, place the circuit with the graph paper on the table you've chosen to work on. Before you start, it's also useful to have the main components to hand to check their exact spacings on the layout.

I always work from the 'top' of the board, that is, the non-copper-clad side which takes the components. Some people prefer to work from the copper track side, but I have difficulty in thinking upside-down!

### Pencil Lay-Out

Using the pencil, I begin to lay-out the components on the paper. Large dots mark the insertion points and soldering pads for the component leads.

I also sketch in the components, thus providing a basic layout drawing as I proceed. The tracks are included by drawing lines between the 'pads'. The 'pads' incidentally, are the larger points on the copper track where components will eventually be soldered.

Using this method of design, translating the circuit to the layout is a real case of trial and error. My attempts usually involve a lot of rubbing out and relocation of components, before I'm satisfied with the final layout.

Once you're under way, you'll see that having the main components available is a great help. It means that the spaces between the leads or contacts can be accurately marked by placing the component on the paper.



Fig. 1: Various ways of providing an etch resist to blank p.c.b. material using a Berol marker pen, a Pentel marker, and the well-known Dala etch resist pen. The method of making p.c.b.s by the 'punch and join' system, using the automatic centre-punch shown (bottom), is described in the text. The partly completed p.c.b. on the left, has been made by 'punch and join'.

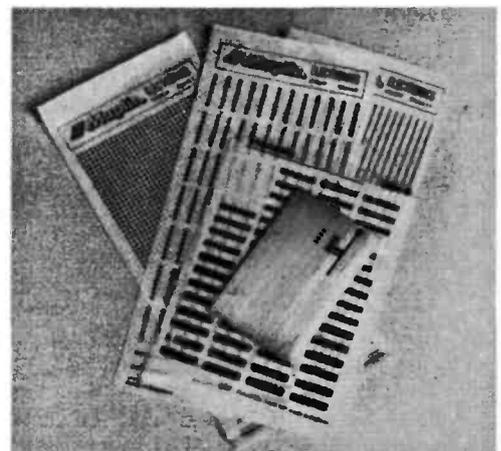


Fig. 2: Etch resist 'rub down' transfers. These are particularly useful for i.c. footprint pads (see text).

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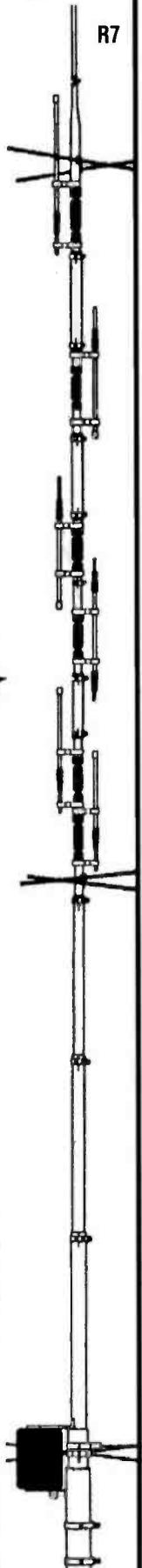
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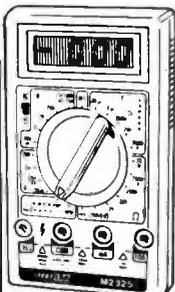
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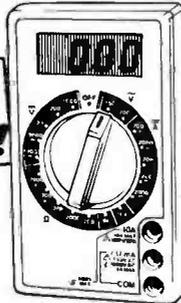
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## Track Marked In

When the layout is satisfactory the track can be marked in, by using a ball-point pen. Make the markings clear and press hard with the pen.

The positions of the pads are enlarged to a 'blob' rather than a dot. This represents the top of the circuit, but the actual tracks are on the underside.

All the track and pad positions must now be marked on the reverse of the paper. Use a ball-point pen again, and don't forget to press hard. This should result in the pen-lines being visible underneath, and marked in on that side.

The correct way to do this is to use a 'light box', which brightly illuminates the paper from below. You use it by placing the paper face down on the box. The light shining through then reveals the tracks.

Many amateur constructors won't have a light box but placing the paper, against a window in daylight, will do the same job. The p.c.b. artwork is now complete, with the layout on one side, and the tracks and pads marked on the other side.

The next task is to transfer the track and pad design to the board as etching resistant material (usually called 'etch resist'). To do this, there are a number of methods.

## Free From Grease

Copper-clad board can only be successfully etched if the surface is clean and free from grease. Any dirt left on the copper, may well act as an etch resist material itself, and leave unwanted areas of copper on the board.

The copper surface should be cleaned until it shines. A good cleaning material is wire wool. I prefer to use standard kitchen materials to clean my boards.

First, I squirt neat washing-up liquid on the board. Then I sprinkle household abrasive cleaner (Ajax, Vim, etc., will do the job) onto the liquid, before rubbing the whole surface with a warm, wet cloth.

This process degreases and cleans the surface in one go. Finally, you should rinse the board in hot water, dabbing it clean on a paper kitchen towel, avoiding finger contact with the now prepared copper surface.

Practical Wireless, February 1992



Fig. 3: The most commonly used etching chemical, ferric chloride, shown in dry powder and liquid form.

## Tape Technique

The tape technique is the simplest method of making an etch resist surface on a p.c.b. It's ideal for quick, one-off boards, but is not suitable for boards that contain a lot of detail.

In essence, this method consists of covering the copper side of the board with adhesive tape or plastic. It's then removed, with a sharp knife, uncovering those parts which are to be etched, exposing them to the etching fluid.

With this technique, I normally use strips of masking tape, allowing a large overlap on each strip. However, I have used the Fablon type of sticky-backed plastics covering material and even self-adhesive address labels! Whatever you use, the material should be chosen so that markings can be made on it with a pencil or a felt-tipped pen.

When using this method, you should first cut the piece of copper clad board to the size of the p.c.b. design. Then cover it with masking

tape or other suitable material.

The easiest way to transfer the layout to the tape surface, is to use carbon paper. Cut a piece of carbon paper to the size of the board and lay it, carbon surface down, onto the masking tape. The board design with the tracks and pads is placed, face-side upwards, on the carbon paper.

Secure the paper to the board with a couple of small pieces of masking tape. Draw over all the tracks and pads, pressing down hard, with a ball-point pen.

When the artwork and the carbon paper are removed, the design should be seen on the masking tape surface. It's a good idea to 'thicken-up' the lines with a felt-tipped pen and a ruler.

## Sharp Knife

Using a sharp modelling knife, or better still, a scalpel, carefully cut along the edges of the tracks. It's easier to convert the tracks into rectangular blocks rather than thin and stylistic lines. Remember the



Fig. 4: The G3RV etching assembly! Clothes pegs (once used for this job, don't even consider them for wash-day ever again!) provide a simple and secure way of holding the p.c.b. vertically in the etching fluid (see text).

tracks must remain ON the board: they will be retained copper (as they are protected from the etching process).

This method lends itself to the 'minimum etch technique', that is, leaving as much spare copper on the board as possible. The spare copper is joined to ground (or earth) on the circuit, and provides a low impedance ground-plane around the board. So, you can cut out the tracks as 'islands of copper in a sea of copper ground-plane'.

Once the tape has been removed, the board is ready for etching. You may find that the edges of the cuts have lifted slightly. If they have, place a sheet of clean paper over the board and rub firmly all over the surface with the back of a comb, to ensure the edges are firmly adhered to the surface.

## Surface Mount Boards

The masking tape technique may also be used for another method of p.c.b. construction, the 'surface mount' board. Perhaps you have seen surface mounted boards using tiny components without leads.

It's also possible to surface mount normal components on a board. This method has several advantages in some types of circuit.

With this technique, all the parts are mounted on the copper side of the board. Their leads are cut short and they are soldered directly onto the tracks.

This method requires thick tracks of the 'island' type. It has the advantage that no holes are required in the board, and components can be easily taken off the p.c.b., and changed during experimentation.

With this technique it is also possible to design the layout directly onto the board. I have used this method in prototyping, progressing directly from a circuit diagram to a complete board in a very short time.

To use the surface mounting technique, cover the board with tape in the way I've already mentioned, then take a pencil or felt pen and mark out the components on the board.

It's even possible, in some cases, just to re-draw the circuit on the board and translate it directly into a layout. You only have to tidy up the lines with a pen and ruler,

# PCB Special

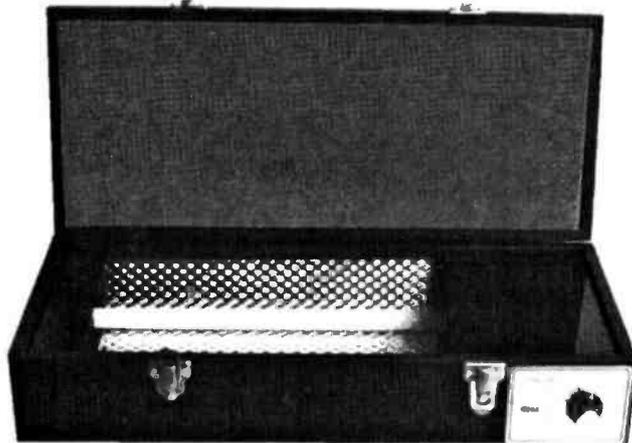


Fig. 5: An ultra-violet light exposure box, used to 'fix' photo-sensitised etch resist. (see text).

and then cut and etch.

With this process, no holes are required and the components solder directly onto the copper surface. Many commercial linear amplifiers are built in this way.

## The Felt-Tip Pen Method

The felt-tip pen method is probably the most popular method of making p.c.b.s for most amateurs. With this method, the board is marked with etch resist material using a pen, or in some cases a brush.

Special etch resistant felt-tip pens are sold for p.c.b. work, but I use ordinary spirit-based felt tipped pens. Most spirit-based pens provide good etch resistant markings, and they can be bought cheaply in a variety of widths and point styles.

Which pens are best? Well, a good test is to pull the cap off the pen and sniff the tip. If you want to sniff it again, it's probably a good etch resist pen! **Editorial note: Take care, as some of the solvents used in this type of pen, are petroleum-based and can have the same effect as the well-known 'glue' vapours.**

My favourite felt-tip is the Pentel N50 Bullet Point Permanent Marker. It has a bullet-shaped point which can lay down quite thin lines. When it's pushed firmly onto the board it will also make a good 'blob' for a solder hole or pad. For thinner lines, I use one of the fine permanent markers made for writing on overhead projector transparencies.

## Surface Clean

Naturally the copper surface must be clean and grease free, before the pen markings are made. Sometimes however, the copper surface is reluctant to take the markings if it's very clean and smooth.

If this happens, place the board into the etching solution for a few seconds, then remove and wash it. This provides a dull, but clean surface, which can often help the marking fluids 'stick'.

## Two Ways

There are two ways to transfer the p.c.b. artwork to the copper surface. They are the carbon paper method and the 'punch and join'

technique. These methods can be useful for home-drawn layouts or layouts copied from magazines.

The carbon paper method is exactly as I've already described, except that the carbon paper is placed directly on the copper surface. The carbon marks then form the basis of the lines and pads which are drawn in by hand with the felt pen.

Don't be timid when drawing the tracks. On professional boards, the tracks are often slender, but on amateur boards they can be as thick as the space allows.

If large areas of copper are to remain on the board, these can be formed by laying down several layers of felt-tip pen markings. It's also possible to cover large areas with a small brush and nail varnish (a good etch resist material) or even strips of masking, or plastic tape.

## Punch And Join

The 'punch and join' method is my favourite. To use this technique, secure the artwork (original or magazine) to the cleaned copper board, using a little sticky tape along a couple of edges.

Each pad marks the point where a hole has to be drilled. It's helpful in the drilling stage, if these points have been marked with a centre punch, so it's best to mark them at this stage.

I use a spring-loaded punch, pressing down on each pad or hole point. When the positions have all been punched, the artwork is removed. The copper will now have a series of punch marks on the surface.

Now you should take the felt-tipped pen (the Pentel N50 Bullet marker is ideal here) and make a blob mark on each punch mark. These marks provide a pattern of dots for the pads. I then draw in the tracks free-hand between the pads. A small ruler can be used for a neater board.

## Rub-Down Lettering

Most readers will already be familiar with the Letraset or other brands of rub-down lettering. These are dry transfers, which are rubbed down onto a surface, to provide neat lettering or graphics.

A whole range of rub-down dry transfers are made for p.c.b. fabrication. It's possible to buy sheets for pads, integrated circuit pins, lines, curves and other component 'footprints'.

The transfers can replace the felt-tip pen in either of the techniques described above. I have made very attractive p.c.b.s using the punch and join technique with rub-down transfers.

A basic set of transfer sheets to suit most amateur radio applications, would include several

sizes of pads, several thicknesses of lines, a sheet of i.c. pads and, if required, a few curved lines.

The lines can also be obtained in rolls. Both the roll-type and the sheet-type lines, are placed on the surface and cut to length with a sharp knife, then rubbed down. It's best to use one of the purpose made spatulas to rub down the transfers, although a blunt pencil tip may be used.

## Using A Combination

I have also used a combination of the rub-down transfers together with hand-drawn lines, which were marked down with felt-tip pen. In this context, the i.c. pin spacings provided by the transfers are very useful, as they provide an accurate footprint for the pins.

I have often used these transfers, and then added the tracks using a pen and the result has been successful. But please take care when you're adding transfers, and try to keep your fingerprints off the board!

## Hot And Cold Water

I live in a large Edwardian house with extensive cellars, which include a room with a sink and hot and cold water. My wife and I (reluctantly!) share the room for her photographic darkroom and my p.c.b. making area. The etching process is not dangerous or even tricky, but a few sensible rules **must be observed**.

The most popular etchant, ferric chloride, is a poison. It marks the skin, but worst of all, it stains cloth. A ferric chloride stain on a towel (an evil dark brown colour) will **NOT** come out. **You have been warned!**

So, in the interests of domestic harmony, it's best to keep the etching process way from food and household goods. Some people buy a large deep plastic bowl for etching. Please try and keep all the materials within its confines. Use rubber gloves and plastic tweezers and avoid splashing the liquid.

## Dry Form

Ferric chloride is supplied in dry form (crystals or pellets) or in concentrated solution. The dry form is cheaper, and once mixed the solution is stable and keeps well.

The mixing proportions are



Fig. 6: A pair of 12V powered drills suitable for p.c.b. work, shown with a collet used to accommodate small drill-bits in a larger drill chuck.

usually one part dry ferric chloride to two parts water. **IMPORTANT NOTE:** Add the ferric chloride to the water - NOT the other way round. When the crystals dissolve, heat is given off, so add the solids slowly to the water.

The concentrate solution will have instructions on the container, telling you how much water has to be added. Ferric chloride is best stored in solution because it is very hydrophilic, and it will quickly absorb water from the atmosphere.

Having said all this, I have used this form of chemical etchant for years, and apart from the odd splash on a shirt sleeve, I have never had any problems. So, don't let the precautions discourage you from having a go, just take care and take sensible precautions.

## Speeded Up

The etching process is speeded up if the solution is slightly warm. The process is also aided by agitation of the solution.

A fresh, warm solution (20°C or so) will take 15 to 20 minutes to etch a board. A cold solution will take 30 to 45 minutes. If the process is taking much longer than 45 minutes the solution is probably spent and should be replaced.

A number of boards, depending upon the size and amount of copper being removed, can be etched in the same solution, but each successive etching process will take a little longer.

The etching process **must** take place in a plastics or glass container. Plastics trays of the type used for photographic developing type are very commonly used for etching, and they are quite cheap to buy.

There's some debate about etching boards face upwards, or face downwards, in the solution! Some people like to place the board copper side up and sink it in the tray, gently rocking the tray from time-to-time.

Others prefer to float the board, copper side down, on the surface of the etchant. This is done because they consider that this method enables the waste products to sink, preventing them interfering with the etching process.

I do neither as I etch my boards sideways! My p.c.b.s are etched in jars (jam jars or coffee jars) for small boards, and a plastics cereal container for larger boards.

The container is filled to near

the top, and I attach a wooden clothes-peg onto one edge of the board. The peg **must** avoid any of the tracks.

Then I lower the board, on its edge, into the solution. Then I place a wire rod across the top of the jar or container, and also through the spring hole in the clothes-peg.

## Standing Vertically

The board remains standing vertically in the solution. From time-to-time I give the board a twist in the solution, this is to stir the liquid and free any deposits.

The board requires frequent checks during the etching period. The secret is to stop the process when all the unwanted copper is removed, but not to allow further etching.

This is because of a problem known as 'under track etching'. It starts once the copper has been etched away from the exposed places on the board. The process will then continue with the solution eating away under the etch resist...under the tracks we need!

When the etching process is complete, remove the board, plastic tweezers are useful, and wash off all the etchant in tap water. The etch resist itself must now be removed.

If you've used tape, it will simply peel off. Pen marks and transfers are best removed with steel wool or household scouring powder. Etch resist from the popular Dalo fibre-tip p.c.b. pens, can be removed easily with switch cleaner or methylated spirits.

Next job is to closely inspect the board for small bridges of copper between the tracks. Holding a glass fibre board up to a strong light, can help check for this problem as they are normally translucent.

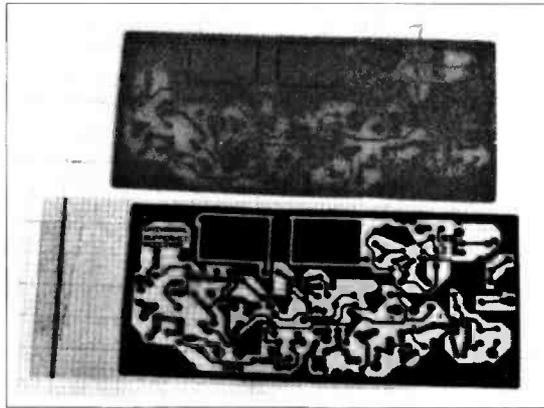


Fig. 7: A p.c.b. design copied from a book using the photo-etch technique. The 'positive' is in the foreground. This particular project is from the newly-published 2nd edition of *WTFB's QRP Notebook*.

## Special Drill

If the etched board is not to be used with the surface mount technique, holes must be drilled for the component leads. These holes are small, around 0.8mm or 1mm, and require a special drill or a collet on a bench drill.

Many radio component suppliers sell lightweight 12V drills with small chucks suitable for such drills. If a hand-drill is available, a small collet chuck can be used in the existing chuck.

The drills are thin and break very easily. A drill stand is very useful, and several of the 12V powered drills have a stand as an optional extra.

**Warning: Do not** use a normal household electric drill, even with a collet chuck. If you do, the chances are it will quickly break your small drills and 'drill' you with small fragments!

Before I start drilling, I prefer to make a centre-punch mark at each drill point. The small drills tend to 'walk' across the surface if a freehand stab is made at the board.

Drill with care. It can be a tedious job, but it's even more tedious if the last drill breaks before the last hole is drilled!

## Cleaning Again

The board should now be complete for use. However, it's a good idea to clean the copper surfaces again before the soldering begins.

A useful item for this job is a p.c.b. abrasive cleaning block, sometimes called a polishing block. These blocks are made from a polishing compound bonded in an elastic material.

Finally, I often add a layer of clear protective lacquer. A special spray-can lacquer can also be

obtained. This lacquer protects p.c.b.s from dirt and oxidation, but it can be soldered through.

Commercial p.c.b.s are usually tinned or plated, and some manufacturers sell tinning solutions for boards.

## Photo-etched Systems

Nowadays many radio amateur constructors make their p.c.b.s using the photo-etch system. This technique is very similar to the process used for making commercial boards.

It's a more expensive process, but is quite simple and gives very professional looking boards. It can also be used for making copies of the same board, which is especially useful for amateur radio clubs and groups.

In this process, the copper is covered with a photosensitive resist. The pattern of the circuit is transferred by placing a photographic 'positive' over the board, and then exposing it to ultra-violet (UV) light.

The tracks on the positive are opaque, and the areas to be etched are clear. After exposure to the UV light, the board surface is chemically developed, like a photographic film. After washing in water, this leaves a pattern of tracks and spaces that can be etched in the normal way.

**For this process, the amateur requires:**

1. Photo-sensitised copper-clad board
2. An ultra-violet light box
3. A developing solution

All of the necessary parts are now readily available from component stockists. It's also possible to buy an aerosol spray to photo-sensitise normal copper-clad board.

I have found the results with the photo-sensitising sprays to be variable. Because of this prefer to buy the prepared board, although it is considerably more expensive than normal copper-clad board.

There are many ultra-violet light sources available, although many people make their own. Even though the tubes, other bits and starters are widely available, I managed to persuade my wife to buy me one for Christmas a few years ago!

## Choice Of Developer

I'm going to offer firm advice on the choice of developer. It has been usual to develop the exposed boards with a solution of sodium hydroxide (caustic soda). Unfortunately, it's not very nice stuff!

Fortunately, we can now avoid caustic soda. This is because the German company 'Seno' has produced a range of p.c.b. chemicals, that includes a developer SN110 (SN111 for spray-on resists) which is free of caustic soda.

This useful material comes in a sponge-ended applicator, like some shoe cleaners. It's harmless and has a shelf-life of two years.

The chemical is simply wiped on the board, and is in my experience quite economical in use. Seno also supply a photo resist applicator (SN100), a resist stripper (SN120), and a de-oxidiser (SN130), for cleaning boards.

## Technique Ideal

The photo-etch technique is ideal for taking p.c.b. artwork from books or magazines. Using this method you can hijack any of the p.c.b. artwork from *PW*!

## Suppliers of printed circuit board equipment

**Maplin Electronics, PO Box 3, Rayleigh, Essex SS6 8LR.**  
Full range of the materials mentioned in this article.  
Catalogue available from W.H.Smith. Sales (0702) 554161.

**CirKit Distribution Ltd., Park Lane, Broxbourne, Hertfordshire EN10 7NQ.**  
Full range of p.c.b. materials including transfers and the 'Seno' range of chemicals.  
Catalogue from W.H.Smith. Sales (0992) 444111.

**Marco Trading, The Maltings, High Street, Wem, Shrewsbury, Shropshire SY4 5EN.**  
Good range of p.c.b. materials including transfers.  
Catalogue available. Sales (0939) 32763.

**Rapid Electronics Ltd., Hill Farm Industrial Estate, Boxted, Colchester, Essex CO4 5RD.**  
Extensive range of p.c.b. products including Seno chemicals and UV boxes.  
Catalogue available. Sales (0206) 272730.

The method is to photocopy the artwork onto a clear acetate sheet of the sort used in overhead projection. Many high street copy shops will do this job, and even supply the sheets, although they're not cheap.

It must be a dry-powder copier, but most of them are of this type these days. A single copy may not be opaque enough for UV light exposure. You should hold it up to the light to see how dense the black appears. If one is not opaque enough, two copies can be used, one on top of the other and carefully aligned.

## Mirror Image Tip

A tip I can offer here, is to get the two copies as a mirror image

to prevent parallax distortion. To do this, make a simple copy onto an acetate sheet. Then put the sheet in the copier as the master, but turn it over to give the mirror image.

This second copy can be placed over the first copy so that the acetates are copier-toner side, to toner side. This ensures that the thickness of the sheet does not come between the two copies. This method can produce very good reproductions of p.c.b.s from magazines and books.

Full details of the photo-etch method are usually supplied with the materials. It's a fascinating technique, and one which is well worth exploring for the excellent results it can provide.

*Well, I hope you've now got enough interest to 'have a go' yourself. Do try making your own boards, it's a marvellous way of making some really attractive, and extremely interesting projects.*

I've been the technical artist on *PW* for the past 13 years. During that time, I have seen the technical advances in professional board design, far exceed the advances made in p.c.b. production by and for the hobbyist.

In this respect, the introduction of specialised computer technology for p.c.b. design appears to be self defeating. This is because since the output of such systems are incompatible with the 'Heath Robinson' methods adopted for producing home-brew p.c.b.s.

This technology gap causes numerous problems. It's especially awkward, when I'm considering how best to advise potential authors on the correct method of preparing articles for publication.

I can see, on the one hand how a project built on a p.c.b. drawn with an etch-resist pen, is a perfectly adequate method of producing a prototype. On the other hand, however, the supplied p.c.b. artwork can very often resemble the proverbial scrawl from the spider in the ink well!

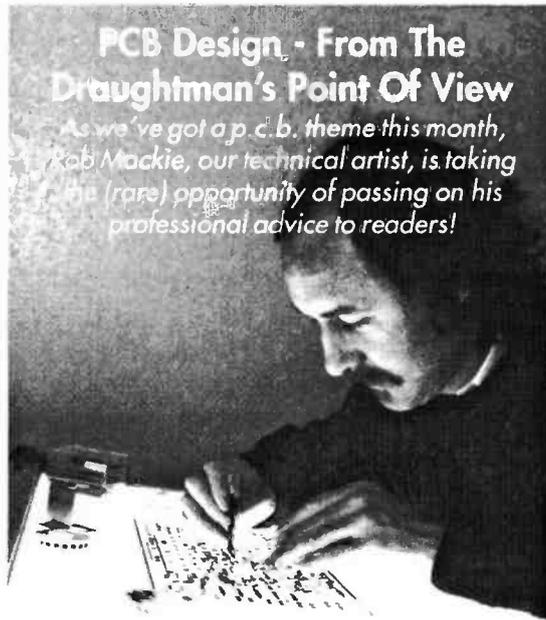
So, as a simple guide to better design, I've outlined a few tips that should make your task a little simpler. My ideas will probably not only help you in your own shack work, but they'll also help when you send possible projects into *PW* for consideration.

In general, most electronic component leg spacing (lead pitch) is based on a standard 0.1in grid. To this end, all the major catalogues, RS Components, CirKit, Maplin Electronics, etc., provide this information, along with the component sizes (some are better than others!).

Don't worry if this sounds a bit daunting, it's not! It's a fairly simple process to apply to your designs. All you need to do, is to arm yourself with a pencil, a sheet of tracing paper, and a sheet of 0.1in graph paper placed underneath.

To begin any design, start by drawing the pad pattern of the major components. This will usually be the i.c.s, and if's done on the tracing paper, using the graph paper underneath as a guide.

The next job is to draw the tracks between pads on a clean sheet of tracing paper, placed on top. This method is particularly useful when you're to construct double-sided boards. It's helpful where another sheet can be added, or just to add another sheet to enable



**Rob Mackie, *PW*'s technical artist at work on a light-box designing a p.c.b., using traditional methods, now replaced by computer technology.**

you to manipulate areas of components with one another.

The reason for starting with the i.c.s, is that you'll find a number of tracks link direct, pad-to-pad. This means other links cannot cross them.

When placing other components (resistors, capacitors, diodes), etc., you can bridge across tracks using the lead pitch. The pitch can be increased if a large number of tracks have to pass beneath them.

It's usual for experienced designers to draw p.c.b.s from the track side of the board, where all the components are seen reversed (particularly the i.c.s).

Although this method may seem to be particularly intricate for beginners, it's worthwhile. In practice, it's quite simple to draw from the component side of the board, then just turn over the final track pattern tracing paper. Finally, don't forget to mark it 'track' side! After all this effort you should end up with two separate drawings (for a single-sided board). One drawing details the components outline and positioning, and the other, showing the pads and tracks on the reverse side of the board.

The method of building up layers of tracing paper, can be greatly enhanced by the use of a light-box. The photograph shows me (some years ago), working with a light box to produce a p.c.b., using dye-cut pads and tape produced by Chartpak.

This method has been superseded by Adobe *Illustrator 3* on a Macintosh computer as shown on the front cover. This application has the added advantages of manoeuvrability of pads and components, plus extreme accuracy with speed of operation.

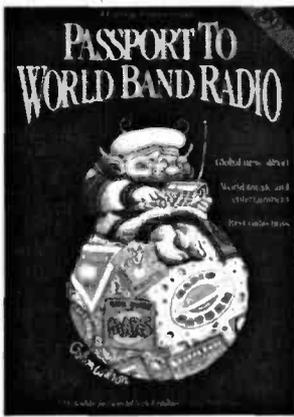
In the near future we will be designing all our p.c.b.s on a full CAD system. This will ensure accuracy, due to the program linking the circuit diagram to the p.c.b. layout.

So, all you manufacturers out there reading this, how about a decent system to produce good quality p.c.b.s direct from a computer output?

Hoping my few words have helped you, I wish you all a happy new year and may all your designs be good ones!

Rob Mackie

# Book Reviews



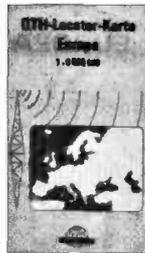
**Passport To World Band Radio 1992**  
 Editor-in-Chief Tony Jones  
 International Broadcasting Services Ltd.  
 ISBN: 0-914941-27-5  
 385 pages, price £14.50  
 Available from PWBook Service, £1 post and packing.

Every year this book provides a window on the world of radio listening. The 1992 edition is no exception. Packed throughout its 385 pages with useful information and product guides, this book is a must for any listener's bookshelf. Readers often ask us for advice regarding what equipment to buy, and quite frankly a book of this calibre provides most, if not all of the answers. It's worth buying the book just for the 1992 buyer's guide, let alone all the information on frequencies, features on broadcasters, where to listen and when to listen. A

truly excellent buy for anyone just starting in the hobby, or for that matter any enthusiast wanting to keep up to date with what's on the radio worldwide. Highly recommended.

**QTH Locator Map Europe Cartographia. Price £5.95**  
 Available from PWBook Service, plus £1 post and packing.

A good map is a very useful aid to v.h.f. and u.h.f. amateur band working, and this bright and attractive coloured wall-mounting QRA locator, provides some useful extras. The locations of v.h.f. and u.h.f. beacons throughout Europe are marked on this 675mm x 1079mm map, with all the relevant information on frequency, mode and operational details. The map also comes complete with instructions on how to use the QRA locator system.



**1992 Radio Amateur Callbook - North American Listings**  
 American Radio Relay League  
 ISBN: 0-8230-8712-3

1631 pages, price £19.50  
 Available from PWBook Service, plus £1 post and packing.  
 This annual publication seems to get larger every year, and it's packed with the vital information needed by DX-chasers. Covering over half a million licensed radio amateurs it also includes 29300 new call signs and over 75000 changes. A must for the keen DXer who is chasing North American stations.

**1992 Radio Amateur Callbook - International Listings**  
 American Radio Relay League  
 ISBN: 0-8230-8711-5

1887 pages, price £19.50  
 Available from PWBook Service, plus £1 post and packing.  
 This book, which makes a natural purchase to go with the North American listings, provides fascinating reading. Radio amateurs from Togo to Thailand and from Belfast to Burundi are all listed. A very useful book for both the listener and transmitting amateur.

# BARGAIN BASEMENT

Write out your advertisement in BLOCK CAPITALS - up to a maximum of 30 words plus 12 words for your address - and send it together with your payment of £2.35, and corner flash or subscriber dispatch label to: **Donna Vincent, PW Bargain Basement, Enefco House, The Quay, Poole, Dorset BH15 1PP.**

Subscribers must include the dispatch label bearing their address and subscription number to qualify for their free advert.

Advertisements from traders, apparent traders or for equipment which it is illegal to possess, use or which cannot be licensed in the UK, will not be accepted.

No responsibility will be taken for errors.

**Wanted** Can anyone get the following cards for Apple computers to work with an Apple 2e. (1) Digitek PAL colour encoder DK21-5. I can get a red background but no text display. (2) Digitek parallel interface card DK25/4. I need the connections to the 26-way cable connector. Both cards made by Digitek, Unit 14, Grafton Place, Chelmsford, Essex. Have written to them but received no reply. S. Shaw, PO Box 1404, Randfontein, 1760 South Africa.

**For Sale** Uniden Bearcat 200XLT as new, boxed with charger and case, £165 o.n.o. Peter. Tel: 081-804 4565 after 6pm.

**For Sale** Fairmate 100E scanning receiver in excellent condition, boxed with charger, NiCads and two antennas, £175. Tel: (0633) 255609 anytime.

**For Sale** Glenstar Navy Special dipole base antenna 14MHz unused, £25. FRG7000 immaculate, £200. AOR-2001 scanner, £200. ST5VIC RTTY terminal. Cost £145, never used, £75. Labgear 7056 colour text, £25 offers considered. Tom, 5 Centre Parade, Kettering, Northants. Tel: (0538) 522007.

**For Sale** Sale of commercial and home-brew valve and transistor equipment and parts. Including 1949 Zenith, 1990 Regon, ATS and more. Need space, cash. SAE for list. Peter GALEG, 14 Stagelands, Crawley, West Sussex RH11 7PE.

**For Sale** FRG8800 with FRV8800 v.h.f. converter and

FR7700 antenna tuner, £450. Comax decoder RTTY Morse TOR with display CD670, £150. Tel: North Devon (0271) 812622.

**For Sale** ADR AR-2800 scanner boxed as new, £300 cash no offers plus postage. Mr Lepino. Tel: London 037-245 4381 anytime.

**For Sale** Trio 144MHz all-mode transceiver TR9000, £250. System base BQ-9, £20. Power supply PS-20, £30. Speaker SP120, £20. Jaybeam 10XY/2m antenna, £30. Dairwa rotator and controller, £150. Trio communications receiver R1000, £150. Tel: (0827) 897880 after 5.30pm.

**Wanted** Grundig Satellit 1400, 2400 or ganged tuning capacitor block to fit the same receiver. Tel: Hampshire (0703) 333431.

**For Sale** Yaesu FRG-7700 receiver with manual - owner deceased, £120 o.n.o. Tel: (0495) 225825.

**For Sale** Icom R7000 h.f. communications RX, 200kHz to 26MHz. With manuals, hardly used, £850 o.n.o. Tel: (0734) 811792 after 7pm.

**For Sale** Lowe HF-225 keyed, active whip antenna, a.m./f.m. detector, battery pack, unused still in box. Manual and Lowe's listener's guide, £390. Akai 4000SD MKII reel-to-reel stereo recorder, £65. Mr Foster, Chester. Tel: (0244) 390184.

**For Sale** Kenwood TS940S with internal a.t.u. a.m. filter. Lowe mods. MC50 base mic. Boxed v.g.c., £1275. Racal RA17W an RA17L with 2kHz & 4kHz filters v.g.c. with manual, £190. Bryan Robertson. Tel: Woodstock (0993) 813046 evenings/weekends. Buyer inspects/collects.

**For Sale** Trio TS-120S, DFC-230 external v.f.o., AT-130 a.t.u. All boxed v.g.c., £520 o.n.o. Yaesu FT-208R hand-held, NC-8 base charger, mobile adaptor, spare NiCad, speaker/mic. All v.g.c., £180. Prefer buyer collects. Ian, Bury St. Edmunds. Tel: (0359) 70527 after 6pm.

**Wanted** Kem Kantronics all-mode TNC by almost broke student. No silly prices please. Dave GILCX, Leeds. Tel: (0532) 784043 after 6pm.

**For Sale** G2DAF receiver (Philpotts chassis, 898 Dial, etc.) Idle 20 years. Now needs attention, with handbook, £60. Hallicrafters TX/RX FPM300 - solid state with driver PA valve, £150. Mr J. Gibbs. Tel: (0625) 428806.

**Exchange** Canon EOS 600 camera with standard lens and 35-105 zoom for h.f. communications receiver, Yaesu, Icom or Kenwood with digital read-out. Willing to haggle for the best deal. Doug Smith. Tel: (0582) 841697 evenings.

**For Sale** IC-720A h.f. all-band transceiver and general coverage receiver. Brand new and still in box. Bought for use in Tall Ships race but never used, £450 o.n.o. Gavyn Wright, London. Tel: 071-435 8960.

**For Sale** Microreader MkII as new, £100. Yaesu FR7-7700 a.t.u. boxed as new, £40, or swap outdoor active antenna. Racal RA17L, mint condition 0-30MHz with matching speaker, guaranteed if required, £200. Tel: (0332) 372696.

**For Sale** Sony ICF SW7600, £100. Buyer collects. Tel: Portsmouth (0705) 735385.

**For Sale** Global a.t.u. AT1000 rarely used. Deecomm a.t.u., never used. Price for Global, £35 and for Dee, £25. Both together, £55. Due to low price no offers. Mr Walker, 202 Swansea Road, Trebanos, Pontardawe, Swansea. Tel: (0792) 830981.

**For Sale** Realistic PRO-2006 25-1300MHz Hyperscan, 400 channel/memories priority, a.m. n.b.f.m. f.m. wide 240V a.c. or 13.8V d.c. Eight months old, boxed, mint condition, £225 o.n.o. Mr Lannon, 152 Heol Llanishan Fech, Rhiwbina, Cardiff CF4 6RG. Tel: (0222) 625314.

**For Sale** Sony ICF PRO-80 (PLL synthesised receiver) plus antenna and instructions, as new, £100 o.n.o. Tel: 071-730 7174 (work).

**Exchange** Icom IC2SE 144MHz hand-held for Icom IC4SE/SET. The set is in good condition with the box, instructions and standard accessories (Same mis-read the novice licence). Allister Watson. Tel: 031-857 3942 before 10pm.

**For Sale** Eddystone 940 receiver with speaker plinth, mint condition - no mods, £150 - collect or deliver in country. G3VVB, Cornwall. Tel: (0726) 842368.

**For Sale** Wideband communications receivers. Icom R7000 with remote control, £650. Also Yaesu FRG-9600, £270. Both with extended coverage, v.g.c., manuals and original packaging. Tel: Gwent (0600) 716256.

**For Sale** Components for Robin frequency counter. Unfinished project. Insufficient time. All eighteen i.c.s. Digital displays mounted on p.c.b. WR290, BC548s, 7805, Crystal. Total cost new £37, sell for £25. Tel: (0204) 51502.

**For Sale** Grundig satellite 650 international, NiCads fitted, two years old, £280. Tel: 071-722 4684.

**For Sale** Kenwood TS130SE h.f. transceiver mint, £600. Kenwood TM321 v.h.f. mint, £200. Kenwood TH-41E spare battery, £99. Pye Olympic 144.650, £25. CB 3000

f.m., £20. Dumbterminal, £10. Buyer collects. Tel: (0603) 627389.

**For Sale** Trio R2000 with v.h.f. receive, and books, £395. Tel: (0268) 762366.

**For Sale** Icom ICR70 100kHz - 30MHz communication receiver with f.m. fitted, £350 o.n.o. J.L.L. SX400 26-520MHz continuous coverage scanner, £200, both in mint condition. Tel: Dorset (0305) 821152.

**For Sale** AOR-3000 multi-band scanning receiver, a.m./s.s.b., n.b.f.m./w.b.f.m., 100kHz-2036MHz, 400 memories, £575 o.v.n.o. Standard AX700 scanner, panoramic adaptor (spectrum analyser), 50-905MHz, 100 memories, multi-scan facility, £375 o.v.n.o. Both boxed with usual accessories. Peter, West Sussex. Tel: (0798) 872363.

**For Sale** Swan 350 Transceiver, 35, 7, 14, 21, 10MHz, s.s.b. phone, c.w., a.m. with power unit, handbook. Tel: (0504) 49514.

**Wanted** for novice class. G3HSC rhythm method of Morse instruction. First 12in LP record for beginners, to buy or borrow to copy. Jack G4IZM, Rugby, Warwickshire. Tel: (0788) 811295.

**For Sale** Trio TH21E, 144MHz hand-held transceiver, including Trio battery case, 2AH NiCads, mobile bracket, 2 spare sets NiCads and extension microphone/speaker, £120. Tel: Burton-on-Trent (0283) 225466.

**Wanted** Second-hand Icom R7100 with h.f., will pay about £500 in good condition. Tel: (0284) 705469.

**Wanted** Pye low band a.m. hand-helds for use by Air Cadet squadron. Must be in good working order. Clive. Tel: 051-525 5568.

**For Sale** Collector's item. Set of 4 volumes *Newnes Complete Wireless* leatherette bound and in good condition. Weight 5kg - buyer to collect. Sensible offers please. G3DSV, Exeter. Tel: (0647) 61753.

**Wanted** Inter-connection details and circuit for Mullard 'Unilux' stereo amplifier, pre-amp, and power unit modules. John GDCH, 18 Bay Close, Horley, Surrey RH6 8LF. Tel: (0293) 775702.

**For Sale** Sony PRO-80 scanner with airband and 8-way tuning 150kHz-108MHz and 15-223MHz. Complete boxed, very good condition, £195. Tel: Burton-on-Trent (0283) 30962.

Readers' Ads  
 February 1992 Coupon

## Theory



*This month, the Rev. George Dobbs G3RJV takes a look at 'graph paper' layouts and describes another practical project, an audio amplifier for you to build.*

# Getting Started The Practical Way

If you walk into almost any high street stationers, ask them for a pad of 0.1in graph paper, the chances are that they'll not have any in stock. The usual reply is "We have plenty of 1mm grid graph paper, that's what everyone uses these days, everything is metric".

If you meet this response, be ready to reply! Your answer should be "yes, everything is metric except your cash till, the calculators you sell, your television and radio set, your audio system, your....."!

Almost all equipment has a p.c.b., and the standard pin spacing for the i.c.s they contain is 0.1in. The world of the p.c.b. is a world of 0.1in squares!

The concept of 0.1in as a unit (perhaps we should say a tenth of an inch) is not quite as whimsical as it might seem. I can remember my son once doing homework where the answers were odd things like 3/8cm!

## Last Month's Project

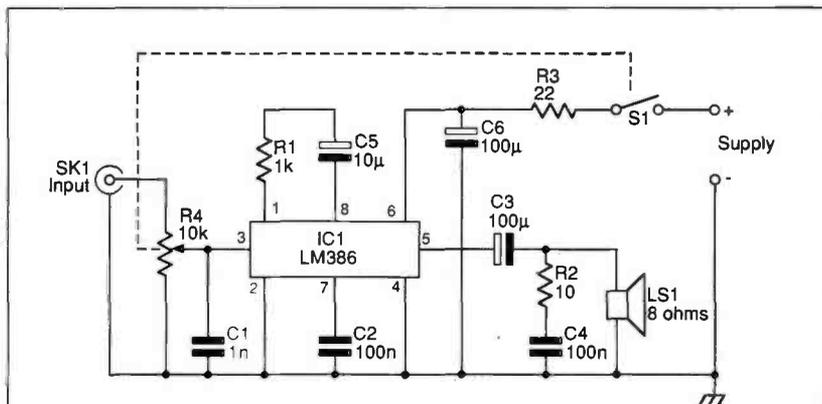
In last month's project, we built a little multivibrator circuit on a perforated board layout which used a matrix of 0.1in. The layout duplicated a printed circuit board, and I've no doubt that some of you would have built the optional p.c.b. version.

This time, we are going to build a circuit which includes an i.c., using the same methods. How do we arrive at the layout for a circuit using 'perf' board, or a p.c.b. I hear you ask? Well, the answer to that question lies in being able to locate and buy some of the precious 0.1in grid graph paper. But first of all, let's consider this month's project.

## Useful Amplifier

A small audio amplifier is a very useful item to have around the amateur radio workbench. It can be used as a piece of test equipment, or it can be added to projects requiring an audio output.

The circuit we're about to build, Fig. 1, will appear again in more complex projects later in the series. This handy little circuit uses the popular LM386 i.c. audio amplifier.



**Fig. 1: The circuit diagram and connection details of the LM386 audio amplifier project. The power supply voltage can be between 6 and 9V, audio input is applied at SK1 and the speaker can be any small type of around 8Ω.**

## Complete Package

The LM386 is a complete audio frequency (a.f.) amplifier capable of up to 300mW output. This is just enough to drive a loudspeaker, and yet the device comes in a small, 8-pin dual-in-line (d.i.l.) package.

The pin connections of the LM386 are shown in Fig. 2. The voltage gain of the amplifier is internally set at 20. This is done to keep the number of external components to a minimum.

However, the addition of an external capacitor and resistor between pins one and eight, will allow the voltage gain to be increased to any value between 20 and 200.

If pins one and eight are left unconnected, an internal resistor sets the voltage gain to 20. Connecting a 10µF capacitor between pins one and eight, bypasses the internal resistor and the voltage gain becomes 200.

The gain is controlled by adding a resistor in series with this capacitor. For example, if a resistor of 1kΩ is connected in series, the gain becomes approximately 50.

I should make it clear that here we're talking about the maximum overall gain of the amplifier. It's usual to add a volume control on the input of the circuit, to allow the user to vary the gain up to this circuit-dictated value.

## Useful Feature

Another useful feature of the LM386, is its low quiescent current drain. This is the term used to describe the amount of current taken up, just to make the amplifier 'tick-over', without handling any signal. This makes it particularly useful for battery operation, as a lot of a.f. amplifiers drain batteries very quickly.

The LM386 will also operate over a wide range of voltages, between 4 and 12V. From my experience, the best power supply level for minimum distortion is around 6V.

## The Circuit

As you can see in the amplifier circuit, Fig. 1, I have used a 1kΩ resistor, R1, in series with the capacitor, C5, between pins one and eight. This resistor may be reduced to give a higher voltage gain.

The capacitor, C2, on pin seven is a bypass capacitor, and it's recommended by the manufacturers to ensure stability. Further stability is encouraged by adding R2 and C5 across the output.

The circuit formed by R2 and C5, is sometimes called a Zoebel Filter, and it helps to prevent the i.c. oscillating. These small packages have a lot of gain, and bypass capacitors should be mounted close to the pins of the i.c. The capacitor, C6, decouples the supply voltage line.

## A Layout

A layout for the circuit on 'perf' board (viewed from the top) is shown in Fig. 5. The drawing also shows the matrix of holes including those which aren't used.

How did I arrive at this layout? The simplest way is to gather all the components, the circuit diagram, a sheet of 0.1in grid graph paper, a soft pencil and an eraser.

The components will give the spacings between the connections. More experienced constructors often know what such spacings are, and they can work without having the parts to hand.

Many experienced constructors also do their layouts from the underside (the interconnections side) of the board. But I'm not clever enough to think upside down! So, I work on the layout viewed from the top of the board.

## Marking Out

The exercise is now to mark the layout out on the graph paper. You do this by following the circuit paths, and working out the component spacings using the components themselves.

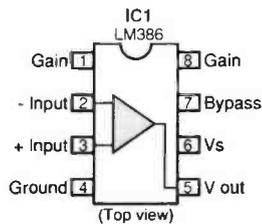
There are some basic rules you must follow, which also apply to most types of circuit. Here they are:

Try to make all circuit paths as short as possible.

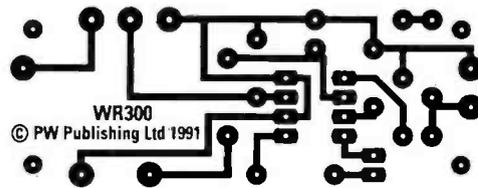
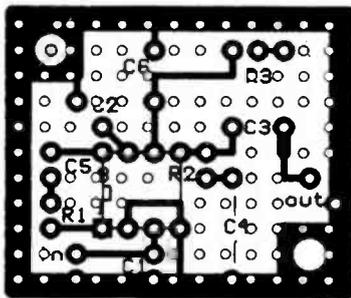
Try to keep the input away from the output.

Place decoupling and bypassing capacitors as close to the i.c. pins as possible (putting a ground connection all round the board helps component placement).

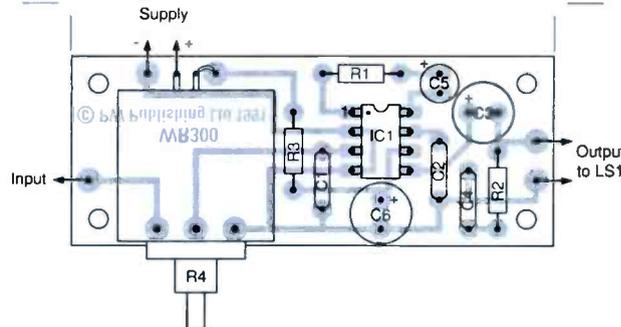
The eraser is essential, as it's often a trial and error



**Fig. 2: The pin connections for the LM386 audio amplifier i.c. viewed from above. Take note of the identifying notch at the top end of the i.c., which locates pin one and pin eight.**



**Fig. 3: The view of the p.c.b. track diagram from underneath (copper track side) of the audio amplifier project. This p.c.b. track diagram can also form the basis for a wiring layout using perforated matrix hole board.**



**Fig. 4: The above board component placing diagram viewed from above. The shadowy track outlines are the main etched copper tracks underneath the p.c.b. In effect, the view is looking down through the p.c.b. and through the copper tracks.**

**Fig. 5: The amplifier project laid out on a perforated matrix hole board with component positioning guide. The actual layout is down to the individual, but this version is a good starting point. Un-used holes in the perforated matrix are lightly outlined, whereas the tracking (wiring) is shown in bold outline (see text for further details).**

process. Remember, that the layout doesn't need to follow the placement of components in the circuit diagram. A circuit diagram is a little like the London Underground Map - it shows how the parts are connected to one another, but it does not show their actual places on the finished board.

Why not try it for yourself. Use the circuit in Fig. 5, in conjunction with Fig. 1, and the required components to make your own layout drawing. It may well turn out better than mine!

### Track Arrangement

The diagram, Fig. 3, shows how the layout appears as a p.c.b. track arrangement. Comparing this with Fig. 4, shows that the track layout is the same, although it's viewed from the other side.

Building the amplifier is simple, just drop the components into the correct holes and wire them up. The LM386 can be wired directly into the board. However, I would advise the less experienced constructor to use an i.c. socket. This is a base into which the LM386 can be plugged, after all the other components have been fitted and checked.

Take care with the pin orientation! The i.c. socket gives you a second chance, which is best taken before the power is applied for the first time.

When using 'perf' board, the surplus wire on the components will probably be long enough to use for the interconnections. Extra connections can be made with tinned copper wire. Check the placement of C3, C5 and C6, as these are polarised capacitors.

### Using The Board

The circuit diagram in Fig. 1, shows how to connect the LM386 board ready for use. A suitable supply would be a 9V battery connected to the positive (+) side of S1.

The loudspeaker can be a small 8Ω speaker, and a 10kΩ logarithmic potentiometer is added to the input as a volume control. The dotted line connecting S1 and R4, indicates that the two controls are 'ganged'. This means that the on-off action of S1 is controlled by the spindle of R4. In other words, the volume control and switch S1 are combined.

A quick way to test the amplifier is to apply power and place a finger on the input, which is pin three. This should produce a buzzing sound.

Then you should repeat this check on the input side of the volume control. Rotate the control to see if it's wired the right way round, and the volume increases as the control is turned to the right. If everything's okay, that's it all finished.

## Shopping list

### Resistors

Carbon film 5% 0.25W

10Ω	1	R2
22Ω	1	R3
1kΩ	1	R1

### Resistors (rotary)

10kΩ	1	R4 (see text)
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### Capacitors

Disc ceramic

1nF	1	C1
100nF	2	C2, 4

### Electrolytic (16 or 25V d.c. working suitable)

10μF	1	C5
100μF	2	C3, 6

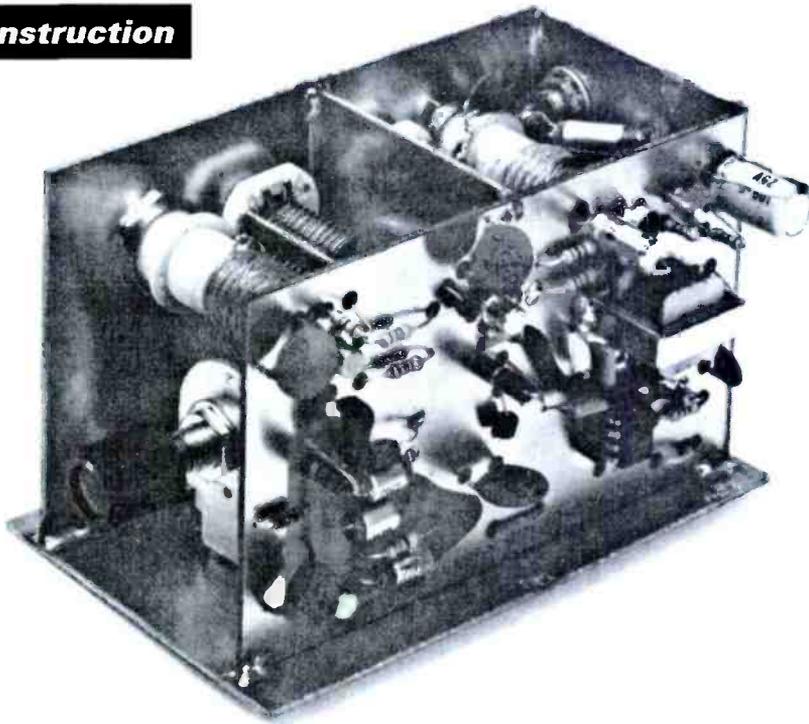
### Integrated Circuit

LM386	1	IC1
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### Miscellaneous

Matrix board ('perf' board), solder, connecting wire, prepared board for p.c.b. version (available from PWPCB Service). Potentiometer for volume control (see text), battery for power supply and small speaker.

*You now have an audio amplifier! You can use it for many little jobs. Next time, we'll combine it with another useful circuit to make the PW Oscamp (more about that later!). If you haven't had a go at making your own p.c.b., now's your chance with an ideal project. Cheerio until next month, and I wish you and all your family a very happy new year.*



# Making Sma

*In his first article in Practical Wireless, the world's leading radio writer Doug DeMaw discusses techniques for moving towards greater miniaturisation if that seems to be*

**Fig. 1: Doug DeMaw's approach to 'making it even smaller' is clearly illustrated in this picture. An idea of the relative size of the project (a high-quality receiver) can be obtained by the size of the components, especially the i.c. in the bottom right hand side of the photograph.**

**A**re you one of today's experimenters who likes to build compact equipment? Certainly, the industrial electronics trend is towards keeping things compact and orderly. Amateurs who construct portable equipment tend to 'scrunch' their equipment as much as is practicable, and this is a necessary means to an end for hikers and campers especially.

It is my perception that QRP operators in particular feel that the equipment, and to some extent even the antenna, should be small in order to qualify as QRP gear. I confess that I am one of those people, even though the assembled station need not be miniature for most applications.

The physical dimensions of a particular piece of equipment should be based, in part, upon operating convenience. That is, will there be ample finger room for operating the controls of a small receiver or transmitter?

If you are a large person with 'fumble fingers' like mine, you may prefer a bit of 'breathing space' around the panel knobs and switches. The chosen dimensions of your project must, therefore, be based on practical considerations.

### One Approach

The photograph, Fig. 1, depicts one approach to miniaturisation that I often use. The picture shows a high-performance, 7MHz direct-conversion receiver.

High-Q, slug-tuned inductors (the J. W. Miller 43 series) are visible inside the module. These, along with air-dielectric variable trimmers, are used for tracking the tuneable oscillator and detector tuned circuits. These components are installed on one of the vertical walls of the basic module.

A two-section variable capacitor (main tuning) is mounted to the bottom plate of the box. The active sections of the receiver circuit can be seen at the right in the photo. They are installed on a p.c.b., which also serves as one vertical wall of the assembly.

### Double-sided Board

The box is made from sections of double-sided p.c.b. A 40W pencil-type of soldering iron is used to join the walls and the floor of the box.

A screening wall, also made from p.c.b. material, is located between the oscillator and detector tuned circuits. This screen not only helps to isolate the tuned circuits, it also provides the necessary rigidity for the box. Without the inner wall, the v.f.o. can shift frequency from stress on the box, or from vibration.

You'll also spot that the copper on the ground-plane side of the main p.c.b. (left front of the photograph), has been etched away in the area where the local oscillator components are situated. This helps stability, by eliminating unwanted parasitic capacitors, which are formed by the p.c.b. conductors and the ground-plane.

Glass-fibre epoxy-resin p.c.b. insulation is not a very stable dielectric material. Heating effects, however minor, cause changes in capacitance between the conductive material on each of the boards. Removal of the ground-plane copper laminate near the oscillator circuit, cures this problem.

### More Complex Circuits

If you are building more complex circuits, such as superhets, there's no reason why the top cover of the box you've made can't contain additional circuitry. Likewise, this technique can be used for the rear and front walls of the assembly.

The major consideration is that we must keep heat-generating components away from the local-oscillator part of the module. For example, in the ideal situation, we would locate the local oscillator of a receiver or transmitter in its own shielded box, spaced away from the main module.

I have built modules that were similar to the one shown in the picture. In one particular version, the

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a conflict in terms!

local oscillator was isolated from heat by using a double-sided p.c.b. wall, with foam insulation between the two walls.

The approach helped to prevent the migration of heat that was generated elsewhere in the circuit, to the local oscillator board. With this method I used a spacing of approximately 13mm between the double wall sections.

## The Completed Assembly

If you look at the photograph in Fig. 1, you can see the completed assembly. It must have a top cover in order to prevent dirt and changing air currents from reaching the inner components, especially those of the local oscillator.

You may use another section of p.c.b. for the cover. It can be tacked into position using solder at six or eight points. This procedure allows easy removal with solder wick or a sucker later on.

A front panel is also needed. I used a shaft extension on the tuning capacitor shown in the photo', to provide front panel adjustment by means of a vernier slow-motion drive. The completed module was then attached to the bottom plate of the equipment box, using suitably sized screws and nuts.

## Final Thoughts

Now that I've given you some ideas, perhaps it's time to have a few final thoughts on the approach I'm suggesting. The dimensions of the module discussed (and seen in Fig. 1, and Fig. 2) are: 76 x 63 x 102mm and the same circuit would occupy a space of 101 x 178mm if laid out horizontally. The cabinet height would need to be approximately 76mm with the change in format.

I built the module discussed in this article, a number of years ago. It's obvious by looking at the photographs, that the same circuit could be reduced by

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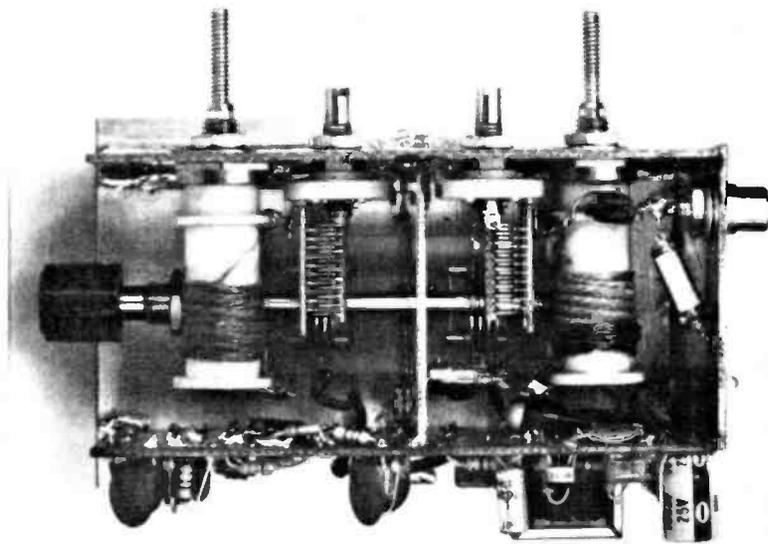


Fig. 2: A view of the completed project from above, showing the method adopted to mount the components, coils and inductors. The neat result obtained by using p.c.b. material as 'walls' is clearly demonstrated (further details in the text).

a factor of two. This would be possible, if a tighter p.c.b. layout was adopted in conjunction with smaller coils and capacitors.

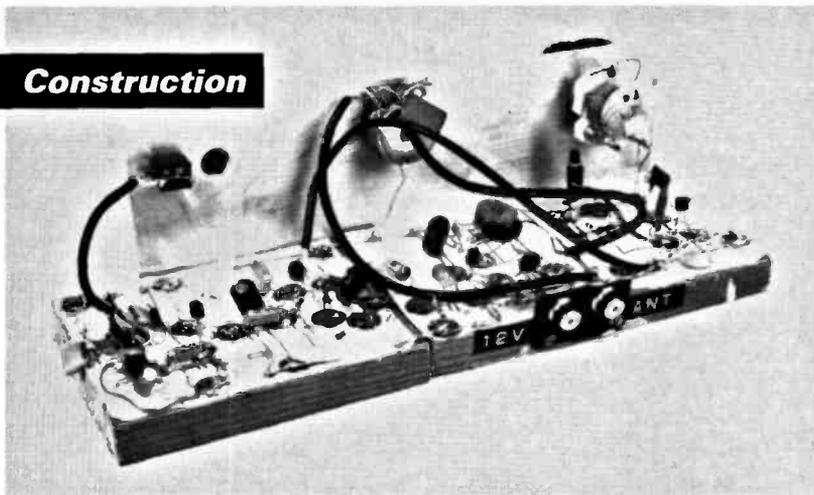
Additionally, surface-mounting techniques (s.m.t.) using surface-mounting devices (s.m.d.s) are ideal for aiding the miniaturisation of today's projects. This especially applies if you are dedicated to building equipment that's suited to gnomes and other small beings!

In any event, I hope that this article has provided some food for thought before you start your next small project.

*Doug DeMaw W1FB.*

*Note: The general circuit for the receiver discussed in this article, plus suitable p.c.b. artwork, can be found in Doug's newly published 2nd edition of The W1FB QRP Notebook, (completely revised and expanded) which will be available from the PW Book Service in the near future.*

## Construction



# The PW Challenger Simple 3.5MHz Receiver

As promised, we now present Steve Ortmyer G4RAW's 'Challenger' simple receiver, to complete the basic station. As with the transmitter, you have the choice to go for the 'instant' drawing-pin board method, or the p.c.b. project.

It was the 'Test Sets' used by Novice trainees, which are made on a drawing-pin and board system that gave me the original idea. I then set out to build a complete Novice h.f. station using drawing pins.

Last time, I showed you how to make the transmitter and hopefully some of you are on the air already! Now it's time to have a go at the receiver.

It's the same procedure as before, and if you wish you can build the receiver using the drawing-pin plan first. After you've proved it, and yourself perhaps, you might like to proceed onto the p.c.b. design. This can be done, using the board layout Rob Mackie (the PW technical artist) has provided.

### International Circuit

The circuit I've used, Fig. 1, has rather an international flavour. This is because it combines ideas from other designs by G3RJV, W1FB and ZL2BMI!

It's a direct-conversion receiver with a simple v.f.o., an r.f. amplifier, diode mixer, a.f. pre-amplifier and a LM386 audio output amplifier. I've built many similar receivers, and they have been very successful in receiving stations from all over the world.

You can regard the various sections of this receiver as 'building blocks'. They can then be tried out in different ways to make other receivers.

There are however, one or two simple rules to obey. The main rule to remember is the amount of r.f. energy you allow into the mixer. This is because 'passive' diode mixers need more energy than active transistor mixers.

In this circuit the v.f.o. output is controlled by the capacitor, C1, between the v.f.o. and the mixer. This capacitor's value can be varied until you get the best results, or you 'zapp' the mixer diodes with too much v.f.o. output!

### Construction Procedure

If you've already gained construction experience with the drawing-pin and board method, by building the Challenger transmitter, you'll know the procedure. If not, you will soon know it's easy!

First, you should find a suitable piece of wooden board. Floor-boarding is ideal for this, but make sure it's not in use as part of the flooring when you take it!

Next, you should draw out the circuit on a large enough piece of paper to cover the piece of board. Fix the drawing down onto the board with brass drawing pins.

The drawing pins are also used on the board to act as mounting terminals, in the same way that the Challenger transmitter was built. The components are soldered to the brass drawing pins as illustrated in the diagram, Fig. 2.

My motto for home-brewing is 'build a bit, and test a bit'. It's a very simple and straightforward approach. Although it's very easy to carry out, adopting the technique will help you to be successful in any project you build.

### Listening Tests

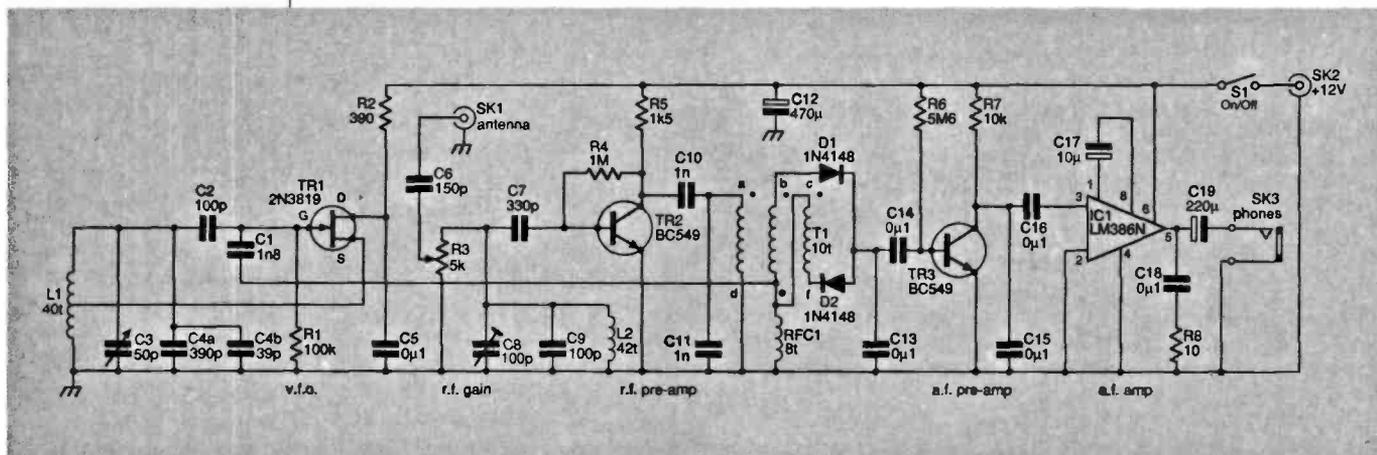
If you build the v.f.o. first, it can be tested by listening for it on a receiver, or with a frequency counter. The output can be checked with a diode probe.

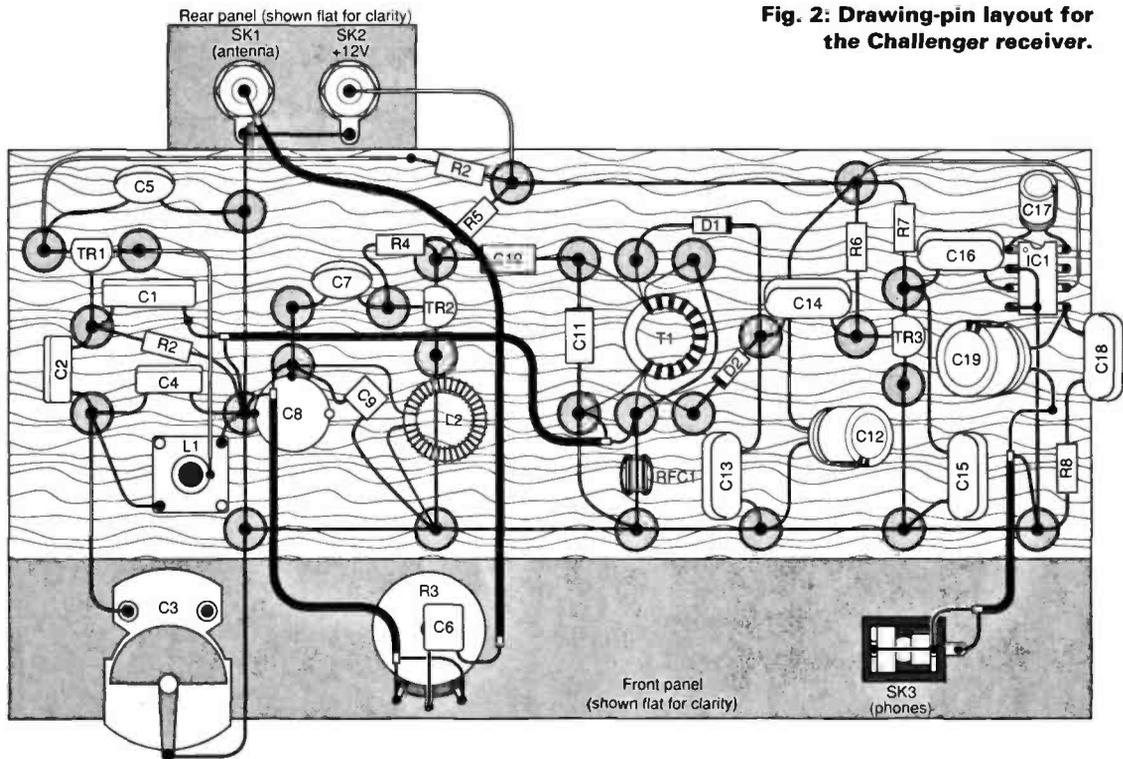
The tuning slug in L1 will allow a wide range of frequencies to be covered, but this may not be enough, and C4a and 4b may have to be changed. As a rough guide, you can try values between 200 and 500pF.

A useful tip I can offer, is that you build the audio amplifier first. Once you've built the a.f. side of the receiver, it's very easy to work backwards so to speak.

Testing the amplifier is very easy. With power

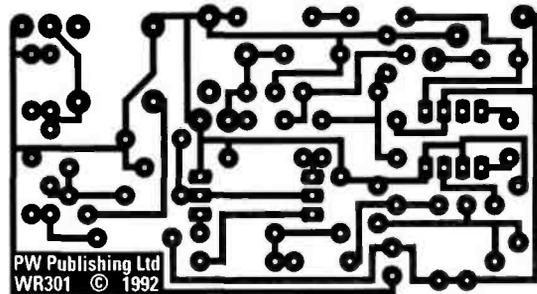
Fig. 1: The PW Challenger receiver circuit diagram.





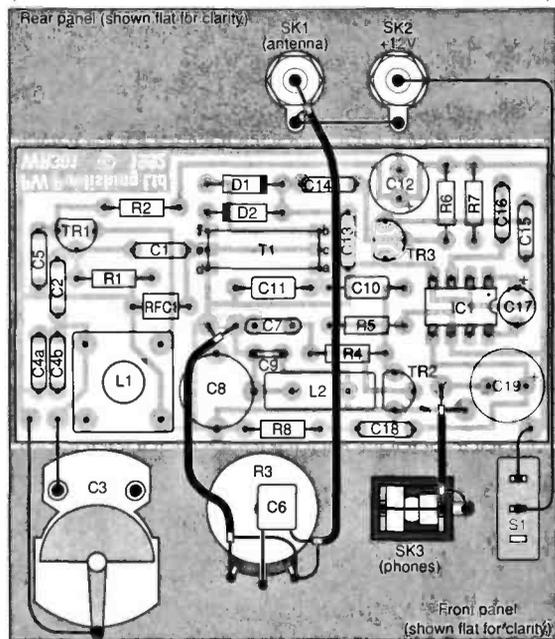
**Fig. 2: Drawing-pin layout for the Challenger receiver.**

**Fig. 3: The copper track layout for the p.c.b. version.**



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WR301 © 1992

**Fig. 4: Component and overlay diagram for the Challenger (p.c.b. version) receiver.**



**How Much ?** Approximately £10 (depends on your junk box plus board costs for p.c.b. version)  
**How Difficult?** Beginner\*

\* I recommend that you build the drawing-pin board version first, before you try the p.c.b. version which is shown in Figs. 3 and 4.

**Shopping List**

**Resistors**

Carbon film 0.25W 5%

10Ω	1	R8
390Ω	1	R2
1.5kΩ	1	R5
10kΩ	1	R7
100kΩ	1	R1
1MΩ	1	R4
5.6MΩ	1	R6

Resistors Linear Rotary

4.7kΩ or 5kΩ	1	R3
--------------	---	----

**Capacitors**

Ceramic

100pF	2	C2, 9
150pF	1	C6
330pF	1	C7
1nF	2	C10, 11
1.8nF	1	C1
0μ1	5	C5, 13, 14, 15, 16

Non-standard value composite capacitor

430pF (nominal)	2	C4a, 4b (see text)
-----------------	---	--------------------

Electrolytic Capacitors 25V d.c. working

10μF	1	C17
220μF	1	C19
470μF	1	C12

Variable capacitors

50pF	1	C3
100pF	1	C8

**Semiconductors**

BC549	2	TR2, 3
1N4148	2	D1, 2
2N3819	1	TR1

**Integrated Circuit**

LM386N-1	1	IC1 (see text)
----------	---	----------------

**Inductors**

L1 (for drawing-pin board project) 40 turns (tapped at 10 turns) of 32s.w.g. enamelled copper wire on 4.8mm coil former with a tuning-slug (coil former from Maplin Electronics, can be the same type as used for p.c.b. version).

L1 (for the alternative p.c.b. project) Maplin ref: LB20W Bakelite coil former with core (former 722/2).

L2 42 turns on T50 2 toroid.

Radio frequency choke RFC1 8 turns of 32s.w.g. enamelled wire on a ferrite bead.

T1 comprises 10 turns of 28s.w.g. trifilar wound (see text) on FT-37-43 toroid. **Note:** The dot shows the start of each winding.

**Miscellaneous**

Aluminium panel, phono type sockets for antenna and 12V d.c. power supply, 3.5mm jack socket or socket suitable for earphone used, knobs, slow-motion drive, brass drawing pins, connecting wire, miniature coaxial cable, wood base and screws.

connected, carefully place the tip of a screwdriver on pin three (don't touch other pins) of the i.c. You should hear a loud buzz in the earphones, but take care when you carry out the test, making sure the 'phones aren't over your ears!

I used the least powerful of the LM386 amplifiers, the LM386-1. There are other more powerful versions (LM386-2 as LM386-3) but the LM386-1 is more than adequate for the job.

The earphones by the way, needn't be expensive, don't be ashamed if they're cheap because mine only cost 99p. You only need feel ashamed if they cost more than that!

**Coils And Toroids**

The mixer coils can now be wound. This is done by using three lengths of 28s.w.g. enamelled wire. The three lengths are twisted together, to form a trifilar winding, before 10 turns are wound onto a ferrite toroid.

I used a scrap toroid, and you can use any small toroid (provided it's ferrite) of around 12mm diameter. If you are forced to buy one, go for an FT-37-43.

To save time, and make a neat job, I twist together the three wires to be wound around the toroid, with a small hand-drill. It's so easy, all you have to do is place the three ends in the drill chuck, firmly fix the other three ends and start winding. There's only one rule to remember, and that's to keep the wires fairly taut as you turn the handle.

When you have finished winding the three wires, clean off the enamel insulation and identify each wire with a multimeter switched to a low resistance range. The correct identification is important because of the need for correct phasing.

**Finishing Off**

Finally, before finishing off the main construction, you should choose two 1N4148 diodes for the mixer. The diodes should be matched as closely as possible for the least forward resistance. You can do this using a multimeter set on a low resistance range.

The rest of the receiver can now be finished off and tested. As I live fairly near a medium wave broadcasting station, I've found that a T-match antenna tuning unit has proved useful to minimise breakthrough.

The capacitor, C8, forming the part of the tuned circuit in the input of TR2, is a variable type. This is done so that you can peak it for best results.

I also recommend that a slow-motion drive be used with the main v.f.o. variable capacitor, C3, so that it's easy to use. Having said that, I found that I could resolve s.s.b. very well without a slow-motion drive!

**Using The Challenger**

Having built the receiver, I thought it best to try using the Challenger on the ideal section of the 3.5MHz band, and that's the QRP section (of course!). What better frequency could there be for testing the receiver, than 3.560MHz, the QRP calling frequency?

Using my 1W 'Bean Tin' transmitter (I really 'meanz' that, as it is in a bean tin!) on 3.560MHz, my first CQ call brought a reply from G31VF. 'Smudge' G31VF, in Derby, was running 3W and I copied him at Q5 on the Challenger receiver at my Halifax QTH!

Next, I had a QSO with G2BRR who was in Chippenham in Wiltshire. He was also running QRP, and I was really pleased that the receiver was working so well. So, go on and have a go, it's a really simple challenge and it's great fun!

PW

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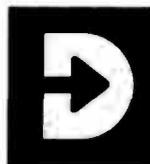
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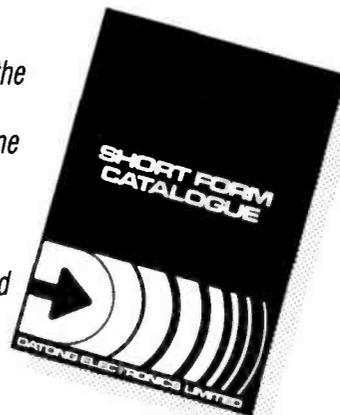
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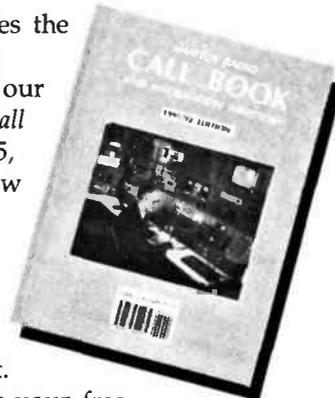


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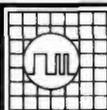
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**H**ere's hoping that you enjoyed the festive season! Now that the time of good cheer and indigestion is over, it's time for us to continue our look back at the origins of UK CB. This month, I'm going to bring us up-to-date by discussing the 934MHz CB allocation.

Field trials carried out by the Post Office Radio Branch, as well as others (equipment manufacturers and independent designers during 1980/81) showed that 934MHz had 'possibilities'. The graph in the diagram, Fig. 1, is one result of some of the tests carried out.

I've no doubt that you'll be interested to know that the effective radiated power (e.r.p.) at the base transmitter was only 4W. The mobile receiver antenna was a quarter-wave vertical on a mag-mount base.

The first commercially made 934MHz CB transceiver was being sold in the UK toward the end of 1981. Despite this, there were no antennas being made for this band.

The commercial antenna came later of course. But it was some time before 934MHz equipment, with a performance comparable with that in common use for amateur and commercial v.h.f. and u.h.f. bands, became generally available.

### Japanese Visit

A year or so before this period, a close friend of mine spent some time in Japan visiting various manufacturers of radio and audio equipment. Some of the manufacturers were already

# CB HIGH & LOW

By 'Quaynotes'

*This month, 'Quaynotes' continues looking back into the origins of CB radio in the UK, with a special emphasis on the 934MHz service.*

supplying 27MHz equipment to the USA and other countries.

They also had u.h.f. transceivers in production for operation at 900MHz. He enquired, "Could these be easily modified to operate on 934MHz for the UK market?" The answer was an immediate 'Yes, they could!'

His next question was "how about antennas?" Again, the answer was quick in coming. The Yagi Antenna Company of Tokyo could supply them!

### Development Slow

Even after CB had been made 'legal', the development of 934MHz equipment was slow. Those already on 27MHz were reluctant to 'go high'. This was understandable since the price of sets and antennas for 934MHz was, like the frequency, a bit on the high side!

Of course, at the time there was little real evidence to convince potential users of the u.h.f. allocation. Most potential

users had no way of knowing that performance generally, and 'communication range' on 934MHz would be equal to, or better than that obtainable at 27MHz. Well, as we now know, the 934MHz service has proved itself.

### Working Ranges

Working ranges at 934MHz are quite equal to those obtained on the amateur 144 and 430MHz v.h.f. and u.h.f. bands. This is dependent on the r.f. power and antennas of course, and they are a little greater than line-of-sight distance.

This is because the path of radio waves at these very high frequencies, is bent a little by ambient tropospheric conditions. As a result they tend to follow the curvature of the earth to a greater extent than might be expected.

To give you an idea, for comparison purposes, the table, Fig. 2, covers the theoretical 'radio distance' for transmitter and receiver antenna heights up to

30m. For a transmitter antenna height of 10m and receiving antenna height of 6m, (marked \*) the 'radio distance' is in the region of 23km. These figures, are in keeping with the results obtained from the Post Office Radio Branch tests made in late 1979, which the example in Fig. 1 shows.

### Working Distance

Remember however, that actual working distance will also depend on other factors. They include (a) the directivity gain of the antenna used for transmission and therefore the e.r.p., the antenna used for reception and (b) the nature of terrain and attenuation due to the concrete jungles we know as towns, along the path of transmission.

There are times however, when tropospheric 'refraction' occurs (commonly called 'lift' conditions). When these conditions occur, they may (for some indeterminate period) greatly increase working range over long distances within the UK, and even to European countries.

Well, I sincerely hope that you were interested in my quick look at 934MHz, and the previous part dealing with the origins of CB radio in the UK. It was aimed especially at newcomers to CB radio, and those of us who might have forgotten the struggles we had to get the service going! Now that we have covered this often neglected area, next time I'm going take a look at the more 'practical' aspects of the subject. Catch you later.

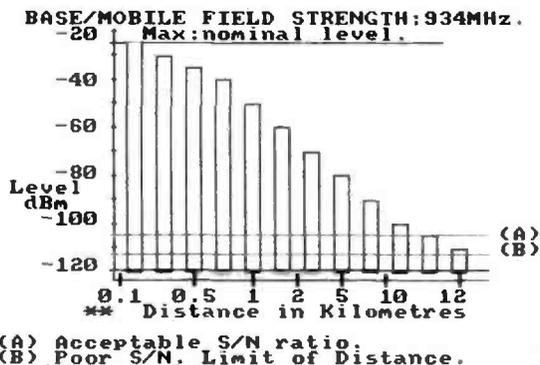


Fig. 1: Results of one of the many tests carried out by the Post Office Radio Branch (late 1979) on 934MHz. Base station to mobile transmissions. Base transmitting antenna (dipole) height 4m. (e.r.p. 4W). Receive antenna (quarter-wave) on car roof. Terrain relatively flat (see text).

UHF/UHF 'RADIO DISTANCE' FOR GIVEN ANTENNA HEIGHTS : TRANSMIT TO RECEIVE.

Tx Antenna Height Metres	Radio Distance K.metres	Rx Antenna Height Metres	Radio Distance Miles
30	45.2	30	28.1
28	43.7	28	26.8
26	42.1	26	25.5
24	40.5	24	24.1
22	38.9	22	22.8
20	37.3	20	21.4
18	35.7	18	20.1
16	34.1	16	18.7
14	32.5	14	17.4
12	30.9	12	16.0
10*	29.3	10	14.6
8	27.7	8	13.2
6	26.1	6*	11.8
4	24.5	4	10.4
2	22.9	2	9.0

Fig. 2: Radio distance at v.h.f. and u.h.f. versus height of transmit and receive antennas (applies to 934MHz). Example shows: transmit antenna height 10m, receive antenna height 6m. Radio distance approx: 23km.

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**72 & 73 from Dave G4KQH, Technical Manager**

# Mathematics For The RAE

Before we get down to this month's topic, I'll give you the answers to last month's questions.

First the series answers:

- (i) 320Ω
- (ii) 83kΩ
- (iii) 1830
- (iv) 120 560Ω
- (v) 2903Ω

For the parallel combinations the answers were:

- (i) 5Ω
- (ii) 7.674Ω
- (iii) 142.205Ω
- (iv) 4.91Ω
- (v) 120.55Ω

Now we must get down to this month's business!

## Ohm's Law

The most fundamental rule used in electronics must be Ohm's Law. Almost all calculations in electronics make use of this at least once. If it is so important I hear you say, what is Ohm's Law? The answer is, that Ohm's Law is the relationship between Voltage (V), Current (I) and Resistance (R).

This law, or rule, says that the current (I), flowing through a resistance (R), is dependent on the voltage across the component, and its resistance. The voltage across a component is sometimes known as the 'Potential Difference' (p.d.).

Consider the drawing Fig. 1, where the p.d. is  $V_R$ , the voltage across the resistor R. This voltage forces a current,  $I_R$ , to flow through the resistor. In words, the rule says: the voltage across the resistor is directly related to the current flowing through the resistor, multiplied by the value of the resistance. The mathematical relationship is:

$$(i) V = I * R$$

Using a little of the algebra that we've used before, we can come up with two other ways of writing it:

$$(ii) R = \frac{V}{I} \quad (iii) I = \frac{V}{R}$$

All calculations are carried out using standard units. So let's put a few figures into the equation. If  $V (V_R)$  is one volt and R is 2Ω, then from (iii) above,  $I = (1V/2Ω)$ , or 0.5A. If the voltage ( $V_R$ ) changes to five volts then  $I_R$  will become 2.5A ( $5V/2Ω$ ).

If we keep the voltage steady at five volts, but change R to 10Ω, the current through R (p.d. = 5V) returns to 0.5A ( $5V/10Ω$ ). Fairly simple isn't it?

## More Than One

Now let's add another resistor. Look at Fig. 2. The same rule still applies but there are now two resistors in series. From our last session you remember that for resistors in series, we just add the resistance values together. So,  $R_{Total} = R_a + R_b$ , and from Ohm's law  $I_R = V_R / R_{Total}$ . Each resistor has its own p.d. across it,  $V_a$  for  $R_a$  and  $V_b$  for  $R_b$ . The sum of voltages  $V_a$  plus  $V_b$  is equal to  $V_R$ . The same current,  $I_R$  flows through  $R_a$  and  $R_b$  and it can be shown that the voltages across each resistor are proportional to the resistances values. But more of this later when we cover potentiometers

## Triangular Tricks

The triangular drawing, Fig. 3, is a graphical trick method of remembering how to apply Ohm's Law. 'But how do I use it?' I hear you say.

The way to use the method, is to cover up the letter of the unit you're trying to find. Then the other two letters show you how to go about calculating the unknown unit's value. Let's try doing an example and we'll assume I want to find the resistance, but I only know what p.d. there is, and what current is flowing.

To find resistance (R) from voltage (V) and current (I), you should cover up the letter R. You can now only see the letters, V and I. They're shown as  $V/I$  ('V-upon-I'), meaning volts divided by amps.

Similarly to find the current, cover up the I, and you see

'V-upon-R' (volts divided by resistance).

To find voltage cover the V. All you see is 'I-by-R', or multiply amps by Ohms.

## A Simple Voltmeter

Now it's time to get back to a little exercise, making a voltmeter. We'll take a look at Fig. 4, the circuit of a simple voltmeter. This is the form of many multi-range voltmeters. From the specifications, we know that, meter M1 has a full-scale deflection (f.s.d.) of 50μA. This is the current that has to flow through the meter to give a full-scale reading of 100% (no matter what the face markings are). We also know that the meter behaves as if it is a resistor of 2kΩ value. This is called the 'internal resistance' of the meter.

Using the Ohm's Law triangle, what p.d. is needed to give 50μA current flow through the meter? The answer, from  $V = I * R$ , is 100mV (0.1V,  $(50, 10^{-6}) * (2, 10^3)$ ). This is of little use if we wish to measure, say, 1V f.s.d. Somehow we must 'drop' the extra voltage. This we do by putting one or more series resistors into circuit.

From terminal B in Fig. 4, the total resistance between that (terminal B) and the common terminal is  $R_a + 2kΩ$  ( $R_a$  plus the internal resistance of the meter). The current for f.s.d. has to be 50μA, and it must flow through both resistors. So what must the total resistance be?

Cover up the R in the triangle of Fig. 3, and you can see V (one volt) 'over' I (50μA f.s.d.) so we can calculate R. The answer is 20kΩ ( $1/50, 10^{-6}$ ). This total has to include the 2kΩ internal resistance of the meter. So  $R_a$  is 18kΩ ( $20kΩ - 2kΩ$ ).

## Homework Again

A little work will help to get the mind supple again after the festive season. Using the voltmeter of Fig. 4, and remembering we've already calculated the value for  $R_a$ , calculate the values of  $R_b$ ,  $R_c$ , and  $R_d$ , to give the following voltage ranges for f.s.d.

Don't cheat! The answers are provided at the end for you to check your work.

- (i) Five volts (5V) between common and terminal C.
- (ii) 10 volts between common and terminal D.
- (iii) 50 volts between common and terminal E.

## The Answers

You didn't cheat did you? Here are the answers.

- (i)  $R_b$  is 80kΩ (68kΩ + 12kΩ in standard values).
- (ii)  $R_c$  is 100kΩ.
- (iii)  $R_d$  is 800kΩ (680kΩ + 120kΩ in standard values).

## Theory

*This month Ray Fautley G3ASG, talks about Ohm's Law. Then he shows you how you can use it in calculating the resistors needed to make a simple meter, into a multi-range voltmeter.*

**A rule to remember:**  
*"Resistors in series share the total voltage in proportion to their resistance values."*

**Fig. 1: A simple, single resistor Ohm's Law problem.**

**Fig. 2: This is essentially the same problem as Fig. 1, even though it may look different.**

**Fig. 3: The Ohm's Law Triangle. See the text about how to use it in calculations.**

**Fig. 4: A simple five range voltmeter. See the text to find what the values are.**

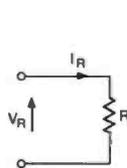


Fig. 1.

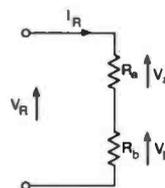


Fig. 2.



Fig. 3.

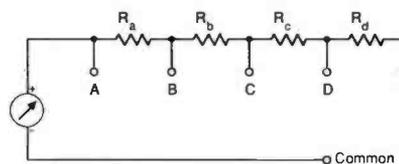


Fig. 4.

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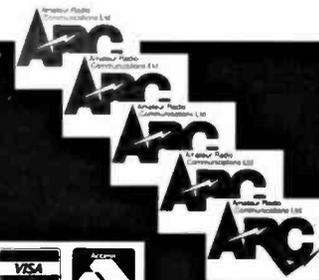
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## Dunstable Doings

Lots of goings-on in the world of amateur television repeaters this time, and we start in the south Midlands with GB3TV at Dunstable. Its callsign recalls that this was the first television repeater to be conceived in Britain, though it was many years before it became a reality.

Much of the original equipment was built by **Graham G3VZV**, who also donated the p.a. block now in use. The repeater still uses his original receiver, **G6JFN** built the new transmitter, while **Tom G3LMX** produced the video switching equipment. Willing labour was supplied by **G8IFF** and **G1YEB**, so GB3TV is very much a team effort.

The 'spin-off' from GB3TV is GB3TG, the 10GHz television gateway, which is now fully linked to 'TV. The power on the 23cm link has been increased to the full legal 14dBW limit in order to ensure noise-free pictures. **Dave G4NJK** (whose baby GB3TG is) tells me he can now get better pictures into Dunstable through 'TG than by 'TV. His home in Bletchley is located 4km from the gateway and he needs to run just 10mW (or -25dBW) on 10GHz, whereas he requires 12W (12dBW) to achieve almost the same results on 23cm. The X-Band is clearly 'greener' than L-Band.

The coverage of GB3TG has been checked and improved by giving the antennas a 2° downward tilt - a similar technique is often used at cellular radio base stations. Take a look next time you pass one of these - they call it 'tilt and fill'. The range of 'TG is exceeding expectations, too; it has been received 25km away at Whittlebury, Northants. According to path profiles, it should be line-of-sight also to the proposed Northampton repeater, which means that interlinking of these two boxes should be feasible.

### More Repeater News

Northampton may well be the next town to have a TV repeater, on 23/24cm and possibly also on 10GHz. A small team headed by **Phil G4IIO** and **Tim G4WIM** is negotiating with a site owner, while the 23cm hardware is already complete. Enquiries please to Phil on (0604) 643056. Northampton might also become a staging point towards other repeaters in time; anything is possible!

The Severnside TV Group have acquired a 10GHz TV repeater. No, it didn't fall off the back of a lorry, but was released from its previous existence as GB3RV near Rugby. Circumstances prevented its continuance there, so it has been overhauled by **Ted G3JMY** ready for installation (it is hoped) together with the 23cm TV repeater GB3ZZ at Filton.

Two repeaters are now reading

# FOCAL The World of ATV POINT

*Andy Emmerson G8PTH takes a look at what's happening in the world of ATV repeaters, news from New Zealand, Scotland and North Wales.*

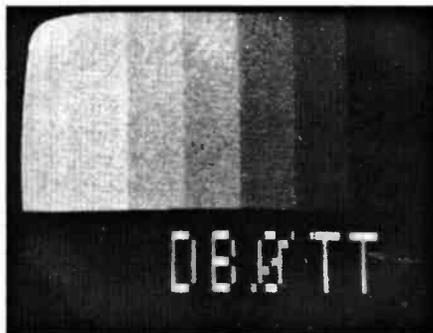
the GB2RS amateur radio news on the air in sound and vision. This is an interesting development and could lead, perhaps, to all kinds of educational broadcasts. Clearly a set of guidelines is necessary, and the RSGB are looking into this. Let's hope the outcome is positive and gives us some interesting possibilities.

### From Down Under

Our regular correspondent from New Zealand, **Mike Sheffield ZL1ABS**, kindly sent a copy of *Break-In*, the national radio club's monthly magazine. The issue in question was for August 1991, and it has become an institution since 1987, that the August magazine is an ATV special. The front cover is in colour and the content is an excellent showcase of amateur television technology.

As Mike points out, this is an achievement unequalled by *RadCom*, *QST* or the Australian *Amateur Radio*. The compiler, **Wayne ZL1UJK**, is confident he can repeat the effort again next August. Mike will probably contribute an article on the transmitter he is making from a Worthing group kit and a Mitsubishi p.a. module. He is also evaluating a Camech transmitter and sub-carrier board (which he will re-tune to 5.5MHz to suit New Zealand standards). Mike has also recently finished a teletext-based video callsign and pattern generator with 8-page auto-cycler.

**This has been a good year for tropos and openings to the Continent. One of the best propagation indicators for 70cm is DB0TT, a German ATV repeater located in Dortmund.**



Several ATVers in the Auckland area were plagued by QRM on their 70cm simplex TV reception, caused by f.m. stereo stations (88-108MHz) and the three Sky channels on u.h.f. broadcast TV. Mike decided to do something about this and read up the chapter on filters in the RSGB *VHF-UHF Handbook*. He writes, "The first one I built used a quarter-wavelength tuned line with coupling lines and a piston trimmer capacitor, all put inside a copper-clad p.c.b. box.

On the regular Sunday night ATV net I tried it out receiving Bruce ZL1BLB. As the beam heading is right at the main commercial TV transmitter site, the QRM is very bad. The receiver pre-amp is a bipolar one (MRF901) and there is no tuned circuit to the base, only a simple T-type high-pass filter I put in earlier to reduce the 88-108MHz signals. With the filter the QRM is now barely there and I get good sound and colour, so the filter is not too sharp. Makes me think, why didn't I do it sooner?"

### Scottish Slow-Scan

**Thomas GM4CAU**, writes from Aberdeen that he had a letter from **G0KYL** who was interested in an SSTV two-way on 144MHz. "A week past Saturday (August 31) I had a three-hour QSO (with lots of pictures) with **Johnny G0KYL**, thanks to a tropo opening. We had solid 5-9 signals both ways. Unfortunately, Johnny is only

operational on eight seconds mode, so I was unable to 'air test' my other speeds, although I have tested them on receive in the h.f. bands.

"Other news on the SSTV front. In recent weeks I have been having a regular Sunday sked on 7MHz with **G3MTQ** and **G4EYD** (Birmingham), both of whom are QRV on SSTV. Now this sked is at 14.00 local time on 7.095MHz plus or minus QRM; it is intended primarily for those who have built the **G3WCY/4ENA** system, given up after running into problems or have added modifications. In other words a regular place to meet and exchange ideas on the **G3WCY/4ENA** (and other hardware) systems.

"One Sunday we were joined by **Jack ON5NM**, so the net is international. This evening I have been watching some good 32 sec. pictures on 14MHz from **CT1ANO** in QSO with several EU stations."

### News From North Wales

Finally a letter from **John GW3MEO** in Prestatyn. "On behalf of **John GW3JGA** and myself, we thought a short activity report might be welcome from this part of the UK.

"I have been building 23cm gear for the last few months and now have the bits and pieces for a low-power f.m. TV station. Due to the lack of signals to receive, my enthusiasm was on the wane and then I discovered I could receive **GB3MC**, which is an n.b.f.m. repeater and beacon on 1267MHz (RM0) for which I would like to thank the owners. **GB3MC** has proved ideal for my antenna and pre-amp development and opened my eyes to the devious ways of r.f. at 1.2GHz.

"**John GW3JGA** has been very busy at work lately but nevertheless has produced a 1W 23cm TX and an f.m. TV receiver based on the Wood & Douglas modules. So you can imagine that when John and I realised we were both ready to do tests, 23cm soon warmed up. Although we are not far apart there are plenty of houses in the way, and for a couple of weeks I received the best signal from John by pointing the antenna upwards to receive his signal reflected off a tree. But raising my antennas 12ft solved the path problem and I was very pleased to receive my first good f.m. TV pictures from John.

"The picture noise is now even less than our local broadcast BBC reception, P5++ if that's possible, both ways. FM is really impressive with regard to picture quality and picture-to-noise. The Colwyn Bay amateur radio club is likely to be in for a demonstration soon, and a local repeater would be nice one day - watch this space!"

And that's it once more. Please keep your reports coming in so that we can all keep up with what's going on in amateur radio's most highly developed mode!

# Reflections

*This month Ron Ham congratulates an old friend, suggests an ideal opportunity, looks at interference, radio noise and a very old telegram!*

First of all, my congratulations go to **Dr. John Mason** (Yapton, Sussex) on his recent election to the post of President of the British Astronomical Association. I have known John a long time, he is a very able astronomer, who broadcasts, lectures and writes about many aspects of the subject and does a lot to encourage youngsters to this particular science. In addition to being deputy editor of the magazine *Astronomy Now*, he is joint author, with **Patrick Moore** (Selsey), of the book *The Return of Halley's Comet* (ISBN 0-85059-667-X). His ability in electronics, combined with a specialist's knowledge of meteors, has enabled him to study this specific area in both the radio and optical fields. Along with Patrick Moore and **Cmdr. Henry Hatfield** (Sevenoaks), John is the third of my contributors to hold this high and very important office.

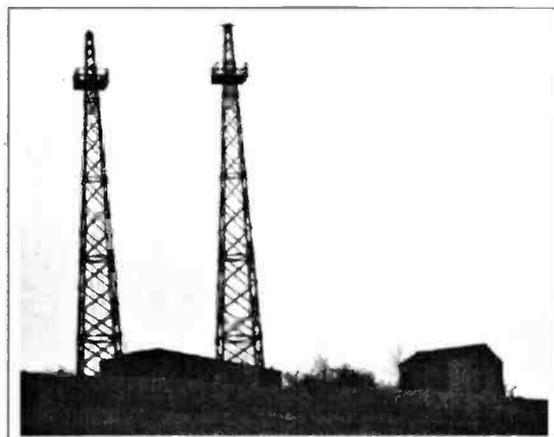
## Ideal Opportunity

The long winter evenings over the next three months provide an ideal opportunity to take a look, with or without binoculars or a telescope, at our 'neighbours' in space. Among the 'targets' you should select on a clear moonless night are the brilliant stars Aldebaran, Betelgeuse and Sirius, groups like the Pleiades, the constellations of Orion and Ursa Major and such radio sources as Cassiopeia and Cygnus. Providing you find a site that is free from street and house lighting and car head-lamps, the sooner your eyes will become accustomed to the dark

and the more detail you will see. Remember that you are standing on a revolving sphere looking outwards and upwards and, as time passes, the mechanics of the universe will be revealed.

In addition to spotting the planets and burning meteor trails, a great deal can be learnt about the heavens by a few hours (don't forget the warm clothes) of outside observation. Your local astronomical society may well be arranging evening or night trips to specific locations, and most likely you would be welcome to go along. Such information is available by sending your request and an s.a.e. to **John Green**, 46 Central Avenue, North Berstead, Bognor Regis, Sussex PO21 5HH.

One of the high spots in Sussex, 'The Trundle' a former WWII radar station, **Fig. 1**, is often used by Patrick Moore, John Mason and members of the South Downs Astronomical Society for specific studies of the night skies. Incidentally, the two towers in **Fig. 1** are made of wood, there were originally four on the site, but two were removed some years ago and replaced with a large mast for public service radio telephone systems.



**Fig. 1: One of the high spots in Sussex, 'The Trundle', a former WWII Radar station.**

## Radio Noise

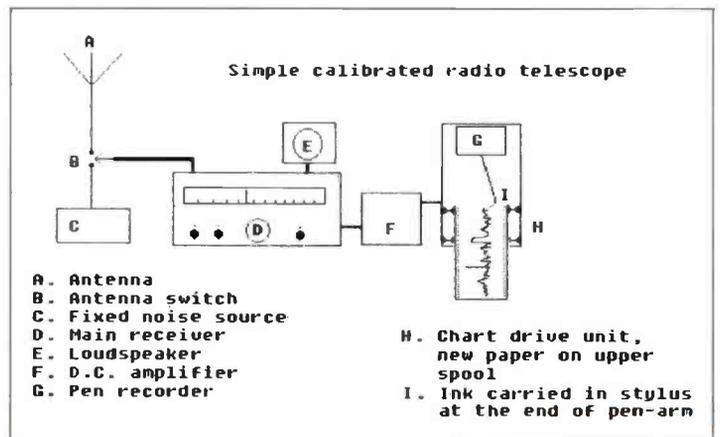
Untold numbers of stars, like our sun, emit noise which can be detected with specialised receivers, **Fig. 2**, on various parts of the radio frequency spectrum. Briefly, celestial noise covers a wide bandwidth and it sounds very similar to the background noise of a communications receiver. The receiver input in **Fig. 2 (B)** can be switched between a calibrated noise source (**C**) and the instrument's antenna (**A**). This provides a basic reference point to compare with the incoming celestial noise and, if required, can be switched in periodically during an observation and the recording chart (**G**) will be scribed accordingly.

This is an ideal arrangement when observing the combined output of noise being emitted by the myriads of stars in our own (Milky Way) galaxy. However, it is not really necessary when observing sunspot activity because there are times when the output from our sun, being so relatively close, is so great that the noise can be heard above the strength of a terrestrial station.

On 22 October 1972 I adjusted the timing of my solar radio telescope, this was so that I could observe the midday sun and the Sagittarius arm of the Milky Way as they consecutively 'drifted' through the beamwidth of the 136MHz antenna. The recording was fascinating, the receiver noise level did a rise and fall between 1330 and 1600 as the sun passed through. Then a gradual increase and decrease, a gentle 'hump', was drawn on the chart from 1700 to

## Interference

Just like the short wave bands, the universe is changing all the time. The work of the radio enthusiast is hampered by solar activity disturbing the ionosphere, or noises from thunder-static and local electrical appliances. The astronomer also suffers from interference in the form of moonlight, man-made light and overcast skies through bad weather. Television enthusiast **Peter De Jong** (Leiden, Holland), tells me that the effect of thunder-storms on satellite TV uplink signals has been very obvious. On November 15, he noted this effect "on the uplinks of German stations on Astral, first PRO7 faded out to almost disappearance, a couple of hours later it slowly came back, while in the meantime Tele5 started to fade out," as heavy showers moved slowly from South-West to North-East over the uplink stations. The other Astra channels remained unaffected. On another occasion during heavy thunderstorms over Italy, the RAI (Radiotelevisione Italiana) signals on IIF2 were almost lost, but, at the same time, there was no effect on the signals from STAR and TVE (Spain).



**Fig. 2: Untold numbers of stars, like our sun, emit noise which can be detected with specialised receivers, as shown here, on various parts of the radio frequency spectrum.**

2200 as the Milky Way took its turn. I repeated this experiment with the same settings the next day and the result, as I hoped, was almost identical.

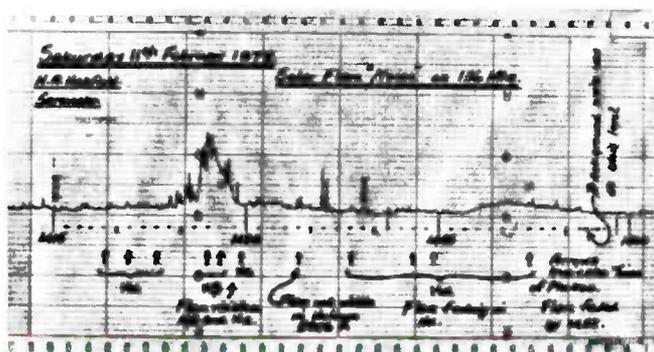
In addition to his spectrohelioscope, Henry Hatfield has two radio telescopes which he uses daily to observe the sun at 136 and 1297MHz. A typical result of his work can be seen on the piece of recording chart in Fig. 3. The dotted line in the centre represents his normal receiver noise level. The higher trace is the general solar noise, at 136MHz, between 1415 and 1500 on February 11, 1978. This particular recording shows a massive burst of noise which began at 1424, peaked around 1427 and died away at 1430. Also on the chart are Henry's remarks about the visual observation that he made at the same time with his spectrohelioscope.

### Visual And Radio Observations

Obviously the visual astronomer looks at the sheer beauty of the stars in the night sky, variations in the planets and the colourful displays of fireballs, burning meteors or an aurora. On the other hand, a radio enthusiast listens for terrestrial signals that are reflected over great distances by the moon and/or the temporary ionisation caused by decaying meteor trails and auroral displays.

For example, many astronomers frequently project the sun's image through a telescope onto a screen looking for sunspots, and local astronomical societies form groups to observe the colour and estimate the number of meteors that enter our atmosphere during the peak of a meteor-shower. A radio observer will know if the sun is active by the amount of noise being received or if, as a result, the earth's ionosphere has been disturbed.

An aurora that manifests during



**Fig. 3: Henry Hatfield has two radio telescopes which he uses daily to observe the sun. A typical result of his work can be seen on the piece of recording chart.**

the hours of daylight can be detected by radio because of the strange (tone-A) effect it has on terrestrial signals. Auroral reflected c.w. sounds as though the operator is 'keying a bath-waste', and s.s.b. transmissions become a 'ghostly' whisper. Therefore, by combining the information gained from these different techniques, the more we will all learn about our surroundings in space.

### The October Sun

Despite sometimes hazy and cloudy conditions during October, Clive Brook (Plymouth), using his own design of projection box, observed three groups of sunspots on days 14, 15 and 19 and four on days 9, 12, 17 and 18. Ron Livesey (Edinburgh) with his 50mm refractor and 38mm projection screen, identified three active areas on the sun's disc on October 14, 15, 18, 28 and 29, four on the 9th and 17th, and five on the 3rd.

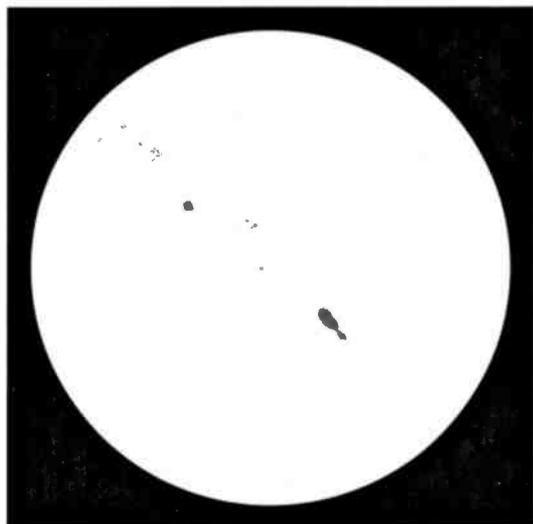
Ron is also the auroral co-ordinator for the BAA and during the month he received reports of 'active aurora', mainly from Scotland, for the overnight period on the 2nd, 4th, 18th and 19th, North Dakota on the 6th and 9th and Canada, Denmark and the USA on the 28th. Various other forms

described as 'corona', 'glows', 'rays and rayed arcs' and 'ray structures' were seen at other times. Tony Hopwood (Worcester) and Doug Smillie (Wishaw) told Ron that between them they heard tone-A radio signals in the 50 and 144MHz bands on days 1, 2, 5, 8, 10 and daily from the 25th to the 31st. In addition to his own observations with a 'Jam-Jar' magnetometer, Ron learnt from Tony Hopwood, Karl Lewis (Saltash), David Pettitt (Carlisle) and Doug Smillie, that magnetic storms were recorded on days 1, 6, 7, 8, 23 and from the 26th to 31st inclusive.

### Stop Press November

There was a 'stop press' at the end of Ron Livesey's October report which said, "Massive aurora all night in UK on November 8/9, coronal all over Scotland in evening and West Ireland. Major bright surge seen in South England about 0130UTC, bright enough to read with in West Ireland".

I hope to have more details about this event next month, meanwhile take a look at Fig. 4, I feel sure that activity from one of those large sunspot groups, observed and drawn by Patrick Moore at 1130 on the 13th, was responsible for that aurora.



**Fig. 4: Large sunspots observed and drawn by Patrick Moore at 1130 on the 13th.**

**Fig. 5: Telegram form sent on 30 July 1871. Because such messages were charged by the word, they were deliberately kept brief and to the point.**

### Computers

For the benefit of the computer buffs among you, I used the Windows 2.03 Paint program and of course the mouse on my Amstrad PC2286/40 to produce the illustration in Fig. 2. Being mainly an 'armchair' astronomer, I enjoy running astronomical programs, like 'Night Sky' on my computer.

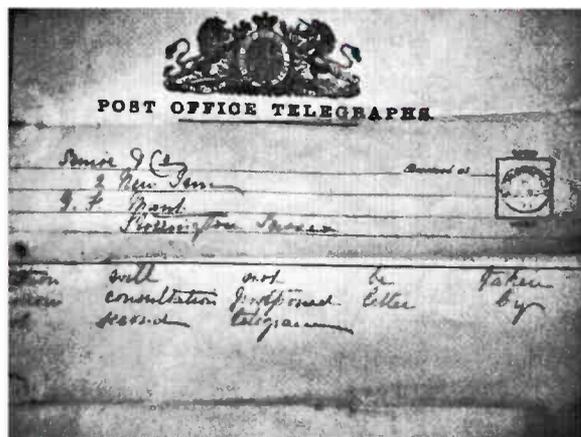
There are a number of similar programs available. So before making a purchase, it is worth having a word with a stockist like Rod Smith at The Public Domain and Shareware Library, Winscombe House, Beacon Rd., Crowborough, Sussex TN6 1UL, on (0892) 663298.

### Telegram

During Joan's local history research, she came upon a telegram form sent to a solicitor. The telegram was received at Storrington Post Office on 30 July 1871. The text reads "Petition will not be taken tomorrow consultation postponed letter by post second telegram." Because such messages were charged by the word, they were deliberately kept brief and to the point. Such 'telegraphese', often transmitted by Morse code between telegraph stations and reproduced on a hand written form, Fig. 5, was then delivered on receipt, almost immediately, by a 'telegraph boy' on his bicycle.

Joan found another, dated 3 February 1892, which was "handed in at the Maidstone office at 7.17pm and received here at (Storrington) 7.46pm." Apart from the address "To Mant Storrington" the message read "Yes" and was signed "Waghorne". The form was enclosed in a special brown envelope (125 x 80mm) inscribed "TELEGRAM." and underneath the words "NO CHARGE FOR DELIVERY."

### Reflections



# WHAT A GOOD IDEA



## Innovation Into Investment

We've always been proud of our authors and their work. Now you can join in - and win £25 - by sending circuits and projects to 'What A Good Idea'. It's the ideal solution to the advice often offered by friends who suggest that 'You should publish that!'

Circuits - accompanied by the minimum of text - must be neatly and clearly drawn in ink. Wherever possible the idea must be original, although your suggestion might be a significant improvement based on another idea. In which case you should always quote the original source.

All entries will be acknowledged. Send your entry, with your name and address, to: 'What A Good Idea', Practical Wireless, Enefco House, The Quay, Poole, Dorset BH15 1PP.

**PLEASE NOTE:** that we at PW may not have built and tested the circuit, but present it on an 'as-is' basis. We do take the greatest care in preparation of the article, but cannot be held responsible for the suitability of the original suggestion, or for any damage that may occur to property or equipment in implementing this idea.

Fig. 2.

### Ingredients For Hectograph Ink

8cc of water  
16cc of glycerine  
1gm methyl violet  
3cc methylated spirit

*Method:* Mix the water and the glycerine. Dissolve dye in hot water. When cooler, stir in the methylated spirit and then the glycerine and water mixture. Shake well before use. For green ink use methyl green. For red ink use eosin. See text for further instructions.



Fig. 1.

## Duplicating Printed Circuit Boards

Fred Durnford from Southampton, has come up with a very simple idea. It could help individual, clubs and groups to easily reproduce small quantities of p.c.b. designs onto blank boards, using a very old method.

How many older readers can remember the Hectograph? More often known as the 'jelly-pad', this simple and very useful duplicating system was for many years, the method by which many clubs and organisations printed their newsletters, club notices, ad's and what-have-you. It's very simple to make, and the instructions sound like a recipe for a birthday-party treat!

For quite a few years now, I have been using the 'jelly-pad' to reproduce small numbers of p.c.b. designs onto p.c.b. blanks. You might like to try the method, and with a bit of experimentation, it's possible to reprint as many as 50 p.c.b.s from one 'jelly-pad'.

### The Ingredients

You might think from the photograph, Fig. 1, that PW is turning into a cookery magazine. Not so! But you do need a packet of Davis Gelatine, available from your local supermarket (you'll probably find it in the 'cooking ingredients' section) for about 54p, and a suitable tray.

I've used many forms of container for the tray to hold the gelatine. The example shown in Fig. 1, is a small baking tray, available from hardware shops at around the £1 mark.

**Warning:** Although the gelatine is harmless (after all, it is a foodstuff) the various dyes, etc., used in the inks I am going to suggest, may well be toxic. So, I advise you not to borrow a tray from the kitchen! Keep a tray specifically for printing use and don't be tempted to taste the jelly, even if it does look like 'Turkish Delight'!

### A Simple Job

It's a simple job to melt the jelly powder down to form the pad, providing you follow some simple rules. Firstly, pour water into the tray until it reaches approximately three-quarters full. Pour that water into a saucepan, and then heat the water until it's warm. Don't make it too warm. Imagine it's going to be a tepid bath!

Now open all five of the gelatine sachets from the packet. Pour them into the saucepan one at a time, stirring the water. Don't be tempted to put all five in at once, or you will have one great lump of gelatine which could take a long time to dissolve. You should also avoid making the liquid too hot.

If you're tempted to use a microwave oven to melt the gelatine into the water, take heed of a disaster that occurred in our kitchen. I used our microwave and ended up with a frothy gelatine soufflé, which made a terrible mess. My advice is **don't**, and use a saucepan instead!

When all the powder has dissolved, find a cool spot to place the tray. Don't pour the gelatine into the tray and try carrying it to the cool place...it makes a mess on carpets and clothes. Instead, pour it into the tray, after you have found a suitable place and then leave it to cool.

### Firm Surface

The method I have described (it's very easy really) will provide a firm surface when the jelly sets. When it has set, you should be able to push a finger fairly firmly onto the surface of the jelly, and it will have a moist but resilient rubber-like feel.

The pad works in a very simple way. The inherent moisture in the jelly, draws water-based inks onto its surface. So, if you



write (brightly coloured felt-tip pens are mainly water-based) onto a sheet of paper, before placing the paper (written side facing the jelly), you can start the process.

Leave the paper on the jelly for a minute or so. Then lift the paper, and you'll find the printing is left on the jelly surface. Depending on the colour of the ink, you should be able to get up to 50 impressions onto clean and dry paper. If you leave the paper on for too long, it will stick to the jelly.

### Experiment With Inks

If you are prepared to experiment with inks, you can get some good results. I have discovered that the commonly-available dark blue felt-tipped 'markers' provide particularly good results. If you're lucky, you may even find a stationer with some old-fashioned hectograph ink in stock.

The most effective inks are glycerine-based, and the 'recipe' I've supplied, Fig. 2, works well if it's made up correctly. By far the most effective dye to use is methyl violet (a rich dark purple colour). You local pharmacy will probably make it up for you, and they usually charge around £2 (less than the NHS prescription charge!).

### Copying Boards

When you are copying boards, let's say for a club project, a different approach has to be adopted. I have found that ordinary water-colour paints provide quite effective inks or you can use a thick felt-tip pen (dark blue is best).

After the design 'master' has been painted onto paper, using a good quality water-colour, let it dry. When it's dry, place the master sheet down onto the jelly and leave it for about a minute.

Next, place a piece of p.c.b. blank onto the jelly surface. Press firmly, and when you lift it off, the p.c.b. design should be visible on the copper surface.

As the copper is not absorbent, the impression will not be as effective as it is with paper. However, all you have to do then, is to go over the faint markings with an etch-resist pen. The difficult bit, the copying, has been done for you.

The pad should be able to provide 25-30 impressions before the jelly begins to crack and stick to the p.c.b. blank. It's not a fast method, but providing the original is correct, at least you'll know that all the reproductions will be accurate.

### Melted Down

Eventually, the jelly will have to be melted down again. All the dyes left on the surface will be absorbed into the surface of the pad. The gelatine will eventually become so discoloured with the dyes, you'll have to discard it, but it's not expensive at 54p a packet!

I will leave you with a few tips on using this old-fashioned but useful method. It's very useful for making posters, copying circuit diagrams, and it's cheaper than a photocopier. No doubt, you will find more uses for the method than I have!

**1:** Make the jelly firm, but only use it when the surface is damp. If the surface cracks and peels, it's time to re-melt the pad and start again.

**2:** Store the pad out of the sun, and cover it so that mould does not grow on the surface.

**3:** Don't forget to add a little bit more water every time you melt the jelly down, to replace water lost by dehydration.

**4:** Discard the gelatine when the dyes absorbed into it, mark the paper you're using for copies.

## Amateurs On Manned Missions

The pair of cosmonauts in MIR have been hyper-active on 145.550MHz S.22 simplex, working many stations on nearly every in-range pass. I worked Sergei U5MIR at 1644 on November 23, followed by Alexander U4MIR on the following pass at 1821, both on speech f.m. I even made a brief packet radio connect with U5MIR-1, using just 7W to an indoor vertical dipole!

In addition to continued radio amateur crewing of the Soviet MIR space station, many of the future shuttle missions will be staffed by radio amateurs. Bill Tynan W3XO, AMSAT Vice President of Manned Flight Missions, pictured in WB2D's photograph Fig. 1, tells us that W5LFL and W0ORE will be on the March 1992 mission, N5QWL will be going up in September 1992, N5FCW in March 1993, N5RAX in October 1993, and WA4SIR in September 1994. Ron Parise WA4SIR is shown at the SAREX station by NASA in Fig. 2.

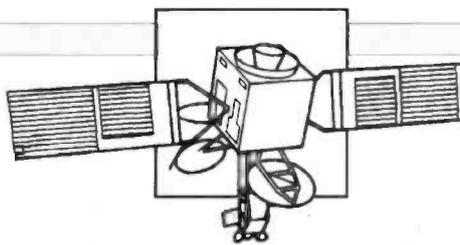
Wilf ON7TH, tells us that yet another European radio amateur is lined up for space flight with all the listed American shuttle astronauts. He is Dr. Dirk Frimout ON1AFD who is planned to be aboard the STS-45 mission. Any resulting 'SAREX' activity has yet to be detailed, and it's also yet to be determined if any of these missions will rise above the UK radio-horizon.

### RS-10/11

RS-10 has been on continuously without fault, with both transponder and ROBOT in fine fettle. (Why can't all our satellites be so simple to use and so reliable, and support so many old and new users?). It may well be that RS-10/11 is to be closed down on Mode A soon, as the main NAVSAT may be brought into service. When this happens, RS-10/11 will be replaced by RS-12/13 and the switching of these to Mode A. Meanwhile, Ollie SM0KV, back from a visit to the RS3A



Fig. 1: Bill Tynan W3XO, AMSAT Vice President of Manned Flight Missions.



# SATELLITE SCENE

by Pat Gowen G3IOR

*This month Pat Gowen G3IOR gives out the topical news on the most popular amateur spacecraft: RS-10/11, RS-12/13, OSCAR 10 and 13. The manned spacecraft amateur missions are covered, along with the topic of satellite 'gateways'.*

command station, reports that a new RS spacecraft is now being planned for the future. It will be much like RS-12/13, and will continue that function.

Jarillot FR4FP is asking stations to look for him on RS-10 on a downlink of 29.395MHz (uplink 145.895MHz) 'A' mode. Whilst the distance to Reunion Island is theoretically too far for the UK, it could just be done with dense E-layer re-angulation aid or the use of the 21MHz Mode K uplink. He invites schedules by sending him a packet message to FR4FP @ FR4FM using the 3B8FP mailbox, or by writing to Jarillot Didier FR4FP, Chemin Gaspard, 97438 St. Marie, Reunion Island, Indian Ocean.

Patrick ON1KBA, just north of Brussels writes "I am less active on RS-10 because of the rather small amount of new stations on the transponder. Most of the time you meet the same calls. I am now trying some QSOs via OSCAR-13 on Mode B, and although my station cannot compare with those very big ones that I meet on it, like a well-known Italian station using 100W to a 8 x 24 element array on the 430MHz uplink, and 4 x 17 elements on the 145MHz downlink,

it does work. I only use 25W to a 21-element ATV on the uplink and a 8-element quad for the downlink, and have no means of antenna elevation. Despite these limitations I have made QSOs with DL, IW, KS, K, KC, VE, JA and JE". Patrick uses his Icom IC-R70 for 28MHz, for 2m his IC-751E transceiver, and for 430MHz his Kenwood TS-811E transceiver.

### RS-12/13

With its transponder continuously on Mode K, 21MHz up, 29MHz down, RS-12 has been most reliable. The 29.454MHz ROBOT has neither been calling 'CQ' nor responding to calls, but the link is on, giving excellent mono-channel transponding to uplinks from 21.130MHz.

Although the lower m.u.f.s and the shorter days have meant very little sub-horizon DX activity, it is confidently expected that by early March we shall be able to work all continents once again. A series of sub-horizon tests between ZL3GQ in Christchurch, New Zealand and myself at the end of the year produced no QSO or mutual hearing whatsoever. The Spring equinox propagation path improvement should permit this and other long distance Mode K QSOs again.

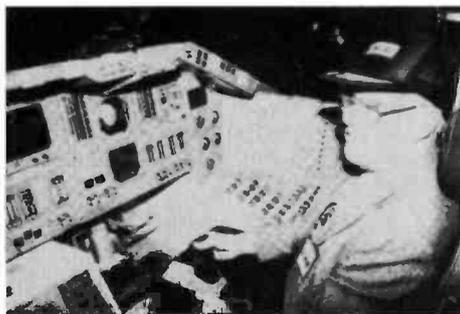


Fig. 2: Ron Parise WA4SIR is shown here at the SAREX station by NASA.

### OSCAR-10

The OSCAR-10 still goes reasonably well, and is even indicating some degree of response to commands put to it. It is believed, but cannot be proved, that the omni-directional antennas are deployed at this time.

Some beacon f.m.'ing has been indicated even at times of potential good sun-angle charging, so perhaps the battery is beginning to weaken now. It has done very well to last this long!

### OSCAR-13

The OSCAR-13 levelled out in its steep dive to extinction by mid-November, and is now showing signs of perigee climb again. Sadly, it will not last, as eventually it will reverse once more. The latest calculations by Dr. Tom Clarke W3IWI indicate the probability of re-entry and consequent incineration of A-O-13 during December 1996.

I have news of JR8XPV who writes that he has been active on the 23cm up and 430MHz down 'L' mode of OSCAR-13 since 13 March 1989, and has now worked 300 different stations in 27 different DXCC countries. He uses an e.i.r.p. of just 1kW or less from a single 37-element looped Yagi with the linear amplifier just below the antenna, this driven by his IC-1271. For the downlink he receives on a 20-element crossed single Yagi which has a GaAsf.e.t. pre-amplifier just beneath the antenna going to his FT-736.

With this relatively simple system he has worked 74 different stations in JA, 71 in the USA, 56 in Germany, 34 in Italy, 12 G's, 10 VK's, seven VE's, five HB9's, four each in France and Austria, three each in Belgium and the Netherlands, two GW's and two ZL's, and one each as 9HIEY, AL7JM, C30EUA, CT1WW, EA8ZU, OH2DG, SM7FYW, SV3KH, TR8BL, XE1XA, YU3BA, Z21HJ and ZS6AXT. He writes "My system is probably one of the weakest Mode L stations, so there are some limitations to my making many c.w. and s.s.b. contacts. The satellite position must be very suitable to me so that my downlink is good". He recommends that others attempt the mode, saying "Please try Mode L with QRP like me".

### OSCAR-13 Schedule

James Miller G3RUH, who with Peter DB20S and Graham VK5AGR, commands A-O-13, provides the calendar operational schedule from current until June 1992. This shows the commencement date, the planned

event, the mode(s) planned, the sun angle, and the Sun elevation/azimuth. See Table 1 to the right.

The schedule set for the attitude of 210/0 from the current date until January 20 1992 is:

Mode B: MA 000 to MA 165  
 Mode JL: MA 165 to MA 190  
 Mode LS: MA 190 to MA 195  
 (Mode S beacon)  
 Mode S: MA 195 to MA 205  
 (Mode B transponder off)  
 Mode B: MA 205 to MA 256  
 Omnis: MA 240 to MA 060

You are reminded not to uplink to Mode B from mean anomaly 195 to 205, as this interferes badly with Mode S.

The schedule for Attitude 180/0, 20 January 1992 to 14 March 1992 is for Mode B transponder operation only, as the sun angle will be between 30 and 45° for this period, this meaning a solar illumination of only 70-87%. Power production can support only Mode B transponder operation under these conditions.

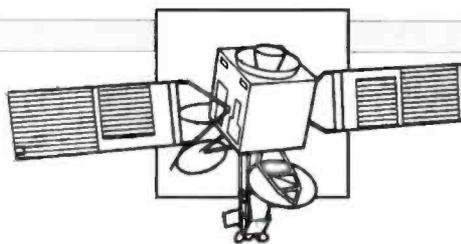
The schedule for Attitude 180/0, 14 March 1992 onwards yet to be decided, but will incorporate the outcome of the Mode L allotment debate to which 64 of you contributed your considerations.

## Eighty-Eights From SARA

Joe Kasser W3/G3ZCZ finds that our latest amateur satellite 'SARA' has been sending a constant stream of hexadecimal '88's' over North America. He wonders if it is dumping data on command over France, if there is a problem on the spacecraft, or if this is a loving message to those who say it's 'an intruder'. If anyone is copying signals from SARA, please let us know what you see.

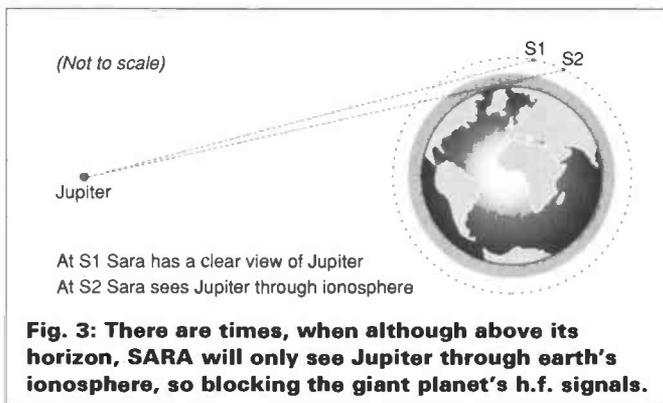
John Branegan GM4IHJ points out that whilst we see SARA when above our horizon, SARA will not necessarily see Jupiter above its horizon. What is more, there are times, as shown by Fig. 3, when although above its horizon, SARA will only see Jupiter through earth's ionosphere, so blocking the giant planet's h.f. signals. The diagram Fig. 4 is John's computed table of eclipse times of Jupiter for SARA from now until the end of 1993.

The telemetry detail for SARA is published in *BELAMSAT Satellite News No.11*, available from the editor, Patrick Hamptaux ON1KHP, at the same QTH as given for SARA QSL cards in your December 1991 'Satellite Scene'. The layout of SARA is shown by Fig. 5, also from BELAMSAT.



Date	Event	Modes	Sun Angle	SEL/SAZ
Dec 18 '91	210/0 Schedule	B JL S	-2 to -28	
Jan 20 '92	Move to 180/5	B — —	-44 to -39	34/335
Feb 24 '92	Move to 180/0	B — —	-43 to -31	41/ 24
Mar 14 '92	180/0 Schedule	B JL S	-31 to +32	33/280
Jun 08 '92	Change to be announced	JL S	32	-24/126

Table 1.



## Specialised Apparatus

The cost of the rather specialised apparatus and antennas for a really effective satellite station is still a severe deterrent to many in the western world, and to even more in the third world! As satellites move to even higher frequencies, this problem further intensifies.

One way out of this situation, much of which is due to the cash and technical limitations of the average would-be user, this due to the sheer cost and/or complexity of the exclusive specialised equipment, is to use a local 'gateway'. This would act like a local repeater, having its input and output on an easily accessible mode and band. It could be 50MHz 145MHz, 435 or even 1296MHz f.m., with linking to a microwave satellite band, thus providing an ultimate DX 'repeater' that could be used by all fixed, portable and mobile stations within the coverage area. It could optimise high-gain dish antennas, and automatically computer-track the satellite, its mode of operation,

signal level required, and also have frequency versatility to allow for Doppler shift and a clear frequency spot, all at one QTH. Such common station 'gateways' have been used in the USA to bring many non-equipped amateurs to the satellite scene. I worked many W mobiles, and low-power speech f.m. stations using the gateway station installed by Rich Zwirko K1HTV near Washington DC.

A little cold water was seen to be poured onto this ideal in practice, at least in the more affluent USA, when N4HY met the point forcefully in the *Amsat Journal* and wrote "Whilst OSCAR-13 Mode B does provide communications, it does so in a marginal manner. One topic where I hoped for support was Gateways. I got none. Regular satellite users said (1) they would not support facilities to make it 'too easy' for others, and (2) that no one would donate cash to build gateways, although half the amateur radio fraternity (apparently the wrong half) would love to use gateways for 'free'. Almost all correspondents cited the difficulties

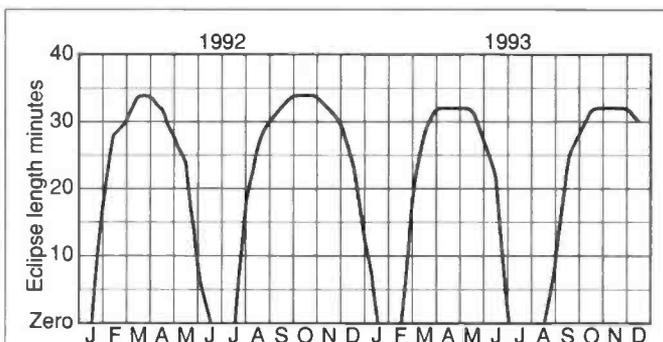


Fig. 4: John's computed table of eclipse times of Jupiter for SARA, from now until the end of 1993.

Fig. 5: The layout of SARA is shown here.

f.m. repeaters and packet BBS nodes have in getting users to provide even limited financial support. There was however, one very interesting suggestion, which I like, but am not sure will be legal. This proposed that gateways should be select call only, e.g. 'no pay - no use'. It may be worth going for this even if we have to get legislation changed to do it".

If the same principle is now applied to the expanding needs of packet radio BBS forwarding via the many digital mode supporting satellites, such an international repeater would serve the needs of a community of perhaps several hundred amateurs within perhaps a 40km radius circle. The outlay for each user would be minimal, and the collective individual savings so made could be placed toward the costs and maintenance of the communal gateway itself.

Where gateways can really make their mark is in the distribution of the packet radio mail to the wider world. Although h.f. links work most of the time, the vagaries of our sun and resulting aurora can give times when messages have to wait sometimes for weeks before forwarding is possible. Already many BBS stations have organised a packet radio gateway as a highly effective means of providing fast and reliable communications, and keeping out of the growing levels of QRM present on the limited high frequency amateur bands. Furthermore, in the coming quiet sun years, reliable communications will be maintained.

At this time KI6QE, NL7NC, VE8DX, WA0PTV, KF4WQ, LU8DYF, ON4KVI, ZS1ABM, JA6FTL, WO5L, ZL2AMD, NU9H, W5ERO, KG4TM, EA6IC, SV8RV, NR3U, LU1ESY, YB0QC, VK5ZK and LU7ABF are already active, passing much of the traffic for large areas of the world mainly using the 'PACSAT' series. Roger G3LDI, alias mailbox GB7LDI, who writes 'Packet Panorama' is now working hard to get his automatic tracking system going, and by the time you read this, it should be operational.

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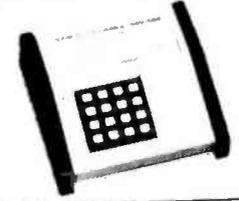
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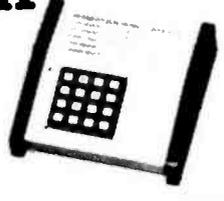
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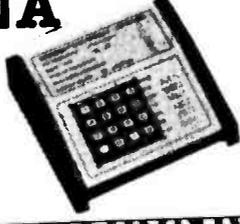
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# Radio Diary

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**January 19:** The Oldham rally will be held at the Queen Elizabeth Hall, Civic Centre, Oldham. Doors open 11am, 10.30am for disabled and for those taking the Morse test. Bar & catering facilities available and parking is free. Details from **Kathy G4ZEP** on 061-624 7354 day or 061-652 8617 evening.

**January 26:** The 2nd Lancastrian rally will be held at the University of Lancaster. Opening times are 10.30am for the disabled and 11am for everyone else. Further details from **Sue G10HH** on (0524) 64239 or QTHR.

**February 2:** South Essex ARS have their 7th mobile radio rally at the Paddocks Community Centre, Long Road (A130), Canvey Island, Essex. All the usual traders, Bring & Buy, refreshments, free car parking, including parking for the disabled outside the main door. Doors open 10am. Talk-in on S22. For further information contact **Dave Speechley G4UVJ** on (0268) 697978.

**February 16:** The Kidderminster & DARS rally will be held at the Harry Cheshire School, Habberley Road, Kidderminster, Worcs. Doors open 10am. **G8JTL** Tel: (0384) 894019.

**February 23:** The Northern Cross rally will be held at the Rodillian School on A61 between Leeds and Wakefield (junction M1/M62). Doors open 11am, disabled 10.30am. On-site parking, dealers, groups and craft stands, Bring & Buy, Morse test. Car crime prevention demo. Bar & refreshments. Talk-in S22. Entry 50p (programme draw prizes). **Dave Gray G0FLX** on (0532) 827883.

**February 29:** Tyneside ARS have arranged a new venue for their annual rally, the Temple Park Leisure Centre in South Shields, Tyne and Wear. The centre offers up to 18 000 square feet of floor space, all on one level, with easy access for traders where needed. Catering facilities, including a bar on site, as well as family rooms. For those other members of the family not wishing to partake in the Rally, all the amenities of the Leisure Centre are available, including heated Leisure pool and gymnasium. Plenty of free parking. Further details about the Rally from **Jack G0QZG** on 091-265 1718.

**March 7 & 8:** The London Amateur Radio Show will be held at Picketts Lock Centre, Picketts Lock Lane, Edmonton, London N9.

**March 15:** Wythall RC will be holding their annual rally at Wythall Park, Silver Street, Wythall (nr. Birmingham). Doors open 11am to 5pm. Usual traders, bar and refreshment facilities, Bring & Buy. Talk-in S22. Admission 50p. Full details from **Chris G0EYO** on 021-430 7267.

**March 15:** Tiverton South West Radio Club Mid-Devon rally will be held at the Pannier Market, Tiverton. Easy access, only minutes from junction 27 on the M5. Free parking. Two halls of trade stands, Bring & Buy stall and mobile snack bar. Further displays and full refreshment facilities in the club room bar, which is to open throughout the day. Doors open 10am. Talk-in on S22. More details from **G4TSW, Mid-Devon Rally, PO Box 3, Tiverton, Devon.**

**March 22:** Pontefract & DARS have their annual Components Fair & Spring rally at Carleton Community Centre, Carleton, nr. Pontefract. Doors open 11am to 4.30pm. Admission by prize programme. Bring & Buy, traders, licensed bar, bookstall, etc. Talk-in on 144MHz. Car boot spaces available. Extra car parking. Details from **G0NQE** on (0977) 677006 or from **G0AAD** (0977) 643101.

**March 29:** Bournemouth Radio Society's 5th annual Amateur Radio, Electronics and Computer Sale will be held at Kinson Community Centre, Pelhams, Millhams Road, Kinson, Bournemouth. Doors open 11am. Admission is 50p, including prize draw ticket. Light refreshments available. Talk-in on S22. For further details of table bookings, etc., contact **Vic G4PTC** on (0202) 516593 evenings after 6pm.

**April 5:** The Launceston 6th amateur radio rally will be held at Launceston College. Doors open 10.30am. **Maggie**. Tel: (0409) 21219.

**April 19:** Centre of England Easter Sunday radio & electronics rally, held at the National Motorcycle Museum, Bickenhill, nr. the NEC (Jct. 6 M42). Doors open 10.30am, 10am for disabled. Admission £1. Over 60 traders, ample parking, Bring & Buy. Talk-in S22. Bar & refreshment facilities. Details from **Frank Martin G4UMF** on (0952) 598173.

**May 17:** The 35th Northern mobile rally will take place in the Flower Show Hall at the Great Yorkshire Showground, Harrogate, north Yorkshire. Showground opens 10am, doors open 10.45am. Talk-in on S22. Bring & Buy, bar and cafeteria. Free parking and loads of stands. Entry and parking of Wetherby to Harrogate Road. Separate arrangements for disabled visitors off Hookstone Wood Road. Details from **Mike G0MKK** on (0423) 564353/507653 or FAX (0423) 520992 or @GB7CYM.

**\*June 14:** Royal Naval ARS have their annual mobile rally at HMS Mercury, Nr. Petersfield, Hants. There will be dozens of trade stands; a Bring & Buy; flea market; radio-controlled power boats and trains; local radio clubs and repeater groups; childrens' rides and amusements; vintage fire engine; TV detector van; ices and refreshments; arts and crafts' exhibition; two Grand raffles; spectacular arena displays and other attractions, making this a great day out for all the family. Talk-in on 144 and 430MHz, free parking and picnicking, free admission for children, adults £1.50, no dogs except guide dogs. For full details, contact **Cliff Harper G4UJR**, 34 Neva Road, Bitterne Park, Southampton SO2 4FJ. Tel: (0703) 557469.

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**PW FEB 1992 OFFER**

# Back-Scatter

## HF Bands

Reports to  
Paul Essery GW3KFE

287 Heol-y-Coleg, Vaynor, Newtown, Powys SY16 1RA

On Wednesday 20 November 1991, a newspaper called the *Shropshire Star* carried a report headlined 'Broadcast in dark, buff told' - no, I kid you not! Reading a bit further down, I found a Councillor Robert Sevant of Leominster who says that Mr and Mrs Powell 'must only operate at night so as to avoid interference to television'....well, well. I have always had doubts about the sanity of some local councils and planners! Having suffered no fewer than four TVI complaints in 41 years while dodging line timebase noises for the same period, I sympathised with the local viewers in their dire distress. I have visions too of operators taking the bulbs out of the shack lights. Various letters have gone forth in support of the Powells - but the vision of all the macho males of Leominster busily viewing 'Watch with Mother' still chokes me with laughter!!

**A late flash and a happy ending! Mr and Mrs Powell got planning permission with no restrictions whatsoever in the end.**

## The WARC Bands

The 24MHz s.s.b. brought Vince 9H1IP contacts with 9M2HB, VP2M/GOAZT, CX8CX, 3B8CF/3B7, ZA1HA, 4J3GM, JT1CO, TA1AL, FG/F6AUS, V73BN, FK/JH1QVW, SV5FD and HR2JAE. As for 18MHz, we find ZA1HA, HC4LH, ZA1ZXV, LY2BR, ZA1QA, NS0W (Colorado), HHZZ, KK0U (Iowa), 3B8FE, G3UHU/TF, HC8GR, T.J1MR, FG/F1JOT, 7X2DG and TZ6VV.

What about Pat ON7PQ (Kortrijk)? Pat as always stuck to his key, and on 10MHz reports ZP6CW, HF0POL, EA8BVP, FG/F9I, 9Y4KB, LU8HGI, FM/F6BHK, KP4U, FY5FP, V2/OH3VV, UM8MBA, 7Q7TA, ZD8LI, 9L1SL, H18A, PJ2/OH5PT, FS4PL, UF6FEI, OH3VV/J73, VP9MP, VK6HD, VK2DXI/9M2, ZC4CZ, 9K2ZZ, KL7UPS, TF3CW, 5N0SKO, UA0KJ (Zone 19), and YJ0AJU. Turning to 18MHz the crop included V85KX, 3B8CF, ZA0DXC, V47TV, YJ0AJU, 9L1SL, ZD8LI, V2/OH3VV, 4K1AFM, ZP6CW, 3B9FR, KL7AF, ZL3GQ, FM/F6BHK, FG0P, 5R8GW, J8/K9FD, KP2/CT1BOH, 8P9HR, UA2FV, OK1IAI/YA, OH3VV/J73, 5V7JG, and 9M8DX. Higher yet, to 24MHz and here Pat keyed with VQ9QM, C6/KR1S, PJ7/W1XPK, YJ0AJU, KL7CYL, C02VG, JT1CO, OK1TAI/YA, J28FO, FY5FP, FG0P, P4/K4PI, J8/K9FD, PPOF, FK/JH1MXV, 5V7AK, 9L1SL, OH3VV/J73, FS4PL, J73AZ and KH2T.

Having a bit more time of late, Ted G2HKU (Minster, Sheppey) had a bash with QRP on 18MHz c.w. rewarded him with OE3IH and SM6SLC, while 24MHz c.w. gave RQ40A, W2VEC, TA1AZ, N4LS, K4II, XN3XN, V2/OH3VV, and W8VSK/M. Ted is thinking of disposing of his Corsair with all the filters and external VFO, to raise funds to buy an Argonaut 2.

On to Don G3NOF (Yeovil), who found conditions patchy with several

periods when the bands were dead. However, 18MHz s.s.b. was the mode for K6YRA and DD5ET, while 24MHz was preferred to raise A45ZZ, FM5DN, FR5GL, FY0EK, H18MEQ, PPOF, SV1UM (IOTA Eu-75), TA1AL, UF6FL, VP2V/KU7F, YS1DRF, YV2BYT and ZA1QA.

## News

The news on the Bangladesh situation continues to be less than clear. Jim Smith VK9NS was to go to Bangladesh, and to return thence on November 20. So far, your strully has heard nothing of Jim or of S21A or S21B; neither has WZ6C surfaced with a Bangladeshi call. Keep an ear to the *DX News Sheet* or the grapevine for the latest gen.

ARRL has passed the word that QSL cards for ZA1ZMX, ZA1ZXV, ZA1ZXV are OK for DXCC credit.

Still with ARRL, I hear that the XY0RR documentation was to reach Newington by the end of November. Incidentally, Romeo has had his calls pirated by a UA9 station, who was also responsible for the P5RR nonsense.

Lloyd and Iris Colvin W6KG/W6QL are off again. At the time of writing they were at HS0ZAP and often split 1kHz up. QSLs as usual to Yasme, Box 2025, Castro Valley, CA 94546, USA.

## The 1.8MHz Band

The John G3BDQ (Hastings) 1.8MHz log shows some six hours in the s.s.b. leg of the CQ WW. Some 35 countries in five zones were hooked, with OY9JD, TK5BF, LX1FJ, LX6A, HG7BX, HG73DX, LY2ZO, RY7D, YL1ZW, RZ1A, CR3A, UC2IDC, LZ9A, EA9LZ, RH2E, ULOA, HB0/HB9AON, ZB2X, RT5UO, PI4TUE, RY1U, and ZA0RS. CW at other times went across to RA6WB, RW9USA, 4N3KV, and RB5SJ. John believes his QSO with ZA1HA at 1817 GMT on October 9 was the first G-ZA on 1.8MHz. This was 599 both ways after a CQ from the ZA - whom John thought was a pirate until the QSL turned up!! As for the earlier ZA activity, back in the sixties, to the best of my recollection there was no thought of 1.8MHz activity.

Having end-loaded her 3.5MHz antenna, Angie G0HGA (Stevenage) found G0EBW and G3YVH just to prove the system worked on this band.

Having surveyed the slope of the site on which his home in Bath is built, Andrew G3VWC has put up a dipole for the band; in its first week, it has found numerous Gs, CT1A0Z, LX/PA3DK, DL9EBA, LA8WG, and OK1FWG.

G2HKU kept his sked with ON7BW on s.s.b., but otherwise Ted has a one word reference to this band - 'Nowt!'

## The 3.5MHz Band

Sometimes it sounds nearly as bad as a London 144MHz repeater - but not quite, I must admit!

The list from Pat ON7PQ is of course all c.w., and it includes CN0F, OY1CT, 4X4JU, TF3CW, EA8/DJ9RB/P, 4K30LL, 6W1QB, PJ2/OH5PT, JW0C, H18A, 6W6JX, 4K1A, OK1IAI/YA, TU2VV, UI8BAA and T11C.

After his shortfall on 'Top Band', Ted G2HKU did a little better on 3.5MHz, when he raised UL8GB; and he did have a QRP contact with DL3YDY as well.

A long letter this time from Angie G0HGA; she has cured the problem with r.f. in the keyer and made some modifications to the far end of the old 22m wire which have brought up the 3.5MHz signal noticeably. On the other hand, having a local piped-TV system which down-converts to around 56MHz rather knocks things around for 28MHz operation. The 3.5MHz roll-call includes HE7DES, OZ4UN, SM0CCE, SM40TI, HG95T, HA6NL/QRP, HA6VR, YL2GT, YT2UR, SP6BLV, OK2PVA, OK2EC, UA3ULN, RB41XQ, RA1AE, EA8GFA for a new one on the band, I2FGT, IK6BAK, 4L1QRQ, F8UFT, the usual crop of UK stations and a 'gotaway' in ZA0DXC who did work a few UK stations.

Enter Don G3NOF, who plucked up courage for a rare foray on the band, and came out with CR3A.

## The 7MHz Band

Much goes on among the cognoscenti hereabouts on 7MHz. A new reporter is G1OPML from Ballymena. Mervyn runs a KW Atlanta, minus the p.a., at what comes out of the driver stage; this is around 1W on c.w. or 500mW on sideband. The antenna is an inverted-v for 7MHz up at 23m, used on all bands 7-28MHz. On 7MHz Mervyn started on Firework Night(!) and a few Gs were worked, three days later there was a GM, then DF2QO, UT5EH, DJ1LE, EI6DA, GW4VAG, EI6AH, G3MWF, GB2KER, G13NHM, UT5UFD, DL6LX, EC2DGH, SM5BDY, EI9ET, and of course loads of Gs. As a nice postscript, Mervyn mentions the kind souls at special event stations who take time out to look for the low-power merchants and pull them through.

For Don G3NOF the sole contact reported was the one with ZA0RS.

Pat ON7PQ keyed with JW0C, FS4PL, SM0DQO/OD5, JH8SR, WL7E, 9K2ZZ, PJ2/OH5PT, ZA1TAC, JJ1VKL/4S7, VU2UKN, C08AV, Z21HS, TR8XX, TF3CW, 4K3DLL, C56/G4ODV, SU1DX,

FG0P, HS0E and JT1CD.

John G3BDQ, as our picture last time showed, is a great believer in the adage that the more light shut out of the garden, the better the DX....having filled the back garden with wire John has now started on the front one. On 7MHz the effect was: UM8MCF, UL7TX, W7ZQ (Colorado), RH3E/DK2DY, R50DPK, 4X4VF, and UO50DX.

Yet another c.w. man, Ted G2HKU mentions UA0WW, UF6FDR, UV9ST, UL8LWO, UI9ACQ, and UZ9CX.

On 7MHz the G5RV netted G0HGA, K4JPB, N4AR, K1ZZI, N8AHH, EA6ZY (older readers will recall him as G3ZY), EA6YG, UA0WW, RW9HZZ, UA9CM, UL8GB, UH2E/UA9TZ, UL7MG, plus q.r.p. contacts around G and a 'gotaway' in VK2KA around 0100Z.

## The 28MHz Band

Don G3NOF opens the 28MHz battling. He mentions BZ4RBX, D68RH, HB0/HB9AON, H18A, HZ1HZ, J82A, KP2A, NT7Y in Utah, V47NS, VE6TK, VK2AHM, P40T, P40W, PJ1B, T14CF, XX9AW, YN/SM00IG, Z21HQ, 4U1UN, 6D2X, and 9L1SL.

Unfortunately, G3VWC has been QRT on this band, having had to drop the trap dipole for a spot of tramping.

Over the water to ON7PQ, where Pat seems to have connected with ZA1DXC, C6/KR1S, FS4PL, V29W, J8/K9FD, FY5FP, Z23JO, P40V, J28FO, JT1CO, 4K1A, 3B8FG, 5W1VJ, C56/G40DV, 9L1SL, JY2FL, 6W6JX, ZF2NE, OK1IAI/YA, 4U1UN and HZ1AB.

Sideband on 28MHz for G3BDQ meant BY5RA and UO50JZ.

The c.w. from Ted G2HKU was used at the 100W mark to hook RQ40A, YN/SM00IG, AB4QA, UA0CIN, W6TZD, TA7I, ZD8LI, HK3RQ, PY2CC, C01HJ, J8/K9FD, V29W, and LU4DXP, while the q.r.p. rig was enough for ZA1QA.

For Angie G0HGA we find c.w. preferred for NY3A, K0HT, K5TF, W2BA, N9AEJ, N4AR, K1KJS, K4TWJ, W3TFP/4, UA0KGL, UA9TT, VE3KLM, and various smaller fry.

## The 14MHz Band

Allegedly, 14MHz is where it all happens. Let G1OPML have first go; his q.r.p. starts off with ZA1QA, LZ2KLW, 9H3NU, F6IIO, LX1CN, PA3FWZ, LX/PA3DBK, and DF9YM all on s.s.b. - then the antenna blew down! After a period of a month activity recommenced with c.w. to DL2XW and OE5MJL who was also q.r.p. It was back to sideband for IT9KDASM6EOT, HE7BCK, DL3HRM, SM7DLZ, then c.w. again to knock off DL2BCV, OK3TBGHA5AEX, UZ1WWW, SP9DEE, HA5GT, RA0NRO, IV3GHJ, and EA7GS. Back to sideband, DJ8CX, EA3GCN, CT1AVR, HA3HV, HA3GR, DF7JH, DJ0XR, SM5GA, HA7UL, SM6CAS, 3A2LZ, LA2CBA, RA0NRO again, DL11Z and EA7GS.

On to an old hand, G3NOF; Don

# Back-Scatter

offers BV2FF, BV40B, C6AFQ, CE0YAD (Easter Is), FT4YD, IK5DNE/IA5 (IOTA EU-28), J37H, J80D, J82A, KL7RA, PJ9W, V31ZR, V47NS, YW1A, ZC4ST, ZF8AA, ZS6DL, 5H3DC, and 9M2DM.

Turning to Pat ON7PQ we find 9K2ZZ, 9K0ZZ, 9M6RO, W5NFS/KL7, 4K4/UA6JCG, ZA0DXC, FG/F6AUS, FY5FP, 4K1ADQ, Y88POL, SM0DQD/OD5, F05IV, ZK2JD, VQ9AR, 7Q7TA, A35VJ, 9L1SL, 4K1A, 5W1VJ, 6W6/K3IPK, KC4AAA, 5V7RC, J73DX, AD1S/KH9, J82A and V85KX.

A short c.w. list from Ted G2HKU for this band, by way of CR2BBR, VK5LE, UM8MAV, UZ6HC, and ZA1TAD.

At Angie G0HGA there was FY5FO, J37ZC, YN/SM0OIG, XN1MO (QSL via VE1BT), C25/G40DV, V2/G6QQ, HK3RQ, VE3DZZ, TA2DA, CU2AT, W5XJ, KD9CK, NI2V, K1NA, N5CE, W9FFQ, K1RM, W0WP, WA2SON, WX8Q, KY9L, K2SIG, and many of the smaller fry.

## The 21MHz Band

Leading off on 21MHz GI0PML, made contact with s.s.b. to LY1BD, IV3KYQ, IV3GJF, 6W1QB/P, OE8WHE, UB4RWC, IK1PAU, SP3GEM, RA3AUU, EA7UG, EA1MQ, OH1MRR, DL5FBB, UB5XDK, DJ6JV, VO1XC, SV0HW/SV9, IT9KDA, while on the key RB5VWW, SM7BG, DL9OX, DJ1CC, EA5DJH, SM7SKM, VE3DIE were all raised. For a first report from a newcomer with low power, and mixed modes, one of the best I've seen.

To Don G3NOF, the tally included BZ4RBX, C6AFQ, FM6A, HZ1AB, J80D, J82A, KG4QQ, LU8XP (Tierra del Fuego), OA4QV, OX3KM, P40T, PJ7A, PJ9W, S03UN, V31ZR, V47KP, V63JC, VE7PL, ST0DX, TV6MN, Y11AFC, ZF2JI, ZF2ND, ZF2QX/8, ZF8AA, ZP0Y, 5Z4DU, 6D2X, 6W7/YU5AU, 8P9Z, 9L1US, 9Y4H, and 9Y4VU.

From all-phone to all-c.w. from

ON7PQ; Pat has 9X5HG, FY5YE, PP0F, FG/F6BFH, JT1CO, KP4P, ZD8LII, BV2DM, 3B8FK, TL8CP, 9J2SZ, 9L1SL, A35VJ, 5U7M, X2BW, ZF2NE, YA2CW, OK1IAI/YA, YJ0AJU, T11C, and N6CW/NP2.

The keyer at John G3BDQ accounted for FS4PL for number 281 (so much for the resolution to stop at 2001) while the sideband made contact with BY5RY, 7L1GVE, UR5M, 4J3GM, UA9MA, TA3KC, LU9AEV, ZX9A, VP9AD, and VO1QF.

Ted G2HKU stuck to c.w. for TA7KA, SU1HV, JA1AH, RA9SSO, VU2TS, FY5YE, and ZA1DX.

Finally, Angie G0HGA who finds the size G5RV not too successful on the band; but WA2SON was raised on c.w.

## Contest

I have been sent the rules of the EA RTTY Contest, 1600Z Saturday to the

same time on Sunday, February 8-9. Call CQ EA Test, non-EA stations score one point per QSO in own continent, two outside own continent on 14/21/28MHz, 3 and 6 respectively on 3.5/7MHz. Send RST plus CQ Zone, EAs send RST and a two-letter code indicating province. Multiplier, each DXCC country and each Spanish Province on each band. Final score sum of QSO points times sum of multipliers on all bands. Categories, single-op single band, single-op all-band, multi-op all-band, and s.w.l. Separate log sheet for each band, mail by April 10, and include summary sheet, and address to EA RTTY Contest Manager, EA1MV, Antonio Alcolado, PO Box 240, 09400 Arando De Duero (Burgos), Spain.

## Finish

That's all for now. Deadlines, January 27, February 24, March 23, to the address at the top of the column.

## Solar Data for November 1991

The first two weeks of November saw a major surge in solar activity with many X and M class flares, ionospheric disturbances, magnetic storms, short wave blackouts and surprise, surprise, a number of intense auroras! One of the biggest events during this period was a magnetic storm on November 8 which started at 0640UTC, causing widespread visual and radio auroras, followed by an X1.1/1/B type flare on November 9, which pushed the geomagnetic A index up to 99 units.

From November 11 through to November 24, there was a decline in the solar activity but the geomagnetic activity remained high, being up to sub storm level on a number of days. There were a number of flares during this period, the biggest being an M4/3B on November 20, pushing the geomagnetic A index up to a level of 37 units by November 21, and causing a number of auroral openings between November 19-22.

## Auroral Events

During the last week of October, numerous radio auroras were recorded in central England and this state of affairs continued throughout November. Openings were noted at my QTH on November 1, 4, 8-11, 15 and 18-22, most of them reached up to 144MHz but the event on November 8-9 was very intense and produced a number of contacts on the 430MHz band.

Mark Holloway G4YRY (I090) has sent me details from his log book of auroral contacts, made on the 144MHz

# Back-Scatter

## VHF Up

Reports to  
David Butler G4ASR  
Yew Tree Cottage  
Lower Maescoed, Herefordshire HR2 0HP

band during the month of October. Most events were of the weak 'Scottish' variety but an opening, starting at 1415UTC on October 28, gave c.w. contacts with DJ1HA (J030), DJ1KE (J043), DH6JL (J031), OK2BFH/P (JN99), OZ1FQP (J046), PA3FMC (J021) and SM5BSZ (J089).

Steve Damon G8PYP (I090) also caught the aurora on October 28, and made a number of s.s.b. QSOs on the 144MHz band, including DG1KBY (J030), DG6YGG (J041), DG5DBK (J031), DB8KJ (J030) and DL8SCQ (JN48).

"Great...At last!" writes Derek Moore G1THG (I081). He continues.. "After six years of trying, I managed to be in the right place at the right time to work my first aurora". The event, on October 28 between 1415-1620UTC, gave Derek s.s.b. contacts on the 50MHz band with EI8EF (I054), G1SDX (I070), GD7JQI (I074), G14XFS (I074), GM1EHK (I086), GW8YUJ (I073) and ON1ANT (J020). He also tried to make some QSOs on the 144MHz band but found that running 25W was not very productive, making only one contact into Derbyshire.

On November 1, Ela Martyr G6HKM (J001) made a number of s.s.b. QSOs

on the 50MHz band, contacting stations in G, GD, GI, GM, ON and PA. Up on the 144MHz band, G4YRY found conditions to be quite good, making c.w. contacts with DF1HF (J043), DJ2UP (J043), DL8HCZ (J053), SM5BUZ (J078), SP2BSF (J094), SP2JXN (J094) and SP5EFO (K002). At my QTH, I made one solitary c.w. contact, with UZ2FWA (K004) in Kaliningrad, before the gale force winds forced me to lower the tower!

## Widespread Event

Without doubt, one of the better auroral openings occurred during the evening and night of November 8-9. It was a widespread event, covering most of Europe and extending up to the 430MHz band.

Robert HB9BZA (JN36) located in Geneva, mentions that the last time he made an auroral QSO on the 430MHz band was in March 1989. He was very pleased therefore to hear Y21TC (J063) 54A at 2356UTC on November 8 and to work at 0005UTC, on November 9, G3UVR (I083) 54A 55A and, at 0013UTC, G3LQR (J002) 53A 55A. For the record, Robert runs 800W into a 19-element Yagi.

Jim Smith G00FE (I090) mentions that he wasn't expecting an aurora as WWV had not reported any flares, and the forecast for the magnetic field was quiet to unsettled. During the afternoon of November 8, around 1400UTC, Jim was listening to east coast USA stations on 28.885MHz, reporting a 50MHz opening into CN, CT and F, when all signals suddenly disappeared. At 1500UTC, signals started to recover but sounded distinctly hollow and by 1600UTC an aurora had started on the v.h.f. bands.

On the 144MHz band, from 1614UTC, Jim made c.w. contacts with many stations including HG5DE (JN96), LY2WR (K024), OE3JPC (JN88), OK1HAG (JN79), OK1VBN (JN78), OK3CDB (JN88), SP5EFO (K002), SP9AGV (J090), YU1EV (KN04) and UZ2FWA, for a new country (UA2). During the evening, at 2136UTC, he worked SM5BUZ (J078) via auroral-E, signals being 559 579 with no auroral distortion.

Did anyone else make or hear AuEs contacts on the 144MHz band around this time? Although Jim is located on the south coast of England he reports an excellent visual display, starting around 2215UTC, with a green glow on the northern horizon which gradually brightened up and rose higher. By 2300UTC, rays and curtains began to spread upwards towards the zenith and much of the northern sky was stained blood red. Max DL4MDD (JN57) located very close to the Austrian border also reported that the northern sky was painted dark red, whilst up in central Scotland, Simon Lewis GM4PLM mentioned airglow and ray arcs so bright that it was light

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# Back-Scatter



**Fig. 1: 144MHz e.m.e. array at the QTH of DJ3WA.**

enough to walk around outside.

**Bob Minton GWOHOL** (I081) reports that he, along with other members of the Cardiff Astronomical Society, had an excellent visual sighting of the aurora, the best in fact since the intense event of 13 March 1989. Bob is also active on the 144MHz band and was therefore able to enjoy the radio aspects of the event. Using an Icom IC751E, 180W BNDS amplifier and a 13-element Yagi, he made many c.w. contacts including HG1XR (JN86), OK1HAG (JN79), SM0HUO (JO86) and SP5EFO (K002).

**Ralph Sachs G2CZS** (JO01) noticed that several American stations on the 28MHz band, during the morning of November 8, had a watery and burly sound indicative of an impending aurora. He asks if there is any correlation between the effects noticed on 28MHz and auroral conditions on 144MHz? Has anyone any views on this? Ralph looked for signs of aurora on the 144MHz band but didn't hear anything until the evening, when he made c.w. contacts with GD0ELY (IO74), DL1EJA (JO31), DJ2QV (JO41) and OZ7LX (JO55). He also used s.s.b. to work DH5YAU (JO41).

**Ian Cornes G4OUT**, the RSGB v.h.f. Awards Manager, was the only one to report that the aurora also coincided with the 144MHz c.w. cumulative contest making that evening's session very exciting! Among his c.w. contacts were HB9BZA, OK1DFM, OZ1FGP, SP20FW and SP5EFO.

Although **Ela G6HKM** managed to make a number of good s.s.b. contacts on the 144MHz band, most of her time was spent on the 50MHz band contacting a total of 54 stations located in G, GD, GU, DL, F, LA, OZ, PA and SM.

Having mastered the technique of detecting auroras, **Derek G1THG** was pleased to catch the event on the 8th but found that conditions on the 50MHz band were very noisy making it difficult to copy stations. However, he did manage to get in the log, G6HKM (JO01), GW8ELR (IO71), PA0ERA (JO21), PA3EUI (JO22) and PA3FYM (JO22).

## Unusual Propagation

**Graham Atkinson GD7HEJ** (IO74) is a newcomer to the 50MHz band, becoming QRV in August 1991 with a Yaesu FT757, an RN transverter and a 5-element F9T Yagi. He detected the aurora, his first ever, at 1600UTC, hearing GB3RMK 59A and then made many s.s.b. contacts with stations in G, DL, PA and SM. Later in the evening, around 2100UTC, he heard signals on a north-easterly bearing that did not exhibit the normal auroral 'roughness', the signals being perfectly readable without any trace of distortion. Graham then went on to make his first auroral Es QSOs, working LA1XDA (JP66), SM3GHW (JP73), SM6BJI (JO57), SM6HYG (JO58) and SM0CHH (JO89).

Another station to note auroral Es

propagation on the 50MHz band, was **Ted Collins G4UPS** (IO80). Up to 2052UTC, all contacts had been made via the aurora with tone 'A' signals, but between 2110-2150UTC many Scandinavian signals became T9. Ted heard LA5TGA, LA9T, OZ4VV, SM1LPU, SM3BIU, SM4BRD, SM6BJI, SM6HYG and SM6PU before the propagation mode reverted to pure aurora around 2200UTC.

**Steve G8PYP**, first noticed auroral-Es propagation at 2138UTC, and then went on to make s.s.b. contacts on the 50MHz band with OZ1BWW (JO45), OZ4VV (JO46), SM6BJI (JO57), SM6PU (JO67) and SM7FJE (JO59). At 2200UTC, whilst working SM6CYZ (JO66), the mode changed from Au-Es back to aurora. Later in the evening, at 2227UTC, Steve worked OE5OLL (JN88) and realising conditions were good, moved up to the 144MHz band to work, at 2238UTC, OE3OKC (JN87).

## Meteor Showers

The following data, concerning meteor showers occurring in the next few weeks, will help you determine in which direction to beam at specific times and when the shower is below the horizon.

The Alpha Aurigids meteor shower will be encountered between January 15 and February 20, with a broad peak of activity from February 5-10. Between 0100-0300UTC beam south-west or north-east, 1600 to 1900UTC beam north or south, 1900 to 2100UTC beam east or west, 2200 to 2400UTC beam north-west or south-east. The shower radiant is below the horizon between the hours of 0300-1300UTC, and is therefore not usable at these times.

## Moonbounce

**Mark G4YRY** found the that pre-ailing auroral conditions, during the first leg of the ARRL e.m.e. moonbounce contest, made copying signals very difficult. Using 200W and a pair of 14-element Yagis he worked KB8RQ 519 539 and W5UN on the 144MHz band. He also heard DL8DAT, K2GAL and K7CA.

**Goeran Rylander SM3TFR** (JP93) runs a 144MHz e.m.e. system consisting, on transmit, of a Kenwood TS700G and 1kW amplifier and, on receive, a Microwave Modules transverter and

Icom IC720A. The antenna array is a group of four 18-element 4218XL Cushcraft Boomers, with full azimuth and elevation control. Goeran is looking for schedules and can be contacted at Kellstromsvegen 1, S-89200 Domsjoe, Sweden.

The photograph, Fig. 1, shows the 144MHz e.m.e. array at the QTH of DJ3WA. The system consists of four 11-element Yagis fixed to a roof mounted mast, a method commonly used in Europe, especially Germany. Special sleeving joints are used at roof level to enable the mast to enter the loft space without allowing any ingress of water.

**Dave Blaschke W5UN** has provided me with details of 'Skymoon', a graphics based PC program providing real-time moon tracking and e.m.e. scheduling. Additionally, Skymoon also features latitude-longitude to locator conversion, azimuth direction and distance between two terrestrial locations, sun greylines tracking, timed schedule sequence alert alarms and much more. Send me an s.a.e. if you want more details of this software.

## The 50MHz Band

Band conditions on 50MHz during November were excellent, but on many occasions were geographically selective therefore denying everyone a good chance of working the DX. It was particularly surprising that the path to Australia, continued to be available with a number of contacts being made on November 4, 7, 12, 13, 15, 20 and 25. The G-VK path during 1991 was undeniably the best recorded so far during Solar Cycle 22 with openings occurring between February 3 - March 10 and between September 28 - November 25 and it is therefore very likely that this path will open up again during March 1992.

The month of November also saw a number of openings into South America, with a very good event occurring on November 2. Among the stations worked from the UK in this opening were CX8BE, CX8BHI, HC1BI, HC5K, LU3DCA, LU3EX, LU7DZ, LU8AHW, LU8AJK, PJ2KI, PJ4/WA3LRO, PJ9EE, PP5WL, PT7NK, PT9FH, PU20ZF, PY2AA, PY2DJC, PY2IAX, PY5CC, PZ1AP, YV4AB and YV4DDK. The event also encompassed central America and the Caribbean

area with CO2KK, HI8A, KP2A, KP4EIT, KP4EOR, TI2HL and 9Y4VU getting in many log books. Phew, I hope you weren't out shopping!

There were a number of days throughout November when propagation allowed contacts into North America, but these were few and far between and not at the level that many were expecting. **Jim Treybig W6JKV** operating as PJ7/W6JKV, provided many people with a new country, his expedition being worked from the UK on November 6, 18, 21 and 23. Other callsigns heard during the month included HC2GE/1, TI2KD/5, TI2NA, YN1CC, N4HSM/6Y5, WS4S/6Y5 and the HC8SIX and FY7THF beacons.

African openings were prevalent, especially during the first two weeks of the month, allowing contacts to be made with CN2JP, TR8CA, TU20J, TU4DH, V51E, ZS4S, ZS6AXT, ZS6WB, 5V7JG, 7Q7CM, 7Q7RM and 9J2HN.

**Ela G6HKM**, was fortunate to be in among the action on November 2 making South American contacts with CX, LU, PJ4 and PY. On November 14, she worked VE1XDX (FN84) and XN1YX (FN74), the XN call celebrating the 25th anniversary of the Canadian National Research Council. Conditions were good on November 18, a QSO being made with HC5K and hearing PJ9, TI2 and 6Y5. Ela managed to work TI2HL on November 23 but missed out on YN1CC because of the bad behaviour of some G stations calling on top of her.

**Ted G4UPS**, reports good propagation into North America on November 13, 14, 17 and 23. Among the stations heard or worked were VE1BVL, VE1MR, VE1XDX, VE1YX, VE1ZZ, XN1SLM, VE3RM, VO1NE, AF1T, K11KN, K1JRW, K1NDF, K1NFE, K1TOL, KA1YQ, KM1H, N1GNN, WA1AYS, WA10UB, W1CWU, W1GCI, W1TQC, AA2Z, W2IDZ, W3EP/1, K4SC, W400, WB40SN, W4WHT and W5HUQ/4.

Although the majority of countries in Europe have obtained 50MHz operating privileges, there still exist a number, especially in eastern Europe, that have not. It is therefore pleasing to

Annual v.h.f./u.h.f. table January to December 1991

Station	50MHz		70MHz		144MHz		430MHz		1296MHz		Points
	Countries	Counties									
G6HKM	61	51			74	24	40	11	33	7	305
G4FCO	25	21			82	13	55	13	33	5	257
G0NPH	44	25	30	7	61	17	43	11	13	2	253
G8ESB	7	6	20	5	85	14	45	8	14	5	209
G8ASR	1	52	10	9	55	28					195
G4LDR	24	20	50	2	56	14	36	5			167
G0FYD	12	38			72	29					151
G8PYP	17	40	1	1	47	21	19	4			150
G0EVT	13	29			37	18	14	6			117
GW7EVG					47	47	8				55
G1THG	8	11			23	9					51
G7CLY					38	10					48
GM4CXP	2	1	2	2	22	3					32

Annual c.w. ladder

Station	Band (MHz)				Points
	50	70	144	430	
G4ASR	48	49	335		432
G4OUT		48	220		268
G0FYD	10		37		47
G0EVT	17		11		28
GW4VXX			11		11
GM4CXP	1		6		7

Number of different stations worked since 1 January 1991

record that Estonia has now granted access for radio amateurs to the band 50.000 to 50.500MHz. Operators are allowed to use c.w., s.s.b. or f.m. with a maximum power of 200W e.r.p., except in the Tallin area where the limit is set at 50W e.r.p. One of the first stations to be heard on the band was ESSIT, via meteor scatter.

Czechoslovakia is another country to have recently obtained permits for the 50MHz band. They became QRV on December 15, with band conditions based on those that exist in Germany, although it is believed there are restrictions in the OK1 and OK2 districts.

## Sovereign Military Order of Malta

In previous issues of *PWI* have mentioned the Sovereign Military Order of Malta (SMOM), a rare and unusual DXCC country that has been activated on the 50MHz band with the callsign 1A0KM. The SMOM is a fully independent entity with an ancient tradition and glorious history, being founded in 1099 and recognised in 1113 by Pope Paschal II. From 1310 to 1522, it had the Sovereignty on the Island of Rhodes, but in 1530 it moved to the Island of Malta, remaining there until 1798 when Napoleon Bonaparte forced the Sovereignty into exile.

After a number of temporary seats, the Order established itself in Rome in 1834 where it holds several extra-territorial areas. In 1991, the Maltese government agreed to give the Order exclusive use of a fortress, a palace and a church and although the SMOM's headquarter will remain in Rome, the terms of the agreement between Malta and SMOM may create yet another DXCC country! The amateur radio station 1A0KM, which is located in Rome, is normally activated on the 50MHz band by Alfonso Porretta 10AMU and QSL cards can be obtained via his home QTH, Largo S Pio V 16, I-00165 Roma, Italy.

## The 70MHz Band

The results of two 70MHz contests held in 1990 have just been released by the RSGB v.h.f. Contests Committee. In the c.w. event the top six places were taken by E19FK/P (298 points, 22 QSOs), G3VIP (166/19), G4ASR (151/25), G3JYP (146/16), G3HYH (132/24) and GM4ZUK/P (103/7). The top six places of the single operator section of the 1990 70MHz Trophy contest were taken by G4PIQ (84 QSOs), G4ASR (78), G3UKV (84), G1SWH (66), G3HYH (66) and G4FOH (56).

Paul Martin EI2CA, has provided details of a 70MHz Activity Award, to celebrate the Diamond Jubilee of the Irish Radio Transmitters Society (IRTS). Operators in the UK must work 30 different stations with a maximum limit of ten QSOs with any one country. Stations can only be contacted once, irre-

spective of the final identifier such as -/M or -/P. No QSLs are required but a log extract certified by two other radio amateurs is necessary. Applications should be made to EI2CA, 15 Merrion View Avenue, Dublin 4, Eire. There is no charge for the award, and in addition, the first station to qualify will receive an engraved cut glass Galway crystal trophy. Sounds like an excellent idea to promote activity on the band.

## The 430MHz Band

Dramatic news concerning the 430MHz band, came in a statement issued at the end of November by the Radiocommunications Agency. The request, on behalf of the Primary User of the band, ordered that all amateur radio transmissions between 432.000 to 433.500MHz, in an area covering J003, J004, I093, I094 and half of I083 and I084, be reduced to a power level of 10dBW p.e.p. e.r.p. for the month of December. This power level, incidentally, is equivalent to 10W into a dipole or less than 1W into a medium size Yagi. All users of the band were affected, including narrow band modes, f.m. repeaters and packet radio links. Hopefully, this one-off request by the Primary User of the band will not effect our secondary usage of this valuable part of the radio spectrum.

## VHF News

Calum Macpherson GM0EWW, on the Isle of Skye, reports that the recent winds got the better of his antenna system but expects to be QRV fairly soon.

Paul Bradbeer GM7GUC, mentions that his home QTH in Leuchars, Fife, is favourably placed for working into Scandinavia and Germany, but is not so good for making contacts into England. Therefore, most of his regular operating on the 144MHz band is carried out from a portable site on East Lomond Hill (I086). From this location he can normally work into central England under flat band conditions and was very pleased recently to have a QSO with G7HJN/P in West Sussex (I090). Paul uses an Icom IC275H running 100W, a mast-head low noise amplifier and a 7-element ZL Yagi, as the picture Fig. 2 shows, although by the time this appears in print he will be using a 12-element Yagi. He is very interested in the WAB scheme and reports that when operating as GM7GUC/P he can normally be found on Sundays, between 1100-1500UTC, on either 144.280MHz or 144.320MHz.

## VHF Operation From Albania

What is believed to be the first operation from Albania, on the 144MHz band, took place recently between October 25 - November 3. Members of a Hungarian group, including HG1YA, HG1YU, HG4DP, HG4ZB, HG4XT and

Fig. 2: GM7GUC/P operating on the 144MHz band on East Lomond Hill



HG5KS, used the callsign ZA00XC to make 28 m.s. and 4 e.m.e. contacts. Countries worked via meteor scatter included DL, HA, HB, I, OE, OK, PA, SP and UB whilst moonbounce picked up DJ9CZ, SM7BAE, N5BLZ and W5UN.

## South Sandwich Expedition

A number of operators, including JE3MAS, K01R, WA3YVN, WA4JQS, K5VT, W6MKB and W7KNT are planning to operate on h.f. 50MHz and 144MHz e.m.e. from the South Sandwich Islands (VP8), South Atlantic, for a two week period around the end of March. All equipment for the expedition, including four Kenwood transceivers and three linear amplifiers, was loaded aboard an American research and scientific vessel, the Abel-J, in October 1991.

The ship has already left its home port of Massachusetts to complete a tour of the Caribbean area and is now heading into the Antarctic Ocean for two scientific expeditions before sailing to Ascension Island, arriving around March 14, to pick up the DXpedition group. After a seven day journey they will arrive at Thule, South Sandwich Islands to set up the stations. I will provide further details of this expedition in the next issue of *PWI*.

## QRZ Contest!

To help you to obtain the IRTS 70MHz Activity Award, the following is a list of 70MHz contests being held in the first quarter of this year. RSGB cumulatives will be held between 0900-1100UTC on January 26, February 9 and 23, March 1 and 15. The contest exchange consists of RST, serial number, locator and QTH. The annual

70MHz fixed station contest will be held on March 29.

A 144MHz c.w. contest is being held on January 19 between 1000-1600UTC. It has sections for the fixed station single operator and open category. Listeners are also invited to compete.

The German amateur radio society, DARC, are holding a winter field day contest during the weekend of February 1-2. The 1296MHz section will be held between 0900-1100UTC with the 2.3GHz-47GHz section following on from 1100-1300UTC, both of these on February 1. On Sunday 2nd, the 430MHz section will run from 0900-1100UTC being followed by the 144MHz section between 1100-1300UTC.

On February 2, the RSGB are holding a 430MHz fixed station and Affiliated Societies (AFS) contest.

Scandinavian activity contests will be held between 1800-2200UTC on the following dates, 50MHz on January 28 and February 25, 144MHz on January 7 and February 4, 430MHz on January 14 and February 11, Microwaves on January 21 and February 18. A full set of rules can be obtained from myself on receipt of an s.a.e.

## Deadlines

Please send your letters to reach me by the end of the month. I always write up the column in the first week of the following month. Don't forget that I can also receive messages via packet radio at my mailbox GB7TCM and I can also be contacted at my DX cluster GB7DXC.

Photographs of your shack, antennas or any v.h.f. activity are especially welcome. Other pictorial items such as QSL cards, awards, certificates etc are also required. They will all be returned to you.

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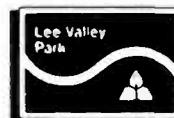
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YHA440	70cm 1/4 wave	12.77	(2.50)
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# Back-Scatter

## Broadcast Round-up

Reports to Peter Shore via the PW Editorial Office

It is possible that readers may have noticed a change to the signals of the UK relays of Radio Canada International in the last few weeks. Up until the end of October, relays emanated from the BBC World Service Daventry site in the British Midlands. But, with the planned closure of Daventry in the Spring of 1992, RCI's two 300kW transmitters were shifted to the Skelton transmitting station in Cumbria, which has recently undergone a major equipment upgrade. Frequencies and times are unaffected by this move.

Another broadcaster will soon be using Skelton as well. Radio Japan has agreed to lease airtime on the newest transmitters at the site for up to 10 hours daily, to beam programmes to Europe, which is at present poorly served, despite the Gabon relays on Africa No 1. The BBC World Service fought off the competing Soviet Ministry of Communications, which seems prepared to lease transmitters left, right and centre these days.

If you want to keep even more up-to-date with news from the broadcast bands, try tuning in to Radiofax. Andy Burnham tells me that Radiofax is on the air every Monday and Tuesday on 6.205 and 12.255MHz. The broadcasts are repeated at 90 minute intervals and contain media, technical and science news, together with DX information.

On February 3, the World Administrative Radio Conference will open in Torremolinos, Spain. The WARC-92 will examine frequency reallocation across the spectrum, and some extension of the short wave broadcast bands is expected. Extensions favoured by broadcasters are below 10MHz and adjacent to existing broadcast bands.

There is much interest in the battle to advance the date for the introduction of single-sideband (s.s.b.) by broadcasters. The final date for the end of double-sideband (d.s.b.) transmissions was set by WARC-HFBC 1987 as the end of 2015. However some countries, including the United States, want this date brought forward to 2007 at the latest. They also want any extensions to the broadcast bands to be conditional on the use of s.s.b. only in the extensions. Most broadcasters are opposed to the early introduction to s.s.b. This is because a majority of listeners are not equipped with sets capable of s.s.b. reception, particularly in the developing countries where the largest audiences for short wave radio exist. This will be one of the key areas to watch, and both *Practical Wireless* and our sister magazine *Short Wave Magazine* will keep you informed about developments at WARC-92.

Derick Marker in Bracknell wrote to me saying that the 25 and 27MHz bands never seem to be mentioned in this column and has sent in details of his findings logged between 0530 and 0730: Moscow has been heard on

26.155, 26.575, 26.895, 26.955 and 27.0, whilst Sweden has been heard on 26.785MHz. Thanks, Derick. I do include details of the highest frequencies when they come to hand and I enjoy having a spin around that band. Do let me know what else you hear up there.

If you want to buy a new receiver that is portable and s.s.b. capable, you could take a look at the newest set from Panasonic. The RF-B45 has been on the market for just a few months and replaces the RF-B40 receiver. It is a digitally-tuned set, with coverage on short wave from 1.6 to 29.995MHz, as well as medium wave, long wave and v.h.f.-f.m.

The receiver is attractively designed, with a concave fascia to the right of the loudspeaker housing the keypad and liquid crystal display. I've had the opportunity to put this new set through its paces and it seems to perform very well. Sensitivity is good and selectivity seems adequate for this type of portable receiver.

With nine short wave memories and clock and alarm function, it is ideal for travelling or for bedside use. One disadvantage is the lack of external antenna sockets and the mains adaptor is extra, but otherwise with such good performance, the RF-B45 can be recommended.

### European Stations All Times GMT(=UTC)

Albania has been moving around the bands again. Radio Tirana's English is at 2230 on 9.725, 7.215 and 1.395MHz, whilst the African broadcast at 1530 is well received on 11.835 and 9.73MHz. Some language services have been disbanded in the last month or two and more could suffer the same fate. Read the details first in 'Back-Scatter'.

Roy Merrall reports, amongst much other news, that Radio France International's current schedule with English:

1230-1300 on 9.805, 11.67, 15.195, 15.425, 21.635 and 21.645MHz (Montsinery)

1400-1500 on 17.65, 21.77 and 11.91MHz (Xian)

1600-1700 on 6.175, 11.705, 15.53, 17.62, 17.795 and 17.85; 11.705 and 12.015MHz are carried by Africa No 1

Relays of RFI via Hungary are heard:

0500-0700 on 15.53MHz  
0700-0800 on 15.53 and 17.69MHz  
1600-1800 on 15.46MHz

Deutsche Welle's present schedule of short wave transmissions includes many broadcasts in parallel with sub-carriers on Astra (11.229GHz sub carrier 7.56MHz) and Eutelsat (11.163GHz sub carriers 7.20 and 8.10MHz):

0100 on 11.865, 9.77, 9.64, 9.61, 9.565, 7.14, 7.12, 6.145, 6.085 and 6.04MHz

0200 on 17.62, 11.945, 9.69, 9.615, 7.285 and 6.035MHz

0300 on 9.77, 9.705, 9.64, 9.545, 9.535, 7.275, 6.12, 6.085 and 6.045MHz

0600 on 17.875, 15.435, 15.185, 13.79, 13.61 and 11.765MHz

0900 on 21.60, 15.41 and 9.565MHz (to Africa)

0900 on 21.68, 21.65, 21.465, 17.82, 17.78, 11.915 and 6.16MHz (to Asia and the Pacific)

1600 on 17.81, 15.595, 15.415, 15.105, 11.785, 9.875, 9.615, 7.225 and 6.17MHz

### United Nations

The Italian Radio Relay Service, the small Milan-based station which operates in single-sideband and carries programmes from the United Nations, is suffering from some interference from BBC World Service transmitting to Turkey and the Balkans. However, the station is on the air weekdays 0600-0800, 0500<sup>TM</sup>1600 and 2030-2200 on 7.125MHz. At weekends the frequency is either 7.125 or 7.30MHz between 0500 and 1600 and from 2030 to 2200. Alternative channels are 7.29 and 9.815MHz. The transmitter is an old Swiss PTT sender and is fitted with computer driven frequency change. Reception reports are welcomed at PO Box 10980, 20110 Milan, Italy - please include return postage.

News from Russia includes details of three easily received new stations. Radio Rezonas is heard 0500-0700, 1300-1400 and 2000-2200 on 11.85MHz in parallel with medium wave outlets on 1.395MHz and 684kHz. Roy Merrall reports that the station experiences problems from time to time, for on November 10th at 1300 there was disjointed audio and long periods with no modulation. The station identifies clearly as "Radiostantsa Rezonas".

Radio Ala is a station with lots of folk music and a schedule:

0700-1500 on 11.965MHz  
0730-1600 on 7.40MHz  
1530-0700 on 6.155MHz  
1630-1800 on 5.04MHz  
2200-0700 on 5.04MHz

There is a strongly heard parallel transmission in the afternoon on 1.386MHz and a weaker signal on 684kHz.

Radio Pamyat is new, and is noted at 1528 signing-on clearly on 12.04MHz. There is a trumpet solo and orchestral piece used for id, followed by "Govorit Radiostantsa Pamyat, radio-programma...". Whilst the station is heard quite well there is co-channel QRM until 1700 when VoA in Chinese signs-off.

From elsewhere in the former Soviet Union, Radio Vilnius is now heard at 2230 on 9.71 and 9.675MHz and at 0000 on 17.69, 17.605, 15.18, 9.71 and

7.40MHz. Meanwhile Radio Kiev has vanished according to Roy Merrall. Anyone know where it might be?

The British hour of Radio Moscow is at 2100 and has been traced to 15.425, 12.06, 12.055, 12.05, 9.895, 9.86, 9.855, 9.795, 9.765, 9.725, 9.72, 9.71, 7.39, 7.34, 7.33, 6.175, 5.96 and 5.95MHz.

### Middle East And Africa

Tehran is heard with English:

1130-1230 on 11.93, 11.79, 9.685, 9.525 and 7.215MHz  
1930-2030 on 15.26, 9.022 and 6.035MHz  
0030-0130 on 15.26, 9.72 and 9.022MHz

Radio RSA's winter schedule is active now with English:

0400-0500 on 15.23, 11.90 and 7.27MHz  
1000-1100 on 15.23MHz  
1100-1200 on 11.90, 11.8 and 9.555MHz  
1500-1800 on 15.16, 11.88 and 7.23MHz

Other European languages include French:

0300-0500 on 15.365, 15.12 and 11.92MHz  
0500-0700 on 17.815, 15.365 and 15.12MHz  
1800-2000 on 15.365 and 11.88MHz

### Portuguese

0400-0500 on 7.23MHz  
0500-0600 on 11.92MHz  
0600-0700 on 15.145MHz  
2000-2100 on 4.965MHz  
2100-2200 on 11.95MHz  
All of these broadcasts are directed to the African continent.

The Republic of Yemen Radio is still clearly heard on 5.95 and 9.7798MHz at 0257 when the station signs-on. A bird calling and chirping for around 90 seconds is followed by what appears to be the National Anthem. Announcements are in Arabic.

### Asia And The Pacific

Radio Afghanistan has English to Europe at 1800 on 9.635, 7.215 and 6.145MHz.

Radio Korea's relay via RCI Sackville has moved from 1030 to 1130 and changed from 11.715 to 9.65MHz, but reception is poor in Europe because of the Yamata relay of RFI co-channel.

Simon Hamer writes to say Radio New Zealand has dropped 13.785MHz in favour of 15.12, apparently because so few sets in the target area have the 21m band. Sri Lanka uses this channel, so problems do occur.

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