AUGUST 1989 £1.30

ISSN 0141 0857

Practical Wireless

The Radio Magazine

REVIEWED
The NAVICO AMR1000

NEW SERIES
Surface Mount Devices

All About Variable Capacitors

"They said I couldn't work DX with just 100 watts. Especially with a radio that has less than 1000 switches on the front panel.

But the truth is, I'm working lots of DX, more than some of these blockbuster types, thanks to my Yaesu FT-747GX.

You see, my no-nonsense FT-747GX was designed with me in mind, so I can hop around the band fast to nail those DX stations. While the other hams are warming up their amplifiers, I'm working the new country!

My FT-747GX has a super receiver, with a directly-driven mixer for great overload protection. And, Yaesu included the CW filter in the purchase price (I used the money I saved on postage for the QSL cards!).

And my FT-747GX is loaded with other features. The receiver works from 100kHz straight through 30MHz, and it's a fantastic shortwave broadcast receiver. I can use all twenty memories for that alone! Plus it's got dual VFOs. A noise blanker. Split frequency operation for the pile-ups. And scanning up the band helps me check out openings as they happen.

I just put in the optional crystal oven, and next month I'm going to pick up the FM board.

And with the money I saved when I bought my FT-747GX, I got a second ten-metre antenna for satellite work on the high end of the band. I use my personal computer to tell me what satellites are going by, and the computer even sets the frequencies on the radio for me.

Now my friends are getting FT-747GX rigs, too. I knew they'd figure out my secret weapon sooner or later. But now I'm setting the pace!

Thanks, Yaesu. You've made a rig that makes sense, at a price I can afford."

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Tel: (0703) 255111
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YAESU

"They laughed when they saw my radio. Then they saw my logbook."

Practical Wireless
The Radio Magazine

AUGUST 1989 (ON SALE JULY 13) VOL. 65 NO. 8 ISSUE 989

THIS MONTH

Regular Features

NEXT MONTH

The Balloon Goes Up - Ground to Air Wireless in 1899!

Build a Home-brew 50MHz Dipole

Reviewed: A 3.5MHz CW Transceiver Kit from Lake Electronics

and
All the usual features

Don't miss it - place your order with your newsagent now!

On sale August 10

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Editorial Assistant
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Rob Mackie
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Accounts
Alan Burgess
Clerical Assistant
Rachel Parkes

Editorial and Advertisement Offices:
Practical Wireless
Enefco House
The Quay
Poole, Dorset BH15 1PP
☎ Poole (0202) 678558
(Out-of-hours service by answering machine)
FAX Poole (0202) 666244
Prestel 202671191

Advertisement Manager
Roger Hall G4TNT
PO Box 948
London SW6 2DS
☎ 01-731 6222
Cellphone 0860 511382
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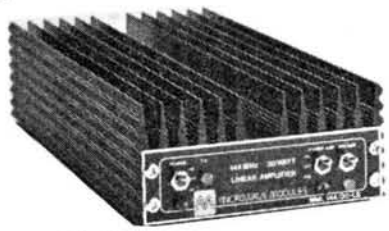
Microwave Modules

MML 144/100-S £149 (C)

★ 100 Watts output power.
★ Suitable for 10 or 25 Watt transceivers.
★ Linear all-mode operation.
★ Straight through operation when turned off.
★ Ultra-low noise receive preamplifier — front panel selectable.
★ Equipped with RF vox and manual override.
★ Led status lights for power, transmit and preamp on.

MML 144/30-LS £105 (B)

★ 30 Watts output power.
★ Suitable for 1 or 3 Watt transceivers.
★ Linear all-mode operation.
★ Straight through operation when turned off.
★ Ultra-low noise receive preamplifier — front panel selectable.
★ Equipped with RF vox and manual override.
★ Led status lights for power, transmit and preamp on.



MMT 50/28-S £295 (B)

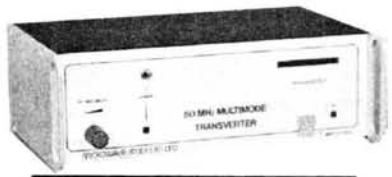
★ 20 Watts output power.
★ Input frequency range 28-30MHz.
★ Output frequency range 50-54MHz.
★ Input level range 0.1-750 milliwatts.
★ Modes:- SSB, FM, CW, FSK or AM.
★ 18.5 DB conversion gain.
★ Exceptional large signal receiver performance.
★ RF vox operator adjustable from 20 milliseconds to 1.5 seconds.

MMT 70/144 £149 (B)

★ 10 Watts TX output.
★ Output frequency range 70-72MHz.
★ Input frequency range 144-146MHz.
★ Input power range 10-500 milliwatts.
★ Low noise receive converter.
★ RF vox provides automatic changeover.
★ Input modes:- SSB, FM, AM or CW.

MMT 50/144 £295 (B)

★ 20 Watts output power.
★ Input frequency range 144-148MHz.
★ Output frequency range 50-54MHz.
★ Input level range 150 milliwatts-15 watts.
★ Modes:- SSB, FM, CW, FSK or AM.
★ 10 dB conversion gain.
★ Exceptional large signal receiver performance.
★ RF vox operator adjustable from 20 milliseconds to 1.5 seconds.



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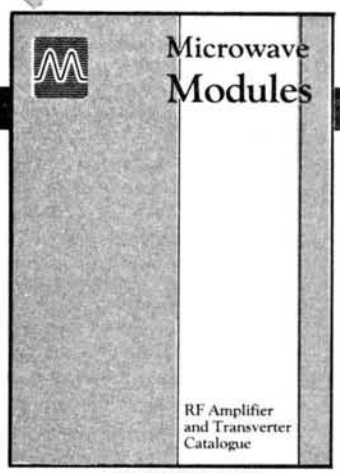

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***Extended receive coverage**
***No Extras to Buy**

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The new ALINCO DJ500E has at last arrived! Covering both 2m and 70cms, it is the ideal handheld for those who demand the ultimate. Full duplex operation means telephone style crossband contacts. Receive coverage can be extended to cover 130-170MHz, 340-380MHz, 420-470MHz, and 870-900MHz. No extras to buy; price includes nicad pack, AC charger, wideband helical, carry strap and belt clip and built-in DC/DC converter for 13.8V supply. Quite a specification, and a lovely rig. Size, with standard pack and DC/DC converter, measure: 7.5″ × 2.5″ × 1.25″ approx. Available now from stock, send for colour brochure.

AZDEN PCS-6000 2M FM + AIRBAND!

This rig is unique. It provides 25 watts of FM on 144-146MHz plus full receive coverage from 108-180MHz AM/FM. 20 memories any duplex split in any memory, auto tone-burst, listen on input etc. etc. The airband section has been purpose designed for the job. Send today for colour brochure.

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ALINCO DR110E (2M)

The new FM mobile transceiver from ALINCO is now in stock. 45 Watts output, completely redesigned front panel and display with extended receiver option of 130-170MHz. Main tuning dial can be used for frequency/memory change and usual memory scanning is included. Price includes all hardware, mounting bracket and up/down mic. Also tone squelch option available.

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ALINCO ALD-24E Dual Bander

If you thought that dual band rigs were expensive, then look again at this one. It gives true duplex operation with a single antenna output. Basically 2 rigs in one box, it has a superb specification covering 2m & 70cms FM. Extended receive coverage is possible upon request. Probably the most cost effective rig on the market. Send for full details today.

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STOP PRESS: G40GW Worked W1EII & KD3DK (599!) with MX14 2 Watt 14MHz rig & Sagant Zepp.

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ICOM

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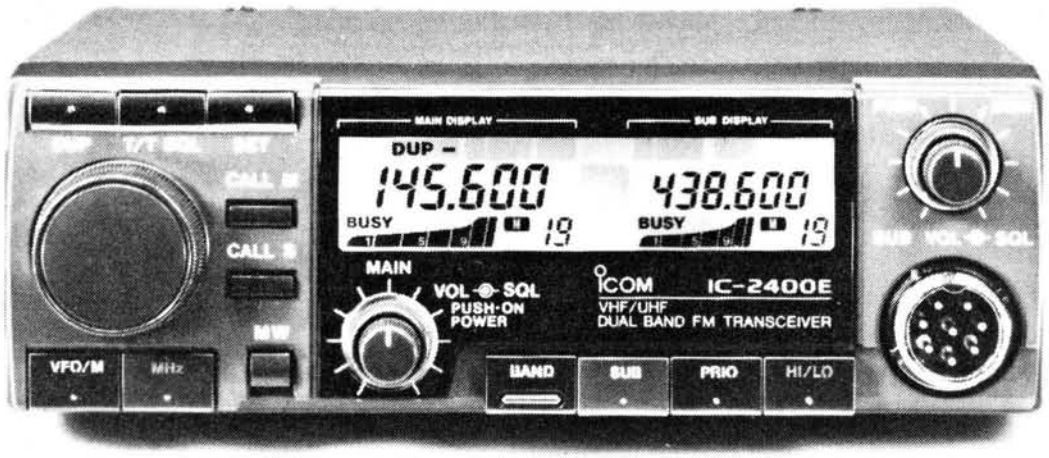

IC-2400
144/430MHz
2mts 45W
70cms 35W

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They are capable of receiving on both MAIN and SUB bands at the same time. While operating on one band, you can monitor a second band for activity. It is very easy to switch between the MAIN and SUB bands allowing you to reply immediately to calls received on either bands.

Full duplex operation lets you transmit on one band while receiving on the other for telephone style contacts. Each band can be independently regulated using separate volume and squelch controls.

Both models incorporate 20 memory channels and a call channel for each band, these memory channels store all the information needed for repeater operation.

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The transmitter is rated for full 100% duty cycle with a high performance compressor for better audio clarity. With 32 memory channels and twin VFO's, scanning of frequency and memories is possible from the transceiver or the HM36 microphone supplied.

The IC-751A is supplied for 12v operation but can be used with either internal or external A.C. power supply. It is fully compatible with ICOM auto units such as the IC-2KL linear amplifier and the AT500/100 antenna tuners.

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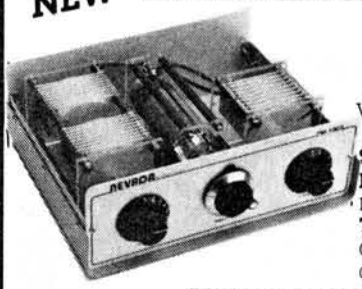

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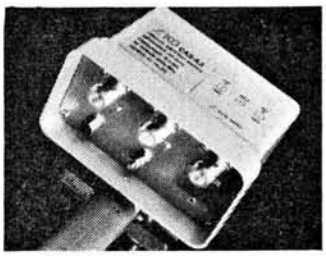

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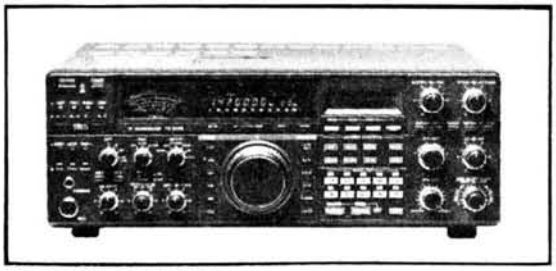

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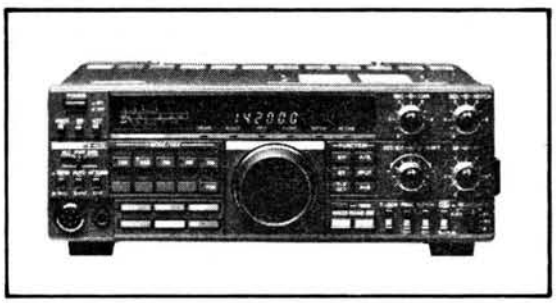

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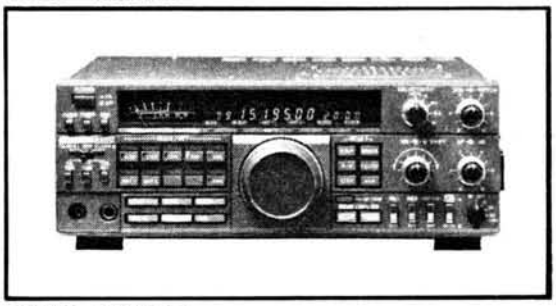

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QSL Managers

Please let me reply to Paul Essery's missive on QSL managers in the June edition of *PW*.

First off, let me say that if F6FNU has been in any way dishonest or greedy, then he deserves all he gets, in spades. However, having said that, not all QSL managers are of that ilk, so it is wrong to tar them all with the same brush. As in everything, there are rotten apples in every barrel. Perhaps publishing a "black list" of rogue QSL managers might go a long way towards ridding the amateur community of these blights.

By the way, F6FNU is not alone in his activities. Six months ago I sent for a ZD9 QSL from W4FRU along with 3 IRCs. Also, I sent for the 3W0A QSL, again with 3 IRCs and have received nothing to date. Thankfully these type of people are in a minority.

As for Mr Essery's suggestion that it is just as quick via the bureau, I find that frankly laughable! You can reckon that sending cards by the bureau can take anything from six months to ten years or more. Fine if you like watching mushrooms grow.

D.J. Burton
Brighton

Packet Book

In reply to G8VEL's letter (page 14 May *PW*), please note that the BARTG packet book is in no way related to the Lowe packet book. Unlike Lowe's book, we charge for ours because we can't afford to give them away.

I also wonder why G8VEL has had to get advice rather than be advised by the dealer who sold the TNC to him.

We'd be grateful if you would set the record straight. We've not cribbed from the Lowe book, (I didn't realise they'd done one until I saw G8VEL's letter). Any two books on packet are bound to be similar, I guess.

I. Brothwell G8EAN
BARTG

NetRom Versus TheNet

I was disappointed with the treatment of NetRom Versus TheNet in April's *Practical Wireless*. The column began with, "I have used a totally unbiased report and comparison from Ronald McCallister N7FYA in this article." This report is over a year old and is nothing more than an emotional tirade toward Software 2000's sales and update policy! His unsubstantiated and unscientific investigation is merely justification for his opinions, which occupy most of the report. An analysis it is not!.

There are two other analyses. My (WA6IGY) analysis is factual and scientific and has been authenticated by a number of qualified software professionals, including those independently selected by Neil Shapiro. WD6CMU approached his analysis from a completely different angle but his results were consistent with mine.

N7FYA states "TheNet has some distinct differences that make it the better of the two node controllers", including being more efficient, having better error handlers and generally having better performance. Notice that he offers no proof of these claims - they're merely a product of wishful thinking. The fact is, since the source code is the same, the object code will be the same, therefore the performance **must** be the same.

I'm afraid Mr McMallister's report is full of misleading and untrue statements. Even his claim to being a programmer is dubious after reading his poorly written technical description and his method of invstigation. I submit that Mr McCallister is not qualified to make a technical evaluation since he obviously does not distinguish between fact and opinion. His claims cannot be verified; my claims have been repeatedly demonstrated and verified by other qualified programmers.

The Tucson Amateur Packet Radio (TAPR) group sent the January 1989 analysis to NordLink in early March. They requested NordLink to respond to the allegations therein. In response to TAPR's request, NordLink responded but, in view of the content of the response, TAPR had requested the return of their hardware from NordLink and

OUR SERVICES

QUERIES
We will always try to help readers having difficulties with a *Practical Wireless* project, but please observe 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 International Reply Coupons for overseas readers).
4. Write to the **Editor, "Practical Wireless", Enefco House, The Quay, Poole, Dorset BH15 1PP**, giving a clear description of your problem.
5. Only one project per letter, please.

BACK NUMBERS AND BINDERS
Limited stocks of many issues of *PW* for the past 18 years (plus a few from earlier years) are available at £1.40 each, including post and packing to addresses at home and overseas (by surface mail).

Binders, each taking one volume of *PW* are available Price £3.50 plus £1 post and packing for one binder, £2 post and packing for two or more, UK or overseas. Prices include VAT where appropriate.

CONSTRUCTION RATING
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 his own.

COMPONENTS, KITS AND PCBS
Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the article. **Kits** for our more recent projects are available from **CPL Electronics,** and from **FJP Kits** (see advertisements). The **printed circuit boards** are available from our **PCB SERVICE** (see page 65 of this issue).

CLUB NEWS
If you want news of radio club activities, please send a stamped, self-addressed envelope to **Club News, "Practical Wireless", Enefco House, The Quay, Poole, Dorset BH15 1PP**, stating the county or counties you're interested in.

ORDERING
Orders for p.c.b.s, back numbers and binders, *PW* computer program cassettes and items from our Book Service, should be sent to **PW Publishing Ltd., FREEPOST, Post Sales Department, Enefco House, The Quay, Poole, Dorset BH15 1PP**, with details of your credit card or a cheque or postal order payable to PW Publishing Ltd. Cheques with overseas orders **must** be drawn on a London Clearing Bank.

Credit Card orders (Access, Mastercard, Eurocard or Visa) are also welcome by telephone to Poole (0202) 678558. An answering machine will accept your order out of office hours.

SUBSCRIPTIONS
Subscriptions are available at £15.50 per annum to UK addresses, £18 to Europe, and £19 elsewhere (by Accelerated Surface Post). For further details, see the announcement on page 45 of this issue.

to discontinue any further software development on it.

In this response to TAPR, Nordlink arrogantly admits cloning the NetRom object code and constructing source code that duplicated the object code precisely. What was their justification? They said they had to fix major bugs. They also wanted to add features to the code that they deemed necessary or appropriate. I believe their real intent was to take control of NetRom and to take what they couldn't have for free. They flooded the packet community with their (ostensibly) public domain version in angry protest of Software 2000 having the audacity to **sell** this product, and Ronald Raikes' polite refusal to **give** them the source code.

It is unfair to influence readers with this emotional and unacceptable "evidence" presented by N7FYA. By not telling both sides of the debate it is glamourising the actions of NordLink.

Let's put TheNet and NordLink's contribution to amateur radio in proper perspective, shall we? Is this the way we want packet radio to continue to evolve?

Thomas M. Allen WA6IGY
California

Dipole of Delight

Having recently moved from a QTH with room for the proverbial antenna farm to a small cottage with a postage stamp sized plot, I was faced with the age-old problem of erecting an h.f. bands antenna in a limited space. It had to perform but be relatively inconspicuous, meet with the approval of "her who must be obeyed" and above all be efficient.

After a long deliberation I could still not make my mind up as to which type would be most suitable and in a fit of pique (having been off the air for some eight years and now retired and keen to get active) I decided to purchase a "Dipole of Delight" from Hately Antenna Technology. This covered from the 7 to 28MHz bands and is some 23m long in total. In order to confuse the neighbours, I had a TV antenna erected on a 3m pole on the chimney stack and suspended the dipole just below the Yagi by its balun in an inverted Vee with the centre at some 10m high tapering down to about 2m at the boundary.

After snaking the coaxial cable around a torturous route came the moment of truth! A quick check on the s.w.r. meter substantiated the claim that it was minimal and flat across each band (out goes the a.t.u.) and then on the air with the Trio 440S. I was "delighted", in the next 12 hours between coats of paint in the bathroom I worked OH, UC, 9K, HZ, YU, LA (on the edge of the Arctic Circle), RA and VK7 with a lowest report of S7.

If anybody wants an antenna that does not scream "Radio Ham", is quick to erect and gives first class results - I thoroughly recommend this product (I have no connection with the Company) and as for TVI, the colour set connected to the Yagi above the balun is as clean as a whistle.

K.L. Bond G3NUV,
Kings Langley

Send your letters to the Editorial Offices in Poole, the address is on our contents page. Writer of the Star Letter each month will receive a voucher worth £10 to spend on items from our PCB or Book Services, or on *PW* back numbers, binders, reprints or computer program cassettes. And there's a £5 voucher for every other letter published.

Letters must be original, and not duplicated to any other magazines. We reserve the right to edit or shorten any letter. Brief letters may be filed via our Prestel Mailbox number 202671191. The views expressed in letters are not necessarily those of *Practical Wireless*.

Morse

I read with interest the old, old topic about c.w.

Morse code will be popular with amateurs for a long long time. Its ardent followers will see to that. I don't see why they are afraid that the time might come when it will no longer be compulsory. It was necessary when radio was young - but voice transmission never ended its use.

It takes time to be good at c.w. and that means regular usage after the c.w. test is passed. Not everyone has time for that because amateur radio is "a many splendoured thing" and we all have our favourite "thing". Constructing radio equipment was my "thing" and it makes me sad to see that this part of amateur radio is in decline. But I would never advocate that some sort of constructional skill should be made compulsory. Compulsion puts many people off c.w. from the start.

The real issue about Morse is whether it's essential. That is a matter for the DTI and international agreements. Do amateurs wish to keep Morse compulsory for the sake of tradition and sentiment? That is the real question.

Hector Cole G3OHK
Workington

Newsdesk...*Compiled by G4LFM*

Bar Graph DMM

Soar's newest series of digital multimeters feature 3200 counts, 3½ digit readout, full scale analogue bar-graph displays and l.s.i. circuit technology for enhanced accuracy, high sampling and operating ease.

Available from Solex International, the Soar models 3210/3220/3230 hand-held multimeters incorporate manual and auto-ranging circuits; high speed sampling for the 32-segments analogue bar-graph display. An important added benefit is the longer battery life - 2500 hours of operation or more from normal alkaline AA battery cells. This is directly attributed to use of the special l.s.i. circuit design. Audible continuity and diode testing functions are also included.

The models are rated: Model 3210 - 0.7% basic accuracy with high speed auto-ranging and 10A current measurement, a.c./d.c. Model 3220 - 0.5% basic accuracy with 30mA to 10A a.c./d.c. current measurements with auto ranging function. Model 3230 - 0.35% basic accuracy, auto or manual ranging with measurements of 300µA to 10A, a.c./d.c. current ranges.

All models are supplied with one set of test leads, two AA 1.5V batteries, a spare fuse and an instruction manual.

Solex International.
95 Main Street,
Broughton Astley,
Leics LE9 6RE.
Tel: (0455) 283486.

Rallies

July 15**: The Cornish Radio Amateur Club rally will be held at Richard Lander School, Truro. There will be the usual trade stands, a Bring & Buy, computer displays/demos and refreshments. There is plenty of free parking as well as attractions for all the family. More details from: ***Rolf Little. Tel: (0872) 72554.

***July 16**: The Sussex Amateur Radio & Computer Fair will be held at Brighton Racecourse from 10.30am to 4.30pm. Free shuttle to Brighton sea-front for the family, trade stands, Bring & Buy, refreshments and car park.

July 16: The Pontefract & District ARS are holding their rally at the Pontefract Racecourse & Park. Doors are open from 11am to 5pm. There will be traders, RSGB bookstall, Bring & Buy, refreshments and bar, boating, putting, etc., for the family. Large free car park with admission 50p per prize programme. Talk-in on S22. Details from: ***C.A. Mills G0AAO. Tel: (0977) 43101.***

July 23: The Burnham Beeches and Maidenhead & District ARCs are staging the sixth McMichael Rally at the Haymill Centre, Burnham, near Slough. Doors open at 10.30am (10.15 for disabled visitors). The CAMRA bar will again be attending. Tea, coffee and food will also be available. There's ample car-parking on site and the car boot sale will be staged again this year. Attractions include radio controlled cars, ATV groups, packet station and the h.f. station GB4MR. Entrance fee is £1 and the car boot area will be £5 per car and driver for the day. Contact: ***Bob Hearn G0BTY on (0494) 29868.***

July 23: The first North Cheshire Radio Club Mini-Rally and Car Boot Sale will be held at the Morley Green Social Club, Mobberley Road, Morley Green, Nr Wilmslow. Car boot pitches are £5 in advance or £6 on the day. There will also be some local trade stands as well as refreshments and a licensed bar. Talk-in on S22 from G1NCR. ***Peter G4WCE. Tel: Lymm 5959 or via packet @ GB7NWP-2.***

July 22/23: The 934 Club (Essex Group) will be holding their 5th Annual Mobile Rally at Thorndon Park, Brentwood, Essex. The rally site will be open from 2pm on the 22nd for campers/vans, etc. An overnight charge of £2 will be required. Entrance on the Sunday (from 10am) will be free. The Southend & District Radio Society will be attending, working h.f., packet and 144MHz using GB0NTF. There will also be the annual "fun quiz" (on air) for mobile stations with 934MHz equipment on Sunday afternoon. Also a free-of-charge car boot sale. ***Tel: (0702) 712595 or (0702) 420918.***

July 28-31: Dataspace '89 (incorporating the RSGB Data Symposium and the AMSAT-UK Colloquium) will be held at the University of Surrey. Full details and booking forms for tickets and accommodation can be obtained from: ***Ron Broadbent G3AAJ, AMSAT-UK, London E12 5EQ or RSGB HQ, Lambda House, Cranborne Road, Potters Bar EN6 3JW.***

July 30: The Hilderstone Radio Society are holding their rally at Hilderstone College, St Peters Road, Broadstairs, Kent. There will be trade stands, a Bring & Buy, a talk-in station, raffle, refreshments, a licensed bar, etc. Contacts are: ***Alan on (0832) 593072 or Ron (0304) 812723.***

July 30**: Scarborough ARS are holding their annual rally at the Spa, on the South Shore Seafront, Scarborough. This is close to the beach and all the entertainment, so there will be something for all the family. Doors open at 11am. There will be trade stands, Bring & Buy, refreshments and bar, with talk-in on S22. Details from: ***G4UQP on (0723) 376847.

July 30: The Rugby Amateur Transmitting Society are holding their Amateur Radio Car Boot Sale at Lodge Farm, Walcote, Nr Lutterworth. Apparently, that's less than 2 miles east from junction 20 of the M1. Talk-in will be on S22. Pitches are available for £5 and entrance to buyers is 50p per car. The event opens at 10am. More details can be obtained from: ***Kevin G8TWH. Tel: (0203) 441590 or David G4DDW. Tel: (0455) 52599.***

August 13**: Hamfest '89 will be held at the Flight Refuelling Sports Ground, Wimborne, Dorset. Gates open at 10am and there's free car parking as well as overnight camping facilities. The day will feature radio and electronics trade stands, field displays and a craft and gift fair. More details from: ***Rob G6DUN. Tel: (0202) 479038.

August 13: The annual Derby Radio Rally will again be held in the Lower Bemrose School, St Albans Road, Derby. All the usual attractions will be there including their Monster Junk Sale. More details from ***Martin G3SZJ. Tel: (0322) 556875.***

August 20: The West Manchester Radio Club's Red Rose Summer Rally will be held in the Sports & Leisure Centre, Silverwell Street, Bolton. Admission 50p (children free) with free cash draw on the programme. All the usual traders, Bring & Buy, snacks and meals available all day. More details from: ***D.R. Camac on (0204) 24104.***

August 27: The Galashiels & District ARS are holding their open day at the Focus Centre, Livingstone Place, Galashiels at 11am. There will be trade stands, a Bring and Buy and all the usual activities. Light refreshments will be available. Talk-in will be on S22. For more details, contact: ***John Campbell GM0AMB. Tel: (0835) 22686.***

August 27: The BARTG rally will be held at Sandown Park Racecourse, Esher, Surrey. Talk-in on S22 and SU22 by GB4ATG. Admission is £1 for adults and 50p for children and OAPs (babies are admitted free). Doors open at 1030 and close at 1700. Details from: ***Peter Nicol G8VXY. Tel: 021 - 453 2676.***

August 28: The Huntingdonshire ARS are holding a junk sale at The Medway Centre, Coneygeare Road, Huntingdon. Doors open from 10.30am to 5pm. Food and drink will be available all day and you can rent a table to get rid of all your junk for £5. The contacts for the day are: ***G1YVS on (0487) 830212 or G8LRS on (0480) 56772.***

* *Practical Wireless* & *Short Wave Magazine* in attendance.

If you are organising a rally and would like it mentioned in *Practical Wireless*, then drop us a line, preferably as soon as you have fixed the date but no later than 6 weeks in advance (marking your envelope Rally Calendar) and we'll do the rest. Please make sure that you include all the details including such essential information as the venue, starting time, special features and a contact for further information.

New Navico Dealer

Transceiver manufacturer Navico has appointed a new dealer to cover the south of England. Recently opened Aditi Communications of Hurstpoint, Sussex has been awarded the contract. The AMR1000 and AMR1000S 144MHz mobiles are stocked and retail for £247 and £299 respectively, with optional telephone handsets available.

Aditi Communications.
Tel: (0273) 833311.

Catalogues

Frequency Sources That Set The Standard, is the title of a new catalogue from Piezo Crystal Company, which has 112-pages of the latest crystal product information, application notes and informative articles.

Available from Anglia Microwaves Ltd., the catalogue is an invaluable reference, covering crystals and oscillators. It begins with introductions to crystal technology and to crystal oscillator design plus a description of the key specifications.

The Piezo product range is then detailed, covering high stability crystal oscillators, frequency standards and hi-rel oscillators for use in the most demanding environments.

Then follows an in-depth tutorial, some 33 pages long, which tackles concepts such as vibrational modes, Q values, etc.

Anglia Microwaves Ltd. Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ.

The latest Alpha Electronics full-colour product guide with price information is now freely available. Featured is a complete range of test equipment to suit all applications and budgets.

Detailed colour-coded sections include real time and storage oscilloscopes and accessories from GoldStar, Hitachi and Thurlby; the latest in digital multimeters from GoldStar, Fluke, Megger and Robin; frequency meters from GoldStar and power supplies by Thurlby and E.A. General, etc.

Also contained within the guide is information on Alpha's repair, maintenance, calibration and test equipment hire facilities from their locations in the North West, Scotland and the South East. For a free copy, telephone ***(0942) 873434.***

Marco Trading have their 1989 catalogue available. It has 215 pages packed with the widest range of components, audio products, speakers, books, kits, etc., that Marco have stocked yet. There is £6.50 worth of discount tickets in each catalogue as well as 21-pages of "special offers". Copies cost £1.00.

Marco Trading. The Maltings, High Street, Wem, Shrewsbury SY4 5EN.

A new four-colour brochure on fibre optic products has been published by Five Star Connectors. Based on the 3M range, it covers a high performance range of cables and connectors; a comprehensive mounting kit for both single and multi-mode connectors; a simple mechanical splice suitable for joining all 125µm single/multimode cables which is also available in kit form; and a comprehensive custom assembly service backed by 100 per cent testing and fast turn-round.

Five Star Connectors. Edinburgh Way, Harlow, Essex CM20 2DF. Tel: (0279) 442851.

Regulated DC PSU

Newly available from the IR Group is the Kenwood PD series of benchtop regulated d.c. power supplies. These employ a novel phase-control technique with a built-in pre-regulator to ensure fast response and efficient, stable, supply of high currents.

Eight models are available in the range: two versions of the PD18 with 0-18V output at 0-10A and 0-30A; four versions of the PD35 with 0-36V output at 0-10A or 0-20A and a choice of analogue or digital readouts; the PD56 with an output of 0-110V at 0-5V.

All the units feature high-accuracy voltage setting and excellent temperature characteristics and thermal response. Remote sensing and protection against overvoltage, overcurrent and overheating are provided as standard. Voltage and current limits are indicated by l.e.d.s.

IR Group. Dorcan House, Meadfield Road, Langley, Berkshire SL3 8AL.

Can You Help?

John Fallon is looking for a Fallon condenser and variometer. ***John Fallon G6BWQ. 16 College View, Mutley, Plymouth PL3 4JA.***

An operation/maintenance manual for a TR9 wireless set, as used in the RAF "Hampden" Bomber of 1940 is being sought by ***Martin Walker, 49 California Road, Tividale, Warley, West Midlands B69 1SR***

John Taylor G0AKN is looking for a copy of *History of Wireless Telegraphy* by J.J. Fahie. It was published in 1901 and reprinted by Arno Press in 1971. You can contact him on ***01-891 2820*** during the evening.

Has anyone got a circuit diagram for the Hallicrafters SX24? If so, please contact ***John Vernon G1KMB, 9 Waternon Avenue, Moston, Manchester M10 9BY.***

We'll Meet Again

Members of the Monte Cassino Veterans Association will be running a grand reunion to which other ex-Servicemans Associations (RN/RAF/Army) are invited attend. There are 600 places so individuals will be welcomed. The date is September 2 from 8 to 12pm. The venue is the Floral Hall, Eastbourne, Sussex.

On Sunday September 3 there will be a Remembrance Service and Grand March Past through the town with regimental bands. As the date happens to be the the 50th anniversary of the outbreak of war, anyone who was around at the time and did "their bit" for the country are eligible to attend, plus their families. More details from:

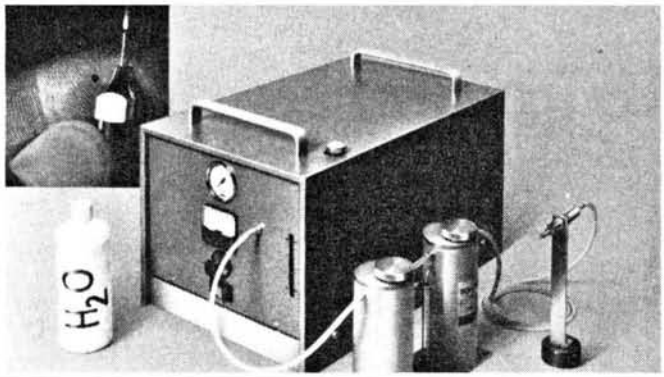
Mr J. Clarke. 41 Aldermary Road, Manchester M21 2QW.

Spirflame

The Spirflame is a self-contained gas production unit which produces gas (hydrogen and oxygen perfectly mixed) from the electrolysis of water, and hence one of the most stable and precise microsized flames available. This allows for an endless list of applications such as soldering, brazing, welding and so on.

It can produce a flame small enough to thread through the eye of a needle or large enough to cut 2mm thick steel. Running costs are apparently just a few pence per hour. Several work stations can be supplied from one Spirflame.

Cobonic Ltd. 32 Ludlow Road, Guildford, Surrey GU2 5NW.



Newsdesk...*Compiled by G4LFM*

RAE Courses

Manchester: North Trafford College of Further Education, Talbot Road, Stretford. Tel: 061-872 3731. Lecturer, J.T. Beaumont G3NGD. Theory on Thursay evening or Wednesday morning; Morse Code on Tuesday evening or Wednesday afternoon; Amateur Television on Wednesday morning; Advanced Morse Code on Monday evening. Enrolment dates are September 6-8.

Broadstairs: Hilderstone House Adult Education Centre, St. Peters, Broadstairs, Kent. Lecturer Dr Ken Smith G3JIX. Friday evenings 7.30 to 9.30pm commencing late September.

Winchester: Henry Beaufort School. Thursday evenings (2 hour lessons), 30-week course starts 7pm on September 21, lecturer John Wills G4AXO. For enrolment, contact Central Hants Community Education Institute, Tel: (0962) 54118.

Bristol: Brunel Technical College, Ashley Down. Tel: (0272) 41241. Lecturer Phil Brouder G3ZJH, Monday evening - Radio Amateur Theory, Tuesday evening - Morse, Thursday evening - Radio Amateur Practical.

The Aerial

The Aerial was originally conceived just as a news-sheet for some "vintage wireless" enthusiasts in the south-west and Midlands. The British Vintage Wireless Society committee were informally approached for support, but declined as they were of the opinion that no-one would support or be interested in such a "parochial" matter. As it turned out, more than just a few people were interested, with subscribers hailing from as far afield as Yorkshire, The Borders, Lincolnshire, Wales, etc. The news-sheet became a small magazine and was produced as a non-profit making service based on free printing and funded by the editor, Geoff Hanham.

Subscriptions are £6.50 for six issues a year. The magazine contains all kinds of vintage wireless information, anecdotes and old adverts. If you're interested, contact:

Geoff Hanham
The Aerial
PO Box 36
14-16 Queensgate
Inverness IV1 1AA

Capacitance Measurement

The GDM 1.11 from Global Specialties is a 3½ digit hand-held multimeter which includes capacitance measurement as one of its eight functions.

The multimeter, which also includes diode testing and semiconductor h_{fe} measurements, has a basic d.c. accuracy of 0.5%.

The 29 ranges, which includes d.c. voltage up to 1kV and d.c./a.c. current up to 10A, are selected by a single rotary control. Probes are included in the purchase price of £49.95 and an optional carry case is also available.

Global Specialties.
2nd Floor,
2-10 St. Johns Street,
Bedford MK42 0DH.

More Information

Radio amateurs wishing to know the broad geographical locations of all other enthusiasts will soon be able to find this information in amateur radio call books. The DTI has announced that it will provide publishers of call books with the first two letters of the postcode of those amateurs whose full details are not already given.

The majority of radio amateurs give permission for their names and addresses to be released for publication but a minority wish their details to be withheld. Their privacy is protected since the information released will indicate only a broad area equivalent to a county or major conurbation.

EI 430MHz Beacon

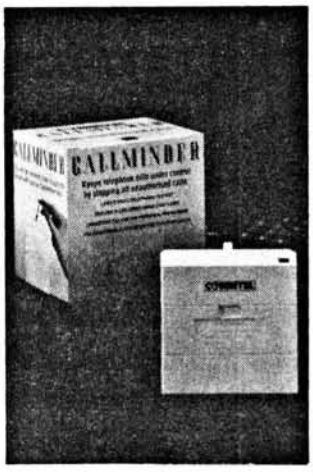
The South Eastern Amateur Radio Group have announced that the first 430MHz beacon in EI is now operational. EI2WRB is co-located with their 144MHz beacon at Portlaw (IO62IJ). The 430MHz band beacon consists of a Pye T461 transmitter running into Microwave Modules 50W linear amplifier and the antenna is a 5-element NBS design, beam heading 95 degrees. The beacon is on a commercial site and costs money both in site and electricity charges. Contributions would be welcome from anyone who uses the 144 or 430MHz beacons. Please send donations and reports to EI9GO, QTHR.

Limited Calls

Callminder is a call-barring unit that locks into the master telephone socket and can only be removed by a special key. It gives total control of all outgoing calls from the socket, although 999, 0800 and 151 numbers are unaffected.

In addition, the unit enables up to seven different call-barring permutations to be programmed in. These range, for example, from local calls permitted at cheap rate only, to restricting STD calls to three minutes. Programming is done from the telephone handset and any calls outside the set program can only be made via the owners special secret "pin" number.

Callminder will cost £49.95.



Commtel Consumer Electronics plc.
Fengate,
Peterborough PE1 5XB.
Tel: (0733)313444.

Special Event Stations

GB2NTS, GB2NTU, GB2NTW and GB2NTE: On July 29/30 four stations will be on the air from different National Trust properties, one each in Scotland, Ulster, England and Wales. Hopefully Ireland will make up a fifth country (EI). If you live overseas and can contact two of these stations, or if you live in the UK/Ireland and contact three stations there is a Commemoration Certificate available. Overseas the cost is $1 or equivalent return postage by Air Mail, UK/Ireland it requires a 19p s.a.e. You need to send QSL cards or log extracts to: ***Scottish Tourist Board (Radio Amateur) Expedition Group, PO Box 59, Hamilton, Scotland ML3 6QB.***

GB2WW & GB4BOB: During 1989, the Bedford & District Amateur Radio Club plan to commemorate the outbreak of the Second World War by operating several Special Event Stations. The locations will include a number of former RAF and USAAF stations in and around the Bedford areas which were in use during the hostilities.

GB2WW: This station will be on the air on August 19 from Kimbolton Airfield for the Remembrance Service of 379 Bomb Gp USAAF. Then, on September 3, it will be on the air from RAF Cardington for the 50th anniversary of the start of WWII. Further details can be obtained from the ***Special Events Manager: Ray G0EYM. 30 Cotswold Close, Putnoe, Bedford MK41 9LR. Tel: (0234) 244506.***

GB?ATC: This station will be on the air from Cardington Airfield to celebrate the 50th Anniversary of 157 Sqdn (Bedford) ATC on July 15.

GB2RBC: Located at Royal Balmoral Castle, Crathie, Aberdeenshire on June 24/25.

GB4ATG: This is the talk-in station for the BARTG Rally on August 27 from Sandown Park Racecourse, Esher, Surrey.

GB4VMR: This is the talk-in station for the Vange ARS 10th Annual Mobile Rally from Basildon on September 10.

GB0KCF: This event will take place on June 24 in the recreation ground of the village of Kingston Bagpuize, which is situated 15km south-west of Oxford. They hope to be active on 3.5, 7, 14, 21, 28 and 144MHz using s.s.b. and f.m. where appropriate.

GB1RLD: Three members of Radio Link - Derby Hospital Broadcasting will be operating from the outside broadcast caravan at the City Hospital, Derby on 144MHz. The dates will be September 30 from 1000-1600, October 1 from 1000-1600.

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The new Standard C150 is a supercompact 2m transceiver that has all the usual features that you would expect from a modern microprocessor controlled radio – plus several new ones.

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£230.00

C500

★ Full Duplex. ★ Frequency coverage 144-146 & 430-440MHz (extended Rx capability 130-169.995 & 410-470MHz). ★ 2.5/5W output (depending on battery. ★ Hi/Lo switchable RF output. ★ User programmable step sizes (5/10/12.5/25/50kHz), repeater offset (0-39.9MHz) and CALL button (instant QSY to a favourite channel – either band). ★ Reverse repeater. ★ Priority Channels (both bands). ★ 10 memories per band (frequency & repeater offset). ★ Numerous scanning modes (Pause or Busy-memories-band etc.) ★ Auto Power Off with Alarm (4mA on standby. ★ Battery Save on Rx (9 user programmable Rx/Off ratios). ★ Keypad & PTT locks. ★ Squelch Off button. ★ Low Battery indicator. ★ Can be powered directly from a car's cigar lighter (5W output). ★ Rotary Knob or Keypad frequency selection. ★ Dimensions 173mm H × 60mm W × 34mm D.

£359.00

AX 700E

AT LAST – a scanner from Standard! For longer than I care to remember people have been asking why Standard do not make a scanner – well now they do. I now have 'English speaking' leaflets available which an s.a.e. will bring you post haste. You can see from the photograph that the AX 700E has maintained Standard's reputation for innovation. The strange looking liquid crystal display not only shows the frequency, mode and so on, it is also a panadaptor! For those of you who are new to scanning I had better explain what that is. The vertical line on the left hand side of the display is to show signal strength and the horizontal line along the bottom is the frequency range. This range can be set to 100, 250 or 1000kHz. The frequency displayed at the top is the frequency at the centre of the line. In other words, if the displayed frequency is 145.50MHz and the width of the display is set to 1000kHz, then the left hand side would be 145.00MHz and the right hand side would be 146.00MHz. Now comes the magic. Every time a signal comes up within that frequency range (i.e. 145-146MHz), it will show up as a spike on the display. The height will show the signal strength and the position will indicate the frequency. By simply turning the tuning knob a cursor can be slid along to line up with the new signal and its exact frequency will be displayed at the top of the screen! To receive the new signal, just press a button and that signal becomes the one that is heard and the display will shift to place it in the middle of the screen. The width of the spikes is governed by the setting of the step size (10, 12.5, 20 or 25kHz) so you can see that it is possible to monitor the activity on up to 100 channels simultaneously. If, for instance, you are looking for a specific signal but you only know the band that it is in and not the spot frequency, just set up the appropriate band edges and then sit back and watch the display. Any signals that then appear can be instantly spotted and tuned to in seconds. That's what a panadaptor can do for you!

As for the rest of the scanner, it covers 50 to 904.995MHz with AM and FM (wide & narrow), it is powered by 13.8V dc and it measures just 180mm W × 180mm D × 75mm H. There is a lot more to it but I can't decipher Japanese, but we should have some English leaflets by the time that you read this ad. and maybe even some radios, so come into the shop and see for yourself. You can even play with our new active antenna which should be ideal for use with this set.

Norman G4THJ

£575.00 (PSU EXTRA)

C5200

This new generation dual band mobile transceiver is virtually two radios in one box. 70cms and 2m each have their own displays showing frequency, S-meter and so on. Both bands can be heard simultaneously through the built-in speaker or through one or two external speakers. Each band has its own Volume and Squelch controls and there is also an Automatic Mute control that can mute the audio from one band while the other is being received.

Full duplex is available (Tx/Rx either frequency) and the Rx frequency can be tuned while transmitting (45 Watts available on each band).

Each band has 4 different scan modes and 10 memories. Five step sizes are available and different ones can be set for each band, for instance 12.5kHz for 2m and 25kHz for 70cms.

The supplied microphone gives remote control of some of these functions and Tone Squelch and AQS units are available as optional extras.

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Leetronics

NORMAN G4THJ

MORE OVER PAGE

An Active Band-pass/Rejection Filter

After experimenting with several published designs of active filters, each with mixed results, R.E. Barber G3NEF decided to use the best that each circuit had to offer. The results of his cross-pollination feature in the following article.

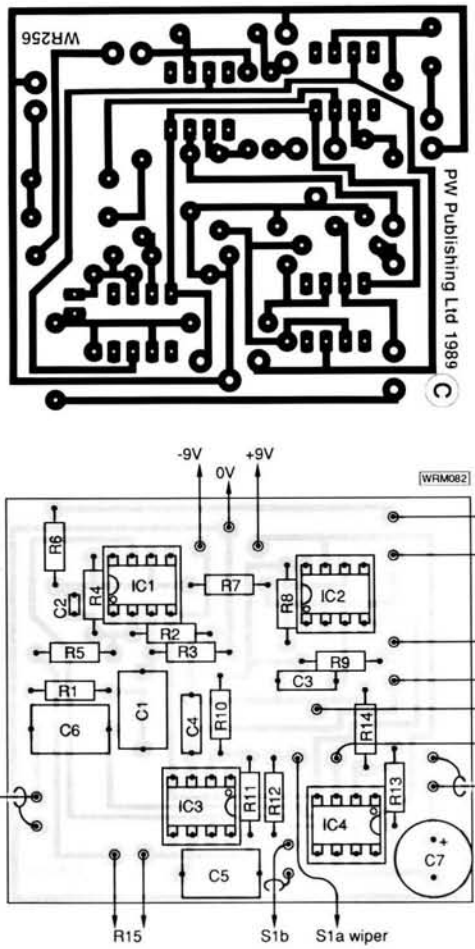

Fig. 1: Single-sided track-pattern and component placement diagram

The two main drawbacks of most published filter designs are that either the Q of the active network is less than 5 or the circuit is unduly complicated and difficult to reproduce.

The author required a filter that could act as either a band-pass filter or as a notch rejection filter. The minimum Q required had to be greater than 5 across the required tuning range of 30Hz to 3kHz. This was to enable the filter to be used for a number of differing tasks viz;

a. Act as a frequency discriminator over the range 100Hz to 2.5kHz.

b. Band-pass a 2kHz signal to enable a 3rd method s.s.b. exciter to be set up.

c. Act as either a band-pass or notch filter on the author's Kenwood transceiver.

No originality is claimed for the ideas that are used in this design, many of which were culled from a number of different articles on the subject, the most noteworthy being those published by *Wireless World* some years ago. The final design, which met with the authors requirements, is shown in Fig. 2, the test result from which are displayed in Figs. 3-6.

The Q of the filter in all modes and frequencies checked is greater than 10, except in the l.f. rejection mode where it falls to 6. This fall-off in Q is due to the capacitive elements reducing the gain drastically at frequencies below 100Hz. This problem could have been overcome by increasing the values of C1, 5 and C6, but as the filter met with the author's requirements no changes were attempted. The Q in the band-pass mode is near constant with frequency and in the rejection mode above 200Hz the same is true. Moreover, the slope of the filter is also very close to linear on the h.f. side of the rejection mode giving good discrimination characteristics, also in the 2-3kHz zone the rejection enables the filter to easily meet s.s.b. requirements.

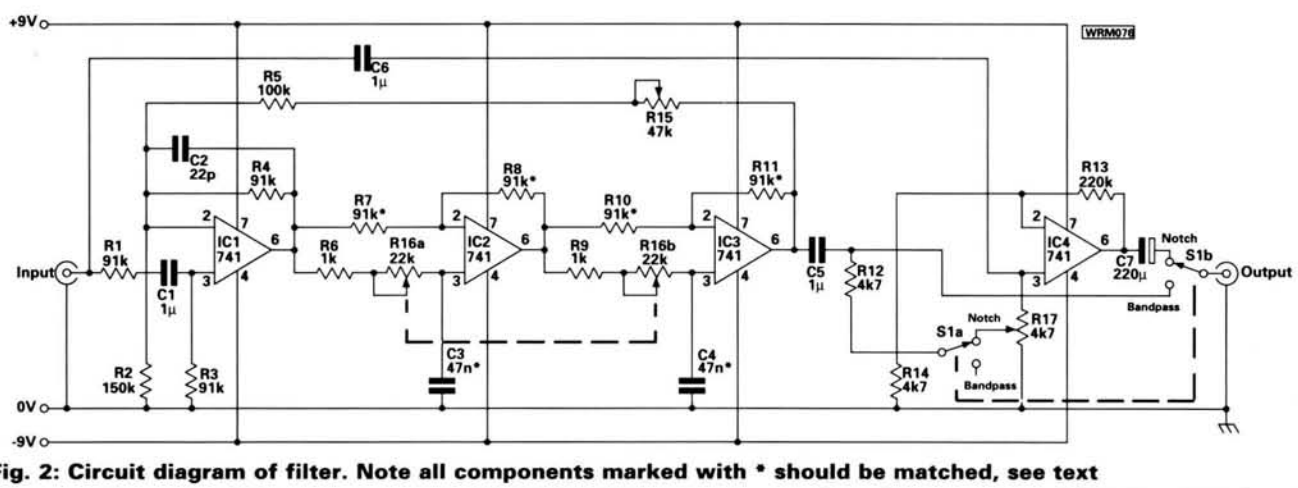

Fig. 2: Circuit diagram of filter. Note all components marked with * should be matched, see text

Finally, the high Q at 1kHz, with no apparent ringing, makes the filter ideal for cleaning up c.w. reception and this worked to good effect on the author's transceiver.

Construction

The author's prototype filter was built on 0.1in copper clad Veroboard. It was noted during the course of construction that component placement was not critical. So almost any means of construction could be used. However, for those of you that are not blessed with the ability to use Veroboard, a p.c.b. design is given here in Fig. 1

Items that are critical to the filters final performance are R7, 8, 10 and R11, in addition to capacitors C3 and C4. Ideally to give the filter maximum Q, these components should be matched to one another as closely as practically possible. However, the test results bear witness to what can be achieved with unmatched components.

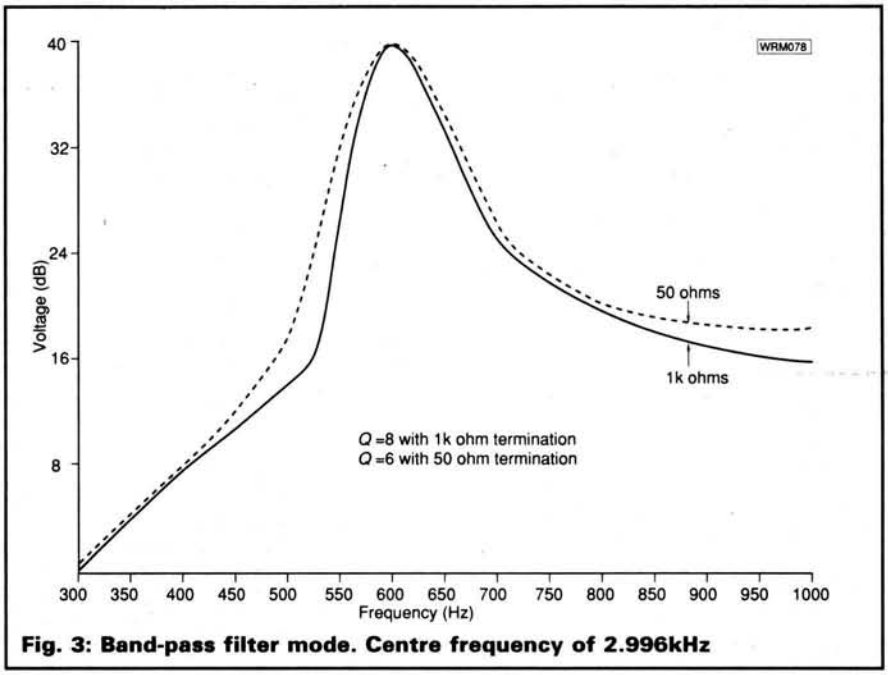

Fig. 3: Band-pass filter mode. Centre frequency of 2.996kHz

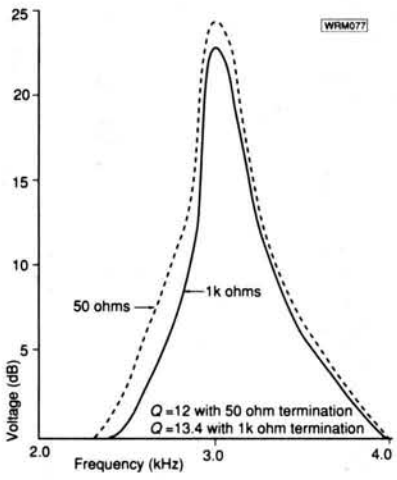

Fig. 4: Band-pass mode. Centre frequency of 60Hz

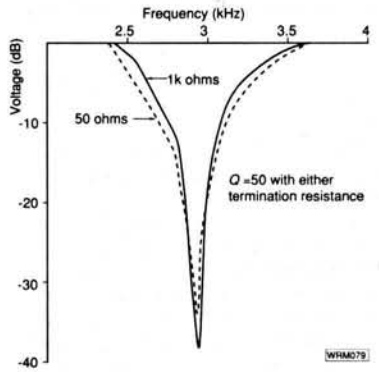

Fig. 5: Rejection mode filter characteristics. Centre frequency 2.95kHz

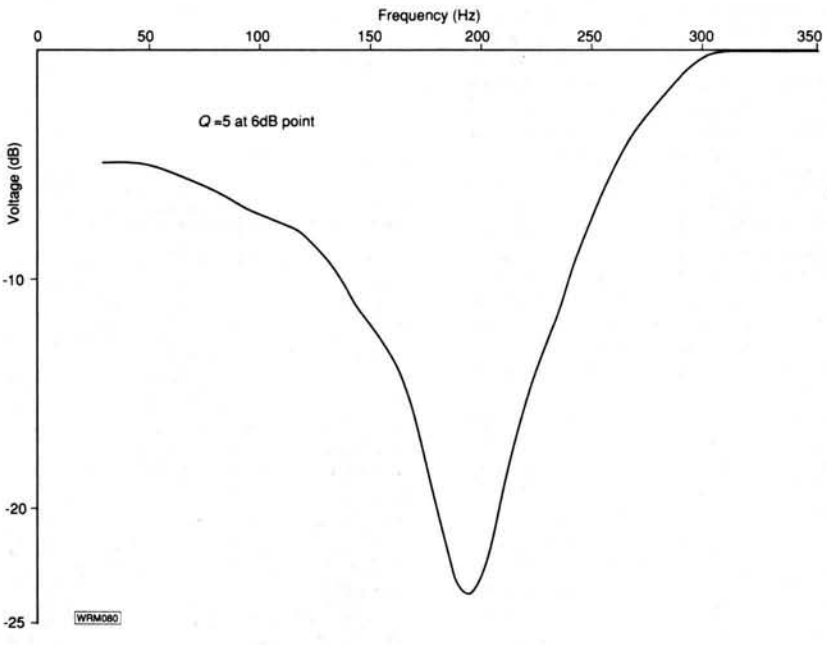

Fig. 6: Characteristics of rejection mode with a terminal load of 1kW.

Normal constructional procedures should be observed. First install all the small components, then the active components, noting capacitor polarity and i.c. orientation. All off-board connections should be taken via Veropins.

Details on housing or supplying the project are left to the individual as in most circumstances the unit is probably best deployed within an existing piece of equipment.

Shopping List

Resistors

0.25W 1% metal film

1kΩ	2	R6,9
4.7kΩ	2	R12,14
91kΩ	7	R1,3,4,7,8,10,11
100kΩ	1	R5
150kΩ	1	R2
220kΩ	1	R13

Potentiometers Lin.

4.7kΩ	1	R17
47kΩ	1	R15

Potentiometer dual-gang log.

22kΩ	1	R16

Capacitors

Miniature layer 100V wkg polycarbonate

47nF	2	C3,4
1μF	3	C1,5,6

Monolithic ceramic

22pF	1	C2

Radial electrolytic 16V wkg

220μF	1	C7

Semiconductors

741	4	IC1-4

Miscellaneous

S1 d.p.d.t. toggle switch; p.c.b.; Veropins; connecting wire; 3 control knobs.

Thanks to Cricklewood Electronics Ltd for their assistance in the construction of working prototype.

HOW MUCH ?
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Test Set up

The block diagram, Fig. 7, shows the test set-up used to obtain the results given in Figs. 3-6. Two different values of termination resistance were used, namely 50Ω and 1kΩ.

In band-pass mode, R15 was adjusted for maximum Q until instability became apparent, then the a.f. oscillator was adjusted in frequency and the output measured and noted.

In the rejection mode the filter was tuned with R16 for a dip in its response at 2.95kHz, and then R17 was adjusted for minimum output on the oscilloscope. The a.f. oscillator was then varied in frequency and the output measured at each frequency. When the same measurement was made at 200Hz it was found that adjustment of R17 would give an 8dB increase in rejection over the plotted result. It is believed that the fall-off in gain already mentioned brings about the need for adjustment of R17.

As already mentioned by careful selection of certain components the measured performance of the filter can be significantly improved. However, to do this an LCR bridge is needed to match the components. For those of you without this facility, the authors protoype, built with unmatched components, works very well and has been successfully used for over 18 months.

PW

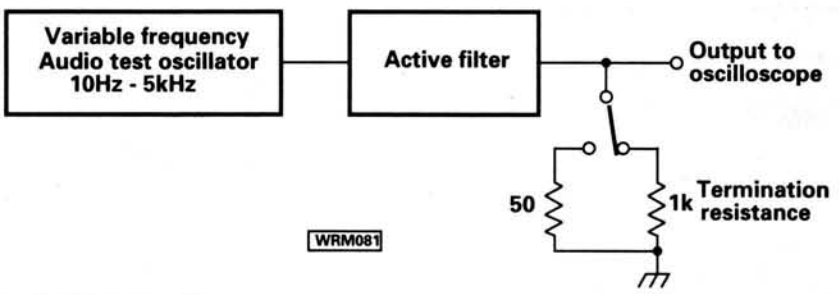
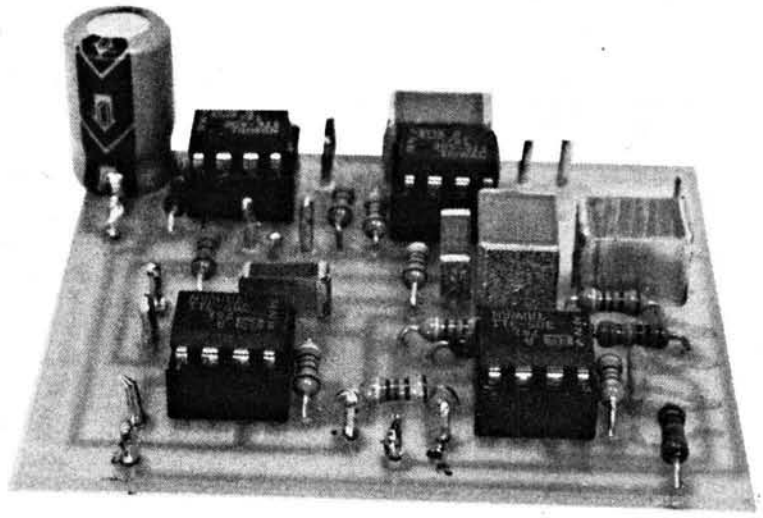


Fig. 7: Filter test rig



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Surface Mount Devices and the Amateur

Surface mount devices, or s.m.d.s, may be unknown or very new to many amateur and indeed professional electronic practitioners. But, in front-line professional circles, their usage has increased dramatically in recent years, says W. Mooney BSc (Hons) CText ATI G3VZU.

The present rate of surface mount device penetration stands at about 40 per cent as shown in Fig. 1.1. A considerable proportion of circuits are manufactured as hybrids, that is a mixture of through-hole or leaded and surface mount devices on the same board. There is no doubt that in the future, the proportion of circuits fabricated from s.m.d.s will continue to increase substantially. Apart from the reasons listed later for using s.m.d.s, the physically flat format of these devices is more in keeping with that of the p.c.b. The leaded component is a mechanical overkill in practically all cases and is a throw-back to the days of point-to-point wiring when the only active device available was the thermionic valve. Also, the use of smaller equipment such as the miniature, hand-held, fully synthesised 144 and 430MHz transceivers, and portable general coverage short wave receivers so frequently reviewed these days, has further fuelled the development of a whole range of s.m.d.s and their support technology. Military and space research has also influenced the technological advances in this field. So, what are s.m.d.s and what use can the hobbyist, experimenter and perhaps the small scale development engineer make of them?

Apart from the satisfaction of being up-to-date with the latest technology, these devices can offer real advantages to the constructor - not least of which is the likelihood of component costs dropping significantly in the near future.

Surface mount devices are essentially components without leads which are soldered directly onto small pads on the surface of the p.c.b. The substrate may be glass fibre p.c.b. which is the most common and used by amateurs, or ceramic which is sometimes used in commercial equipment for very high reliability or r.f. efficiency. The s.m.d.s themselves are of varied composition, for example transistors and i.c.s are frequently miniature versions of the normal plastics encapsulated types. Resistors are small ceramic devices with a conductive, solderable, coating at each end. Ferrite cored standard E-series inductors are also available in this format. The main advantages in using s.m.d.s are:

Smaller circuits. Dramatic reduction in size of circuits compared to insertion type fabrication. For amateur use where pick and place and automatic soldering is not available the greatest reduction in size is a volume reduction resulting from the reduced profile.

No through-holes needed. Surface mount devices require no drilling although perhaps a few holes or through wires may be useful for side-to-side connection. In many cases only a few leaded components will be needed for hybrid circuits.

Better r.f. performance. Lower inter-connection capacitance due to smaller area and more important the much reduced inductance due to elimination of the leads makes r.f. circuits much more efficient and often simpler to implement. Digital circuits are also improved because propagation delays are reduced enabling higher clocking rates.

Double-sided construction. Circuits may be carried on both sides of the p.c.b. Conventionally we have components on one side and tracks on the opposite side or sometimes both sides. Double-sided construction makes a major contribution to reduction in size of the final circuit.

Easier prototyping. Once the basic mechanical skills are mastered, rapid design and implementation of prototype circuits become possible. The tracks are not mirror-image fashion as with through-hole construction and this makes design of the component and wiring layout very simple and far less confusing. Indeed, it is a simple matter to change a component for a different value and reworking prototypes is very easy and a real pleasure. No need to turn the circuit upside down, no need for solder suckers or trying to find the other end of a component on the reverse side of the board.

Disadvantages

So where's the catch? Well, availability is a little difficult at the moment but it is improving and non-bulk quantities can now be obtained.

The variety of s.m.d. types on offer is not yet as great as leaded devices, but again the situation is rapidly changing. Surface mount devices can no longer be considered expensive process, being only marginally higher than leaded.

The major disadvantage is in handling where some skill must be developed. They are very small indeed and lighter in weight. Therefore the slightest movement of the p.c.b. will send them flying or at least out of alignment with the intended mounting area. Professionals often fix them with a dab of glue before soldering.

The surface tension of the molten solder is sufficient to cause resistors and capacitors to stand on one end - an effect known as "tombstoning". They therefore need to be held in place whilst soldering.

Passive components are often unmarked and of very similar appearance and size. There is a real danger of mixing them up. Leaded components are heavily

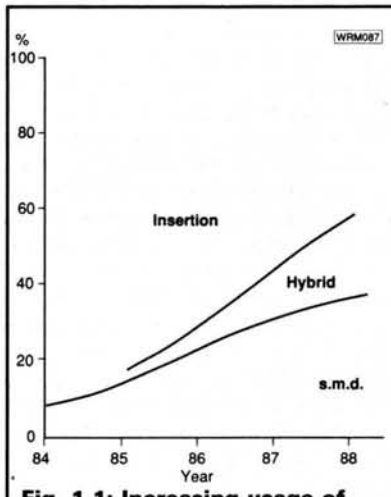
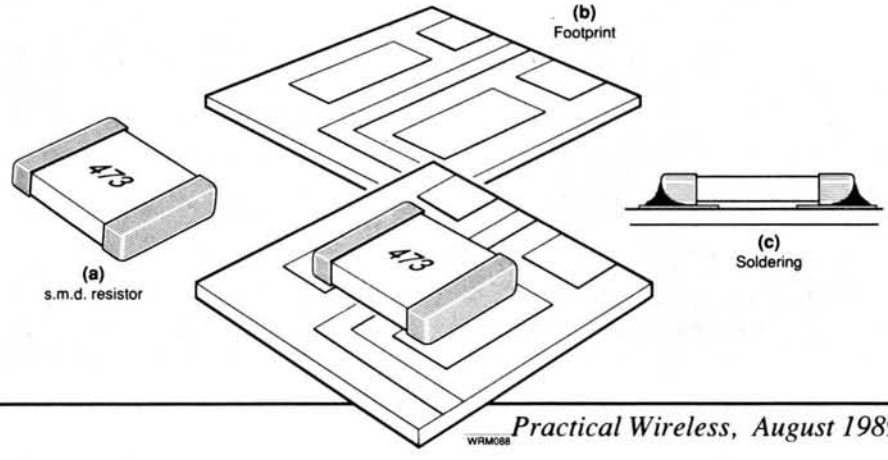


Fig. 1.1: Increasing usage of s.m.d.s in circuit fabrication

Fig. 1.2: (a) Construction of a typical s.m.d. resistor. (b) Footprint showing how a track may pass beneath the s.m.d. Good clearance is needed and more than one underpass is possible. (c) Avoid excess solder and make sure that the s.m.d. coating is "wetted" by the solder



protected by layers of lacquer and a resinous coating. They are largely impervious to moisture and objectionable gases. Surface mount devices on the other hand have little or no protection. Prepared circuits can therefore be sprayed with a protective lacquer - not essential but good practice once a circuit is completed and de-bugged. A solder-through lacquer is the only choice here.

Since s.m.d.s are mounted directly onto the p.c.b. any flexing of the substrate will result in stress and strain on the s.m.d. Very thin laminate is therefore better avoided except for tiny p.c.b.s and normal 1/16in glass-fibre board is very adequate for most uses.

Practically

First, let's look at the construction and pin-out configuration of some typical s.m.d.s. Passive components, resistors and capacitors are similar to that shown in Fig. 1.2. It is also illustrated here how a p.c.b. track may pass beneath a device. This will be found very useful but the track must be narrow and pass through at right angles to the long axis of the s.m.d. The extent of the solderable alloy coating varies little and a good tolerance should be allowed for it in the track design. The device is simply placed on the board where a suitable footprint has been etched and then it is soldered in place. Footprint size information abounds in manufacturer catalogues and a good degree of standardisation exists - but don't rely on it until you are more familiar with the subject. Although batch to batch component variation is small there is no guarantee that the next 0.1µF capacitor you come across will come from the same manufacturer. Larger capacitors, 1µF and above often have a structure similar to that shown in Fig. 1.3. This is a normal component turned into an s.m.d. Nevertheless they are effective although a bit larger than necessary.

Simple active devices diodes, transistors, l.e.d.s often have structures as shown in Fig. 1.4 and it can been seen from photograph 1 that these and the active devices are much smaller than conventional components. For this reason, and the mounting techniques used, an s.m.d. circuit looks very different to the normal p.c.b. which we are used to seeing.

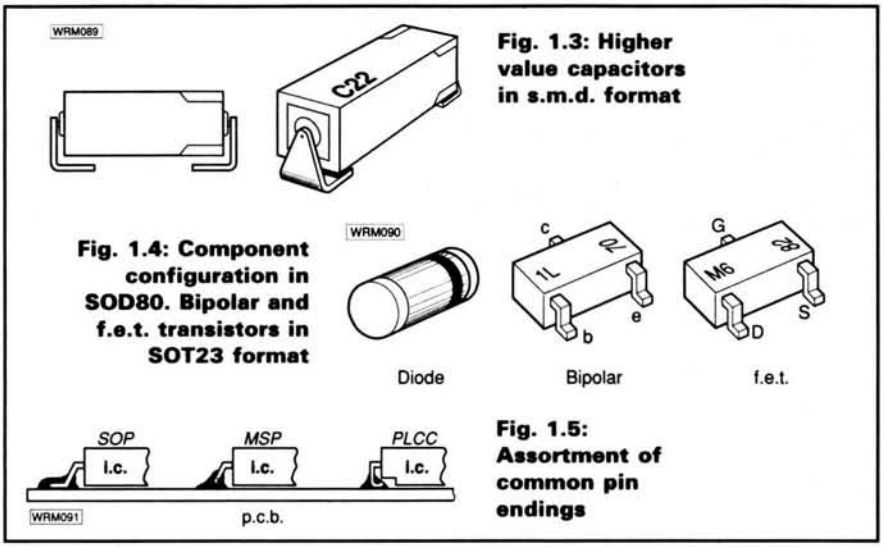
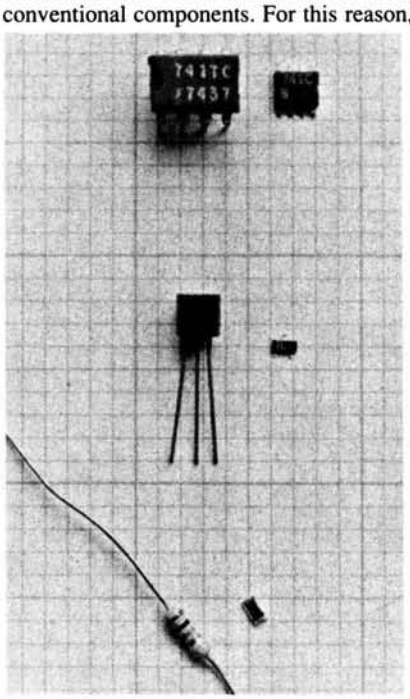


Fig. 1.3: Higher value capacitors in s.m.d. format

Fig. 1.4: Component configuration in SOD80. Bipolar and f.e.t. transistors in SOT23 format

Fig. 1.5: Assortment of common pin endings



Comparative sizes of s.m.d.s and leaded components on a 1in grid

Integrated circuits, from ubiquitous 741 op-amp to l.s.i. devices are available. A standard d.i.p. type is shown in Plate 1 along with its s.m.d. alternative in s.o.p. (small outline pack) will be found. You will come across many of these designations in manufacturers literature. The pin endings differ a little, mostly from the range shown in Fig. 1.5. However, for all practical purposes there is no difference - just get on and use them.

PCB Designs

The methods used for designing the p.c.b. layout are the same as used for through-hole construction. It is unlikely that you can use a c.a.d. program for your computer as they all provide pads for drilling, rather than for s.m.d. mounting.

So it is likely that a manual design procedure will be adopted. One technique for doing this is to make models of the various components and lay them out on graph paper where the interconnections can be drawn in. Many other techniques are used and whatever favourite method you use for normal p.c.b.s can be applied to s.m.d. circuits including the use of photo-sensitive laminate. For a first project pick a simple circuit with resistors, capacitors, a couple of transistors and perhaps an s.o.p. i.c.

The crudest method of layout design is: Select all the components you need for the circuit, keeping them in their plastics packs until required. A good quality pair of tweezers is a great advantage here since is saves excessive handling. But don't be afraid to pick them up and admire them a little - they're not that sensitive. Have a schematic diagram of the chosen circuit in front of you. Start with a pencil sketch of the circuit with components approximately life size. Don't try to minaturise at this stage. One by one lay out the actual components on a clean sheet of paper, graph pad, etc., in the same position as the sketch. Now bring the s.m.d. i.c.s closer together if you require a smaller p.c.b. size. Some skill should be acquired before an attempt is made to implement very

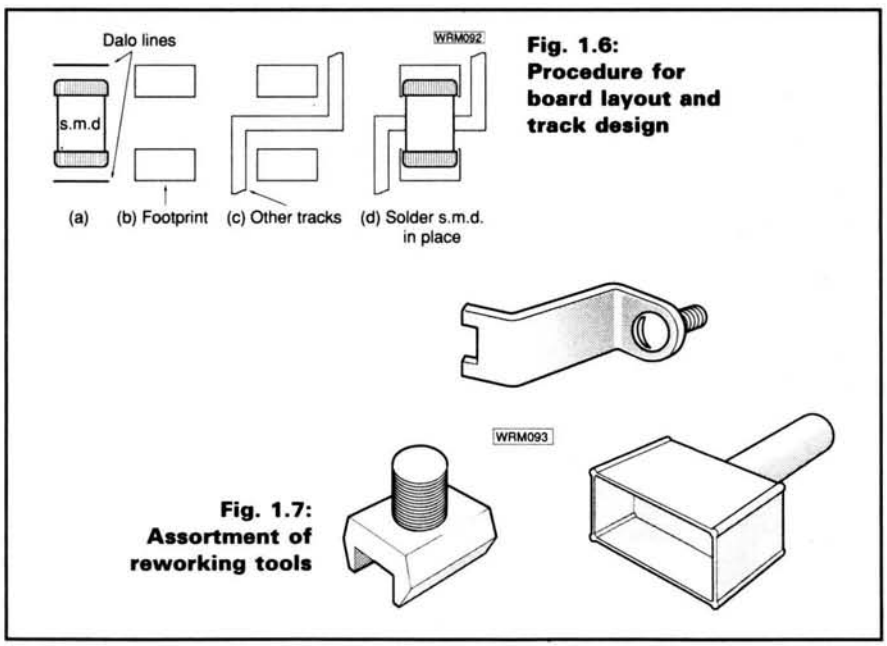


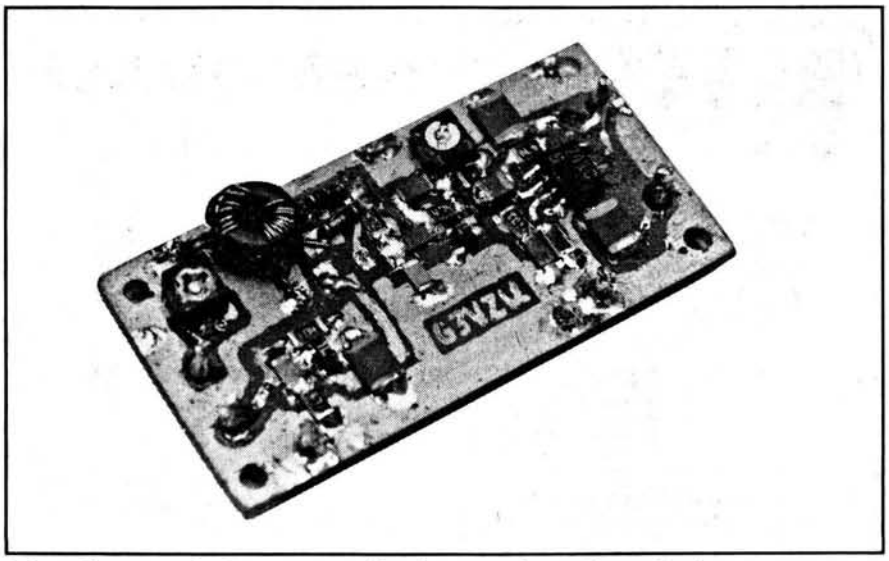
Fig. 1.6: Procedure for board layout and track design

Fig. 1.7: Assortment of reworking tools

small circuits. Once the relative physical position of each component has been established and marked on the paper - ideally with a fine (0.3mm) pencil they can now be transferred to a clean piece of copper p.c.b. You now have the i.c.s laid out on the copper substrate in their desired position. Now mark the board nearest the end of each i.c. with a Dalo pen. The Dalo pen as supplied is far too coarse and should be paired down to a finer point (about 1mm diameter) using a sharp scalpel blade. When the position of the s.m.d. is marked with a line - remove it and place it back on the original design layout paper. Now draw a footprint with a suitable overlap for each end. The procedure is shown in Fig. 1.6. Having drawn the footprint for all s.m.d. the interconnections may be drawn. When under-runners are to be used make certain that the coated s.m.d. ends don't contact the under-running tracks by drawing suitable sized pads. This manual technique is not the most precise but it is very simple and fast and good for one-offs. When the design is complete etch the board in the normal way with ferric chloride solution. Clean off the Dalo with acetone after etching and dry the board well. Wash the board in water with washing up liquid and a mild abrasive and dry. The p.c.b. is now ready for populating. The small prototype 10MHz receiver shown in photograph 2 was made in this way.

Tools of the Trade

In the course of making prototypes or de-bugging a proven design it is occasionally necessary to remove s.m.d. i.c.s from the board. There are a wide variety of tools available for s.m.d. reworking purpose. To remove an s.m.d. it is necessary to melt the solder at both ends simultaneously. The same applies to i.c. removal. A solder sucker should not be used. It is not really safe since the recoil imparts a mechanical shock to the delicate s.m.d. Solder wick is a much better approach. It is possible to quickly transfer the soldering iron bit from one side of the s.m.d. to the other and when both ends melt simply pick the device off with a pair of tweezers. This doesn't work for i.c.s. The main types of removing tool are shown in Fig. 1.7. They are a little costly but if a lot of work with s.m.d.s is contemplated they will save money, time and patience. The time is right to mention soldering irons. There is now a choice of irons made especially for s.m.d. work on



A heavily re-worked prototype showing a variety of s.m.d.s in use

offer from a number of manufacturers. In order to get your feet wet however all that is needed is an iron-coated bit of 1.6mm diameter and some 22 s.w.g. resin cored solder.

Working conditions are important. Place your s.m.d. on a light background and work under well lit conditions. A firm table or bench is needed otherwise the slightest vibration will displace your layout and probably mix up your capacitors. Keep s.m.d.s inside the pack they arrive in. Work in dry conditions - humid conditions and a lot of handling will reduce solderability due to oxide film formation. This puts the device at risk because it will be necessary to apply the soldering iron for longer than the normal one second with resultant thermal stress.

To solder an i.c. in place, rest it on the prepared footprint which hopefully has a generous area in your design. Hold the i.c. in place with a toothpick, a small screwdriver blade or tweezers. A component holding jig is available for keeping individual i.c.s in place whilst soldering (See Availability). This jig gives you your hands back and makes life a lot easier when soldering s.m.d. in place. So, pressing the i.c. to the board, solder one end and checking that it is aligned nicely, the second end may be soldered without any need to hold the s.m.d. in position. Waste a couple of s.m.d. for practice in soldering them onto some clean p.c.b. trying to prevent movement and tombstoning effects. A good magnifying glass is useful for checking joints. Trimmers, resistors and capacitors have a plastics cover or a small silicone rubber coating. This is to protect them during automatic soldering and should be removed. Any i.c.s should have any two diagonally opposing pins soldered first whilst holding the device. The remaining pins may then be soldered, one side at a time, without the need to hold the i.c. in position.

The Way Ahead

Although the use of this technology demands a new set of skills, particularly the ability to work with very small devices and correspondingly good eyesight, the advantages of the technique for rapid prototypes and development work will be found to be very real. There is no substitute for practice, however, and the 10MHz receiver that will be described in Part 2, although not the simplest starting point should give the readers who is already proficient in conventional circuit fabrication a real foothold in s.m.d. technology

Availability

Mr W. Mooney is the MD of Blue Rose Electronics and can supply surface mount devices in small quantities to readers. The catalogue with all the component details costs £1 and is available from: Blue Rose Electronics, 538 Liverpool Road, Great Sankey, Warrington, Cheshire WA5 3LU. Tel: (0925) 727848. ***PW***

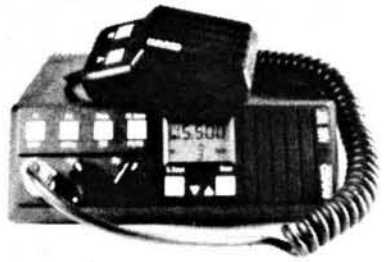
Errors and Updates

Transmitter Control for Mobile Operation July 1989

Please note that in Fig. 8 the diode connected between 0V and pin 4 of the 4093 i.c. is in fact an l.e.d. and not a 1N4148 diode. The polarity is shown correctly.

PW REVIEW

Navico AMR1000S 144MHz FM Mobile Transceiver



The Navico range of transceivers represent a refreshing new entry to the v.h.f. mobile transceiver market and seem to be rousing plenty of interest. Mike Richards G4WNC reviews their offering to the amateur market

One very significant point is that Navico is a British company and obviously determined to break into the Japanese dominated amateur transceiver market. In view of this I think it would be appropriate to give you some background on the company.

In order to get that information on the company I contacted Tom Crosbie who is the amateur radio product manager.

Navico have been in business for about 6 years operating in the marine field with navigational aids, instruments and marine radio as their main business. The company currently employs about 120 people and is a true UK production with no modules imported from abroad. I must say it's good to hear that we have a real Britsh competitor in the Japanese dominated amateur radio market.

The AMR1000S is actually a derivative of their RT6500 marine radio, which is fully type approved and has been selling very successfully. The development of the AMR1000S was achieved by top r.f. engineers with no amateur radio experience. It may at first seem rather odd to use engineers from outside amateur radio for this task but the result is some really fresh thinking on what an amateur rig should really do. Since the original design Navico have been very receptive to suggestions from amateurs and reviewers regarding improvements and these are all included in the current version.

Getting Started

As the AMR1000S is primarily a mobile rig the first job was to fit the unit in the car. Navico have put some considerable thought into the installation aspect of the AMR1000S design and as a result have included some very interesting features. The first concerns the front panel which for a start is angled at about 30° which is very convenient. I was also pleased to see that the internal speaker was forward facing on the front panel as opposed to being tucked away either on top or underneath as happens with many other mobile rigs. To make life even easier, the front panel can be rotated through 180° allowing the AMR1000S to be mounted upside down if required. The reversal of this panel was not a major operation but simply involved loosening four screws, popping out and reversing the panel then tightening the screws again! Incidentally the front panel is connected to the main circuit board by a multi-way ribbon cable, thus allowing the necessary flexibility.

The AMR1000S is supplied with a simple rotatable mounting bracket, which I'm sure will prove adequate for most installations. However, if you have a tricky mounting problem, there are a range of alternative mounting brackets available to cover most situations. One particularly attractive mounting technique for a permanent installation is to use the console mounting kit

One design philosophy which runs right through the AMR1000S is that of simplicity and this is reflected in the external connections. The antenna connection comprised a standard SO-239 socket which, instead of being mounted on the rear panel, is located on an angled recess on the underside of the rig. This panel is used for all the external connections bar the microphone and helps to minimise the depth requirement of the rig, whilst providing a degree of protection for the connections.

The power requirement was 13.2 volts at 5.5 amps maximum, which should not prove to be a problem. The power connection was made using the supplied 2.2m lead, which includes a 7.5 amp in-line fuse allowing direct connection to the vehicle battery. If you have occasion to operate mobile in a vehicle using a supply voltage higher than 13.2 volts, Navico can supply an optional switch mode power unit, the SMR1208, which handles any voltage between 15 and 32 volts.

The only other connection on the recessed panel is a 3.5mm jack for the connection of an external 4 ohm speaker. As is common practice with this type of jack, the internal speaker is disabled when a plug is inserted.

I found that there were several places where the AMR1000S could be mounted in my car but, as it was for review only, I decided to use a temporary mounting between the driver and front passenger seats. The rotatable front panel proved to be a real boon here as I had to turn the panel round to suit the mounting position I had chosen.

The supplied microphone was a fist type with a p.t.t. and UP and DOWN scan buttons. The connection point for the microphone was a standard 8-pin microphone socket on the front panel. My only criticsm here being that it was positioned rather close to the volume and squelch controls.

I was very pleased to see that a full range of facilities were available on the microphone socket. In addition to the p.t.t., audio input and scan buttons. There was a "fixed level" audio output at 500mV into 300 ohms, a speaker mute connection and a 12 volt 100mA supply output. As many amateurs will want the Navico to serve the dual role of mobile/base station, these extra connections are particularly useful. If you are keen on packet operation, all the necessary connections can be made via the microphone socket thereby keeping the shack neat and making the change over process from phone to packet very simple. Full marks to Navico on this one.

Navico can supply an alternative to the fist microphone in the form of "Telephone Handset" which is styled rather like a mobile phone handset and works in a similar manner. Personally I would have preferred to see a "hands-off" option as this is really the only way to operate when mobile.

With the installation complete it was time to work out what all the controls did.

Operation

The first thing that struck me about the front panel of the AMR1000S was the sheer simplicity and elegant design.

Having been used to the Japanese sets which are generally bristling with buttons, it made a pleasant change to see such a clean layout.

Centre place in the front panel is taken by the liquid crystal display which is used to show not only the operating frquency, but the mode, power output and signal strength. The digits used for the frequency readout were well proportioned and very clear and easy to read.

One unusual aspect was the signal strength indication which, rather than use the normal bargraph type display, just showed the S number. If the signal was above S-9 then display indicated 9 +20 or +40. Although I didn't think this system was as clear as a bargraph display, it was plenty good enough for mobile operation.

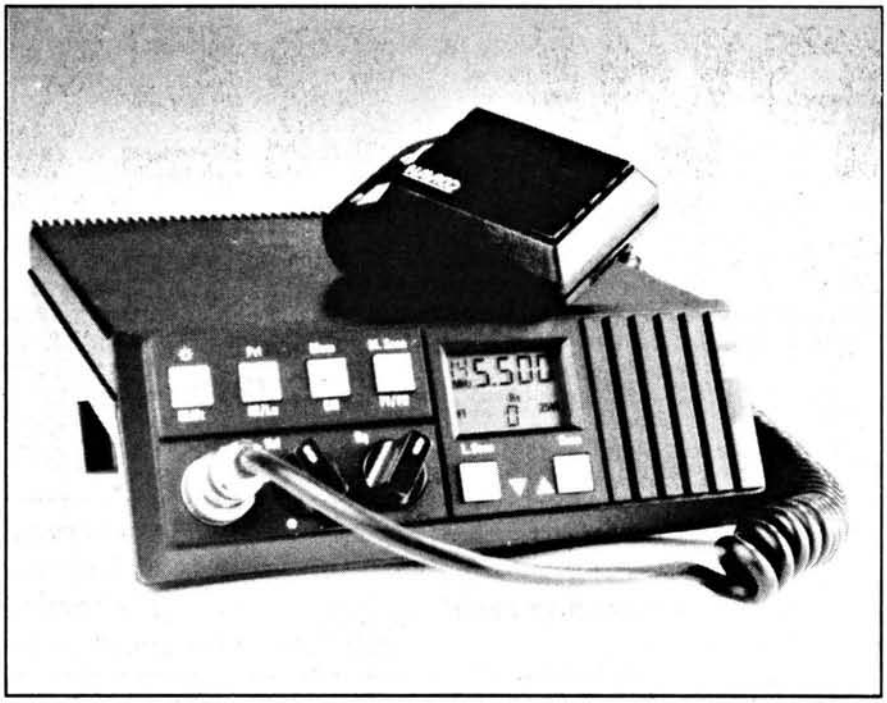
For the adjustment of volume and squelch, conventional rotary controls were employed though, to my mind, they were a little too close together.

Frequency selection was achieved using the now standard UP and DOWN buttons which were located on the front panel immediately below the display. These were nicely spaced and had a good positive feel, which was particularly important for mobile use.

An alternative method of selection was to use the UP and DOWN buttons on the supplied fist microphone which exactly mimicked the front panel controls. When using these buttons each press shifted the frequency up or down by one step which was 25kHz. If however either of the buttons were held depressed the frequency would change at an increasing rate, allowing very fast frequency changes to be made easily. The default frequency steps of 25kHz, although fine for general use, could be changed to 12.5kHz if required. The process to change this was very simple and involved holding the illumination button pressed while the main power is switched on.

In addition to these basic frequency selection options there was another feature which I found particularly attractive. This was called CHANNEL mode and was enabled by pressing the button marked CH on the front panel. Once enabled, instead of showing the operating frequency, the displayed showed the IARU channel number, i.e. S20 for 145.5MHz. Although not in itself particularly revolutionary, there were several other aspects which made this implementation very impressive. Once this mode is enabled then only the channelised portion of the band is accessable i.e. 145MHz to 146MHz but minus the satelite sub-band. This made frequency changing very quick and easy. Where this system really came into its own was when using repeaters. Once a repeater had been selected the display showed R0, R1, etc., but additionally the appropriate repeater shift and tone burst were automatically enabled.

The final "piece de resistance" is the implementation of the tone burst which, to use the manufacturers terminology, is "Intelligent Tone-burst". In simple terms what happens is that once a repeater channel has been selected the tone burst circuitry monitors the squelch line. If



when you press the p.t.t., there is a carrier present, the tone burst is disabled, if however there was no carrier present, the tone burst circuit sends out a 400ms burst of 1750Hz to access the repeater. The idea is so simple I can't imagine why everyone isn't doing it, so full marks to Navico for some smart thinking!

As you can probably imagine this facility makes mobile operation simplicity itself, which of course is how it should be. Imagine, no more searching for the tone burst button!

It is often very useful, when operating mobile, to be able to listen to the repeater input to see if you could work a station simplex. Navico have considered this problem and come up with another novel solution. If you are tuned to a repeater frequency in channel mode pressing the CH button initiates the following operating sequence:

first press = listen on input

second press = restore normal repeater working

third press = transmit on output

fourth press = back to normal operation

As you can see this gives the facility to listen on input and send on output which is all you are ever likely to need. So yet again, well done Navico.

Memories

When it comes to storing your favourite frequencies in memory, there are two versions of this transceiver, the AMR1000 and AMR1000S. The difference is that the AMR1000 doesn't have memories whereas the AMR1000S, being reviewed here, has.

There are a total of ten programmable memories, which can be used to hold repeater shifts in addition to the basic operating frequency. Storing frequencies in the these memories was very definitely a two-handed affair as you had to hold the UP and DOWN buttons pressed whilst powering up the rig. This is no bad thing really, as it reduces the temptation to try and program the memories whilst mobile!

Although there were only ten memories, with the channel mode I described earlier, this should prove plenty. Recalling frequencies stored in the memories was very quick and easy. First the SHIFT and MEM buttons are pressed to enter memory recall mode. This is indicated by the text "Mem" appearing at the bottom of the display. Once in this mode the memory number is displayed using the S-meter digits at the bottom of the display. Selecting the required memory number was achieved with the UP and DOWN buttons.

Once the required memory had been selected the AMR1000S reverts to normal operation some five seconds after the last key press, but still of course on the memory frequency and mode. This is a rather unusual feature, but does give the flexibility of being able to change frequency easily after memory operation.

Scanning

In addition to the basic memory selection, the AMR1000S features priority channel and memory scanning.

The priority channel implementation on the AMR1000S employs an additional memory and is used in the conventional way to provide continuous monitoring of a favourite frequency.

The scanning facilities of the AMR1000S are really quite impressive, involving three serarate modes. An interesting point about all the scans is that they can be set either to find a channel with activity or to find a free channel. This latter facility is rather novel and can of course be very useful for finding a free operating frequency.

The first and most obvious scan mode is MEMORY SCAN which, as the name

implies, sequentially scans the memories.

Starting the scan for an active frequency involved holding the UP button pressed whilst pressing the DOWN button. The scan for a free memory used the same process except that the DOWN button has to be held pressed for two seconds. Alternatively press SHIFT followed by SCAN on the main panel.

The second scan mode was called LIMIT SCAN and again, as the name implies, allowed scanning between two pre-set limits. Any readers who have experience of scanning receivers will be familiar with the facility, but it is normally called search and not scan.

The AMR1000S uses the two v.f.o.s F1 and F2 as the limits for the scan which fails if either of these are not set. This scan was started by pressing SHIFT, L.SCAN. This mode was particularly useful for checking activity in the all mode section of the band, outside the IARU channelised section.

The final scan mode was SCAN ALL which I found very handy. This mode had two effects depending on which operating mode was selected when you started the scan. If you were in channel mode this scan ran through all the IARU channels, including repeaters. As with the other scan modes it could be set to stop on busy or free channels, making it a very versatile mode indeed.

If, when you started the scan, you were in frequency display mode the scan operated over the whole band using the minimum frequency steps of either 12.5kHz or 25kHz.

One of the potential problems with this type of scan is that it will stop every time it encounters a beacon and never move on unless you do so manually. The AMR1000S has a solution to this in the form of a lock-out facility which allows the operator the exclude up to 48 individual frequencies from the scan.

Advanced Programming

Although the design objective of the AMR1000S has clearly been that of simplicity, the user had access to some of the system variables via the second level programming mode. This mode allowed the customisation of eight options as follows:

(1)Scan rate: 0.1 to 2 seconds in 0.05s intervals

(2)Scan Hold Time: 4 to 20 seconds or disabled i.e. scan will stop indefinitely on a carrier.

(3)Tone Burst Duration: 0.1 to 1 second in 0.05 second intervals.

(4)Tone Burst Time-out: 4 to 20 seconds or disabled.

(5)Audio Mute: Squelch operates on fixed audio output and speaker or speaker only.

(6)Illumination Level: Set the default level.

(7)Start-up Frequency: can be set to any frequency or channel.

(8)Start-up Options: 12.5kHz/25kHz steps, R8, R9 and French repeater channel selection.

As you can see this gives the user plenty of choice as to how the rig will operate.

Finally, there are two functions I have yet to cover - illumination and power levels. You may be wondering what's the big deal with illumination, but Navico have thought this one out too. There are six levels of front panel illumination, which can be selected by the operator to cover just about every situation. The illumination is turned on by pressing SHIFT twice holding it depressed the second time. The illumination then automatically increases through six levels, which is pretty impressive.

The power level switching is very straightforward, with no tricks tucked away. There are two options - full power of 25 watts or low power which is approximately 5 watts.

Performance

Having established that the AMR1000S is an impressive rig from the point of view of facilities and ease of use it was time to evaluate it's performance.

It was at this stage that I met with my first hurdle - the majority of the PW lab had been sent away for its annual calibration so I wasn't able to compare my tests with the results supplied by Navico. At least their test results were extensive.

Starting with the receiver, the measured sensitivity for 12dB SINAD using a modulation frequency of 1kHz and 3kHz deviation was a creditable 0.126µV, which puts it well up amongst the leaders in the field. The rest of the receive performance was also of a very high standard with image rejection of 83dB and 85dB at the band edges and a signal to noise ratio of 56dB with an input level of +30dBµV.

One aspect of the receive performance that was particularly impressive was the audio response. The de-emphasis used was 6dB per octave and the measured response followed the theoretical line very closely from 400Hz to 4kHz. This is one area where a lot of other rigs fail quite badly so this is a very good performance from the AMR1000S.

Another critical area, particularly for the data enthusiast, is the receiver response time. On this factor the AMR1000S performed very well both in my own tests and on the air making this is good rig to choose if you are into packet opration.

Moving on to the transmitter, the audio response here was also very good and was spot on the theoretical curve between 300Hz and 3kHz. This measured performance was born out by the on air results which were excellent. The audio distortion was also very low at 2.6 per cent for the transmitter and 2.9 per cent for the receiver at 1 watt output.

I would be very interested to listen to a QSO between two AMR1000S as the resultant audio should be very good indeed. Whilst on the subject of audio quality, the microphone insert used has been chosen to have a relatively high bass cut-off to help minimise road noise when operating mobile. As a result the audio is quite "bright".

The harmonic and spurious outputs from the transmitter were all very well controlled, with the worst case being the 6th harmonic on low power which was measured at -78dBc.

For the on-air tests I used the AMR1000S both in the car and the shack. The mobile set-up comprised an SMC dual band co-linear antenna, AMR1000S, LS100 external speaker and the supplied fist microphone. I found the simplicity of operation a real boon in the car, especially the intelligent tone-burst.

I also tried the LS100 external speaker and found that it provided a very worthwhile improvement both in sound level and quality.

The only two snags I found during mobile operation were the scan buttons on the fist mic and the positioning of the volume and squelch controls. The problem with the scan buttons was due to the very light pressure required to operate them. This meant that it was very easy to accidentally step up or down a channel or two when picking up the microphone. I must admit though, I soon learnt to live with this.

The volume and squelch problem, was simply a case of poor positioniong, as I felt that these two controls were too close together and also too close to the microphone socket.

As you can see with only two minor problems evident the AMR100S performed exceptionally well.

Moving on to the performance in the shack, the antenna this time was a discone, again from SMC, which I find to be very good both for receiving and transmitting. Obviously, without the demands of a

Specifications

GENERAL	
Frequency Range	144MHz to 146MHz
Supply Voltage	12V +30% -10%
Consumption	Standby 150mA
	Transmit (5W) 2.5A
	Transmit (25W) 5.5A
Modulation	F3E with 750µs pre and de-emphasis
RECEIVER	
Adj. Channel Selectivity	
	±12.5kHz 50dB
	(400Hz ± 3kHz interference)
	±12.5kHz 60dB
	(400Hz, ±1.8kHz interference)
	25kHz 70dB
	(400Hz, ±3kHz interference)
Intermodulation Rejection	70dB
Blocking	90dB
Audio Output	4 watts into 4Ω
Co-channel Rejection	-8dB
TRANSMITTER	
Output Power	25 watts or 5 watts
Harmonic Radiation	75dBc
Hum and Noise	better than -40dB
Deviation	±5kHz maximum

mobile environment, the operation presented no problems at all. I thought the AMR1000S made a very good base station rig and its scanning options were very useful.

The audio quality, both transmitted and received, was very good and remained very crisp and clear. I also received several unprompted complimentary reports on the audio quality.

In addition to testing out the AMR1000S phone performance, I also connected up a Siskin Electronics Tiny 2 packet TNC, to see how it fared on this mode. As with all the other tests the performance was very good, with no problems at all. During the review period I had occasion to talk to Phil Bridges of Siskin Electronics who backed-up my findings with the packet performance. In fact Phil has tested the AMR1000S with the G3RUH 9600 baud modem and it performed perfectly, with only a few minor modifications. ***PW***

Summary

What more can I say, the AMR1000S has proved itself to be a very capable transceiver during the review period.

In the mobile environment the operational simplicity is a real asset, with the intelligent tone-burst being a particular favourite of mine.

Despite its obvious appeal as a mobile rig, it is also a very capable base station performer and in fact its performance on packet is probably the best I have encountered to date. With the very competitive pricing of the AMR1000S I think it's a real winner. I must say it's good to be able to say buy British again in the amateur radio market.

The only bad news is that now I've finished the review, I've got to return the AMR1000S!

The AMR1000S costs £299.00 inc. VAT and my thanks are due to **Navico, Star Lane, Margate, Kent Tel: (0843) 290007** for the loan of the review model.

S.E.M.

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Do you suffer from local interference? The answer is probably yes. If you moved your receiver into the country you would be amazed how quiet your reception would be. The noises you hear on the H.F. bands are produced by local electrical equipment.

This completely new idea, developed by S.E.M. can provide the complete removal of any of these problems. You don't even have to know what or where the source is. It can be your own computer next to your receiver or r.f. welding equipment in a factory several miles away.

The QRM Eliminator connects in your aerial lead (you can transmit through it) it requires an auxilary aerial (this can be ANY other aerial e.g. a 2 metre one, or a few metres of wire, because wide band amplifiers are used to boost the level of the QRM). Your unwelcome signal will arrive at the two aerials slightly out of phase and by adjusting the phase of the signal from the auxilary aerial with the Eliminator controls, you can completely remove it BEFORE IT ARRIVES AT YOUR RECEIVER. Forget all the inadequacies of noise blankers, this is a new, different, concept. Sceptical? As W4CXH in Florida says "The power line noise is S 7 and you are coming through 5 and 4." Practical Wireless review says "Does it work? Yes it does". Other comments "A remarkable achievement", "It works like magic", "It even eliminates rain static" and comments about being able to operate again after years of enforced inactivity because of some local problem not previously curable or even traced, are many.

Size: 6" × 2" × 3" deep. Sockets SO239s. Supply 12 V (10-14) 30 mA. Frequency range 500KHz - 60 MHz continuous. May be transmitted through.

Price: £79.50 including VAT and delivery.

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2 or 6-METRE TRANSMATCH. 1kW, will match anything, G2DYM or G5RV? on VHF. £39.50 ex stock.

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TWO-METRE LINEAR/PRE-AMP. Sentinel 40: 14× power gain, e.g. 3 W – 40 W (ideal FT290 and Handhelds), £95.00. Sentinel 60: 6× power, e.g. 10 W in, 60 W out, £105.00. Sentinel 100: 10 W in, 100 W out, £135.00. All ex stock.

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MULTIFILTER. The most versatile audio filter. BANDPASS Hi Pass, Lo Pass and two notches. Frequency and Bandwidth adjustable 2.5 kHz-20 Hz, £75.00 ex stock.

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The Worlds Largest Amateur Convention, Dayton USA

"Surely you've not come all the way from England just to attend the Dayton Hamvention?," said the young man serving beefburgers and piping hot coffee at one of the dozens of cafeterias and bars inside the Hara Arena at the 38th Annual Dayton Hamvention. But that's just what David Jardine G0FDV had done.

Dayton, to me, appeared a well-kept "middle-America" town - with its population of a quarter of a million. Most were probably aware that the world's largest Ham Convention was being staged in their town as during the three days, April 28-30, the population grows by some 15 or 16 per cent.

Attending the Dayton Hamvention is the "trip-of-a-lifetime" if you'll excuse the clichè. The travel by British Airways jumbo for £199 return (London-New York) plus a £100 Greyhound Ticket that takes you anywhere for one week is very good value for money. But, if you do book independently next year - book well in advance as most lodging homes and hotels for 30-50km radius or more get full very early.

So, why was I impressed? The sheer size of the show, its venue and the really first class organisation that went into it all. According to the organisers, 35,000 plus people attended this year. On handing me an 88-page, glossy, A4 book, which was the *Hamvention Guide*, Lois Stoll KA8WXK (Dayton's Information Co-ordinator) told me that Dayton emerged by chance to become the largest US ham convention. She said, "We are the largest in the world and it's all because Dayton Amateur Radio Association are the only ones who could organise it."

Dayton does have at least a couple of other claims to fame since, in 1892, Wilber and Orville Wright opened their bicycle repair shop in Dayton where they conducted experiments that led to the first sustained and controlled flight of an aeroplane. It is also the venue for a prestigious US Air Show and the airport is "out-of-this-world"

The main indoor exhibition area is split up into five areas comprising the Exhibitor Booth Locations. The world famous Flea Market takes up an even bigger area outdoors around these exhibitions areas. It's almost impossible to guess at the square footage of the entire show but the arena alone must be 60 x 15m - and that's just about one-tenth of the total.

Listed were no fewer than 30 organising staff, all licensed amateurs and all forming the Hamvention team supervised by Bill McNabb WD8SAY and Assistant General Chairman, Ed Hillman N8ALN. All the co-ordinating security crew I saw carried small hand-held radios attached to shirts or belts and this made for "super-smooth" operation of external and internal organisation. There was a continuous supply of people, cars, coaches and vans packed with radio equipment and at no time did I feel that anything went out of control. There was space for everyone, everywhere - even in the car parks which were a "stones throw" from the main exhibiting areas. When you think that there were 300 plus trade/commercial exhibitors and stands, this was quite and achievement.

Bill McNabb had this to say, "On behalf of the Dayton Amateur Radio Association and the Dayton Hamvention Committee, I welcome you to the 38th annual Dayton Hamvention.

"During the past year, the Hamvention committee has worked as a team to assemble another outstanding programme in the Hamvention tradition. We have always tried to provide the best forums, equipment displays, flea market and social functions. We want you, our visitors, and everyone associated with this year's Hamvention to have an exciting, entertaining and educational show.

"We feel that we have once again assembled a show that is unequalled in amateur radio. This year, we have more exhibitors and more flea market space than last year.

"Have a great weekend, a safe trip home and plan early for your return visit in 1990."

Noted for doing things in style - two proclamations by both the Mayor of Dayton and the Governor of the State of Ohio were also made.

The $12 admission covers all three days, with $20 extra for the Grand Banquet. The programme lists a number of "unofficial functions" which all add to the excitement and fervour of the event. They include a DX Dinner (the 4th Annual) with DX hospitality suites in the Stouffers Center Plaza Hotel held opposite the Convention. There is an ATVers workshop, an SSTV get-together and a Quarter Century Wireless Association Banquet.

Official Events

Official events included the awards which compromise:

Amateur of the Year - Bill Pasternak WA6ITF

Special Achievement Award - Phil Karn KA9Q

Technical Excellence Award - Byron Goodman W1DX (first editor of ARRL Handbook). Byron wrote many articles and set the standards for modern receiver design. His most important contribution was his early recognition of the value of single sideband over amplitude modulation. If anyone can be called "father of s.s.b.", it's him.

There were approximately 50 forums over the three days held in purpose-designed lecture areas which included a broad range of fascinating subjects such as:

Packet Radio - constructing inexpensive equipment, etc.
FCC
Antennas - 3.5MHz beams! Preparing antenna farms, etc.
Electrical safety demos
Radiation hazards
Inside Hurricane Gilbert
Contests
Weather Satellites
Slow scan TV
"Digital" digest
"Will amateur radio trigger World War III - or is it already too late to stop the destruction of the world?" by Wayne Green W2NSD/1
DX Forum
Repeaters
Amateur TV
AMSAT
Learning the code
Maximising trap vertical performance
QRP
ATUs
Scanners and the s.w.l.
Ham radio in the classroom
Amateur emergency communication (international)

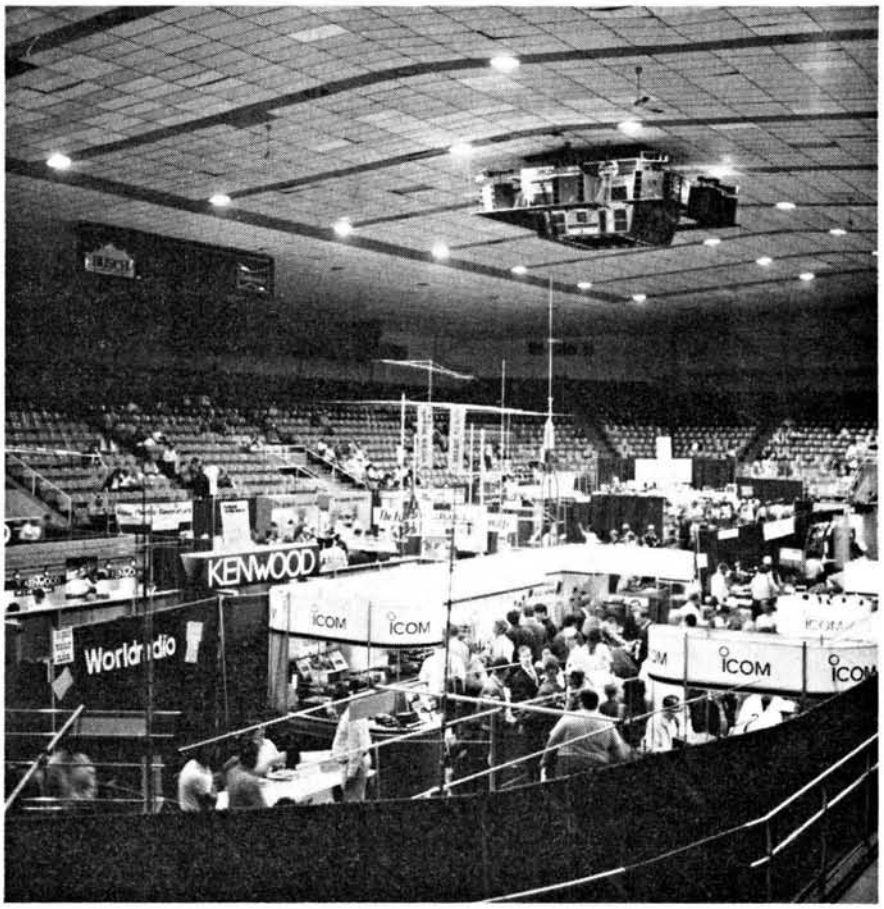
An enormous range of alternative activities were organised for other members of the family who do not have an interest in amateur radio - or perhaps those who'd just like a change. For example:

Child care
Basketry
Fashion
Bow making
Straw placement butterflies
Moulded chocolates
Geneology
Health and emotions
Financial planning
Candy making
Bingo
Flower arrangements
Country ducks
Embroidered hats
Fluffy wreaths
Chiropractice
Nutrition

New Products

There were at least two dozen products that come into the "New This Year" category. I thought they would be of interest to UK readers.

Alinco 45/35W two-band mobile: The DR-510T, a high-powered 144/430MHz transceiver, is so full of features it's scary!



Not only full of sub-audible tones, but a cross-band, remote-base/repeater too. It also has cross-band full duplex and sports a multi-coloured l.c.d.

Alinco dual-band hand-held: The DJ-500T is a dual-band handy that operates cross-band full duplex. Small in size, it has 6.5W on v.h.f. and 5.5 watts u.h.f., with 12V input. Not to mention independent encode/decode sub-audible tones, single memory 16-digit autodialer and more!

Another Alinco product with the budget in mind is the DR-110T 144MHz band mobile. It has 45W, 14 memories, all encode/decode sub-audible tones (factory installed), multi-colour/multi-function l.c.d., 16-button d.t.m.f. microphone with memory up/down buttons.

I think the DJ-100T 144MHz hand-held, also from Alinco, offers you the most attractive and affordable multi-function hand-held in the market place. It has 10 programmable memories, encodes sub-audible tones via a rear-mounted DIP switch and 6.5W of output with 12V input. The DJ-200T (220MHz) and the DJ-400T (440MHz) will be available in the US very soon.

AEA's new FSTV-430 fast-scan television transceiver makes getting on ATV easier than ever. Plug in your video camera or v.c.r., connect a 430MHz antenna and a standard TV set and you're on the air! AEA performance standards are assured with a sensitive pre-amp and one watt of vestigial sideband output.

The "ultimate" keyer from AEA, featuring 2-99 w.p.m., 8400 character memory that's expandable to 32K, 20 memories, RS-232 I/O and much more. You can practice with random code groups that steadily increase in speed, random four-letter words or with their famous Dr QSO for realistic "on-the-air" QSOs.

AEA's AT-300 a.t.u. is a low-pass design which means better harmonic attenuation for lower TVI and matches a wider range of antenna impedances than more common designs. While others promote small size, AEA say that small size degrades the inductors *Q*, resulting in less efficiency and less power to your antenna.

Perfect for the FSTV-430 is the new 16-element Yagi antenna covering 420-440MHz. Robustly built to handle 250W, it has a boom length of 3.05m, weighs almost 2kg and has a wind loading area of 0.76sq.m. The 430-16 uses a 50Ω "N" type connector and mounts onto a 25 to 37mm diameter mast. Stacking kits are available.

Aries-1 combines a logging, terminal unit control and contest program all in one. Date and time are automatically entered into the log as is the frequency and mode when interfaced to current Icom and Kenwood radios. You can change the baud rates with the click of a mouse, it can print QSL labels and much more.

The Digital Multimeter 5365 is an extremely versatile 3½ digit d.m.m. with 11 functions and 39 ranges. That includes frequency up to 200kHz, capacitance, logic level test, transistor gain, diode, continuity beeper, a.c. and d.c. up to 10 amps, resistance to 2000MΩ and voltages. Other options are 1000A a.c. current probe and thermo-module.

The 230CA is a modified version of the 230C commercial 2.25kW 2-30MHz amplifier from Advanced Radio Devices. It is optimised for operation in the amateur

bands to allow even quicker automatic tuning. All the features of the 230A and 230C are retained, such as remote control, complete automatic operation and protection, etc.

Ringrotor, from TIC General, is a powerful antenna positioning device designed to rotate your antenna around your tower. Ringrotors will accommodate a tower face up to 711mm and larger models by custom design. Elevation rotators are also available.

Two new 16-channel portable transceivers have been developed by Fujitsu Ten of America. Both u.h.f. and v.h.f. versions feature microcomputer controlled, priority scanning, PC programming, 2 or 5W output, battery saver providing up to 12 hours of use. It also comes with a 2-year warranty.

A 500MHz frequency counter that fits into the palm of your hand! Digitrex Electronics have one with 1kHz resolution, 9V operation and a BNC input connector for your flexible antenna or probe. The instructions describe modification for 1300MHz coverage.

It was really good to see the name of Heathkit back in the forefront once again. They have an excellent 100-page, full-colour brochure including a large section devoted to amateur radio as well as home entertainment, security and lighting, weather, marine and so on.

Their goods come as ready-finished items or in kits form. Heathkit also manufacutre a range of dual-band v.h.f./u.h.f. hand-helds, mobiles and base station transceivers all under the Heath brand name. I'm not sure of their activities in the UK - but watch out. All in all, a most impressive display, stand and demos.

Yaesu have their own lavish US headquarters in Cerritos, California. Their equally lavish brochure displays the entire range of Yaesu products available in the US. One product that is new and I've not seen in the UK is the FT-1020 - a dynamic h.f. transceiver designed exclusively for elite "world-class" contest and DX operators. According to Yaesu, "The FT-1020 is the culmination of a 3-year design effort to address the many shortcomings of the other manufacturers top-of-the-line products. The result is a dominating tool for the amateur who lives in the fast lane."

Specification:

General coverage receive, amateur band transmit

Dual receive with two tuning knobs for no-confusion split operation

Balance control for dual receive

Independent filter selection on each receive channel

IF shift

IF notch filter

Audio peak filter for c.w.

DVS-2 digital voice system for 'phone "CQ Contest" messages

Single sideband power output 150W plus for -31dB 3rd order intermod. Single-tone (c.w.) output 200W plus

Fast-acting, auto-tracking a.t.u.

Built-in electronic keyer

Clarifier tuning on separate knob, r.i.t. offset holds independently of main tuning

RX pre-amp built-in

Provision for RTTY and Packet

Price: under £3000 complete

PW

Interest

Well, I hope this has been of interest and if anyone would like to visit next year, I thoroughly recommend it - but do allow three days to see the world's largest Ham Convention, believe me you'll need every minute.

SWAP SPOT

Got a camera, want a receiver? Got a v.h.f. rig, want some h.f. gear to go with your new G-zero? In fact, have you got anything to trade radio-wise?

If so, why not advertise it FREE here. Send details, including what equipment you're looking for, to "SWAP SPOT", *Practical Wireless*, Enefco House, The Quay, Poole, Dorset BH15 1PP, for inclusion in the first available issue of the magazine.

A FEW SIMPLE RULES: Your ad. should follow the format of those appearing below, it must be typed or written in block letters; it must be not more than 40 words long including name and address/telephone number. Swaps only-no items for sale-and one of the items MUST be radio related. Adverts for ILLEGAL CB equipment will not be accepted.

The appropriate licence must be held by anyone installing or operating a radio transmitter.

Have generous parcel of Australian stamps. Would exchange for book; *Radio Circuits* by W.E. Miller, published in the late forties. Trevor Mitchell VK3CUP, 19 Simpson Street, Kyneton, Vic. 3444, Australia.

G334

Have Saisho SW-5000. Would exchange for general coverage receiver with f.m., a.m., s.s.b. and c.w. demodulators. T. Williams, 26 Aston Avenue, Winsford, Cheshire CW7 2HX

G359

Have ex-RAF T1154 transmitter with matching R1155 receiver, both working. Would exchange for 144MHz transceiver with a.c. p.s.u., no rubbish please. Items very heavy so swapper collects. Callers only, to apply in writing first owing to shift work. Heslop, 75 Alder Park, Brandon, Durham DH7 8TJ

G369

Have Bearcat hand-held scanner in unused and as new condition, covers 29-500MHz with gaps.
Would exchange for WWII h.f receiver, similar to Command type, to cover 2.5-4MHz, also consider any other 3.5MHz band valved receiver. Fred G8BWI. Tel: Cambridge (0223) 214088.

G437

Have New Zealand ZC1 MkII RX/TX tank set in mint unmodified condition. Would exchange for round EKCO receiver with uncracked cabinet. Bruce Adams, 53 Red Leasowes Road, Halesowen, West Midlands B63 4SE.

G443

Have Amstrad CPC 6128-128K personal computer with 14in colour monitor and 2 disc drives. Also hundreds of pounds worth of software. As new and in perfect condition with all handbooks. Would exchange for Olympus AZ-300 camera, or h.f. transceiver (3.5-30MHz). Sid. Tel: (0255) 554612.

G453

Have a Yaesu FRT-7700 a.t.u. almost new. Would exchange for a.t.u. to suit HF-125 receiver. Tel: (0705) 453575

G492

Have Dragon 32 computer, also program tapes for RTTY and c.w., both RX/TX, worth £40. Plus ST5-MC terminal unit worth £35. Would exchange both for W.S. 62 set. Geoff. Tel: (0344) 52601.

G527

Have 1920s crystal set and AR88 communications receiver. Both in good working condition. Would exchange for "bat detector", zoom binoculars or airband radio. G1VBZ. Tel: (0538) 361390.

G551

Have Realistic PRO-2021 v.h.f./u.h.f. a.m./f.m. 200 channel direct entry programmable scanner in new condition. Would exchange for zoom lens e.g. 70-210mm to fit Minolta X300 or fully automatic SLR camera. R. Dougans. Tel: Greenock (0475) 81207.

G552

Have 64K MSX computer plus data recorder, joysticks and £150 worth of software. Also Korg synthisiser with patch leads, etc. Would exchange for Yaesu FRG-7 receiver or similar. Tel: (0400) 61130

G554

On The Line To CAIRO

In the second part of his article, Dr Peter Best MSc CEng MIEE MBCS MBES G8CQH, considers practical designs for CAIRO accessories, some of which may be constructed from elements in the "spares drawer".

CAIRO is a passport from the manufacturer's cosy little world, where commonality in the use of connectors is a sparse consensus, to the operator's world, where the signals which pass between transceiver and accessories have been properly identified and standardised. Free from the ties of differing connectors which bind our accessories to specific rigs, we may explore the versatility of our standardisation. In particular, we can now examine our role as regular users of radio transceivers and select the most appropriate accessory to suit the very varied circumstances in which we operate. In this new domain, the horizons for the enthusiastic constructor are boundless and, for clarity of illustration, RS Components part-numbers [xxx-yyy] are given.

To recap, the Communications Audio Interface for Remote Operations - CAIRO - is a scheme for using DIN connectors with a specific signal-to-pin assignment, together with suitable lengths of four-core, individually-screened cable. Together these convey the speaker, mic and p.t.t. signals from any (adapted) transceiver to our terminating audio accessories, which we use singly or in combination. Part 1 gave the principles of the scheme and details of the necessary transceiver adaptors together with various line or extension-lead options. In this part we move to the remote end to consider some accessories in closer detail. In practice, it hardly matters whether the remote operating point is one metre or one hundred metres from the rig because we will equip each accessory with a short length of CAIRO-line cable (normally 2m) terminated in a DIN plug, the "Signals-Tail", for convenient connection to the "line".

In the most general CAIRO configuration, we should consider a "fourth" element to accompany the speaker, mic and p.t.t. as the principal items. Considering the uncertainty of factors in the receiver output circuit, like line-losses or the impedance and efficiency of electrical to acoustic conversion of receiving transducers (loudspeakers or headphones), it is customary to include a volume control as part of the remote-end termination. Having left the rig with its volume setting somewhat higher than "normal" (the setting used in local operating) we make corrective adjustments, as required, at the remote end. Thus, the standard termination of a remote line is now seen to be a microphone with a p.t.t. control, for transmission, and a transducer with volume control, for reception. The grouping of these elements into various housings, to suit styles of operating, becomes a matter of ingenuity for the user-designer.

Volume Control

For this, 100Ω, 2W potentiometers (e.g. cermet-type [162-776]) achieve the most beneficial non-linear power delivery, consistent with a smooth adjustment of volume, in proportion to knob rotation (e.g. knob [499-977]). Also, this value prevents excessive loading of the transceiver output when two, and conceivably three, controls appear in cascade along the remote chain connection. Two forms are suggested. The first retains the full-off limit of the simple potentiometer action (referred to as an FO control) and has one track-end made common with the earth-screens (pin-2) while the other track-end is supplied with the speaker (pin-1) line from the rig. The track-wiper becomes the onward feed to the receiving transducer. The second version retains some residual signal (the non-zero; NZ control) by including a fixed-value "pedestal" resistor (e.g. 5.8 or 6.2Ω) between earth-screens and the track "common". The FO-control would be used at the "auxiliary" position in a chain where it is permissible to turn off an individual listening device, whilst the NZ-control would be preferable at the "master" position to ensure, as far as reasonably possible, that a small signal always passes to a device, sufficient to alert the operator to the presence of radio traffic.

Operator Outlet Boxes

Some accessories will be "complete", having all terminating transducers in one item with one signals-tail, but many more plausible terminations arise through combinations of "partial"accessories. For example, when listening casually over long periods (monitoring) and operating only occasionally, we might use a loudspeaker and a fist-mic or desk-mic. At other times, when higher levels of concentration are required or we wish to add some level of privacy to our operating, we may resort to a headset (headphone or headphones with a boom microphone attached) and a separate p.t.t. device. Both of these examples suggest that partial accessories occur in pairs and we should provide paired socket outlets. As the physical form of many accessory will not allow the inclusion of volume controls, we may look to small boxes to house these provisions together.

The Single Operator Outlet Box (based on [509-923]) has two chassis sockets on one long side of the enclosure, an NZ volume control at one end and a signals-tail emerging from a grommet and strain-relief anchorage at the other. The majority of the socket pins are wired in parallel, directly to the incoming cores of the signals-tail, though pins 1 & 6 of both sockets are fed from the pot-wiper. This ensures that the sockets are an indistiguishable pair which accept any plausible combination of accessories. The detailed wiring may be deduced from the diagram of the Dual Operator Outlet Box which is discussed later, once its extra features have been explained.

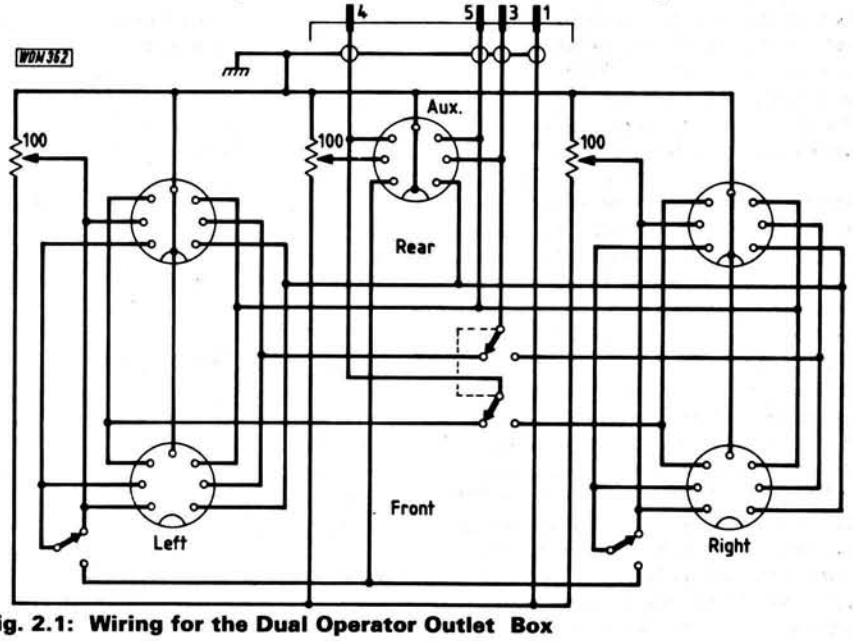


Fig. 2.1: Wiring for the Dual Operator Outlet Box

Electret Capsules

The electret capsule is considerably smaller and of better acoustic quality than most general-purpose dynamic microphones and is frequently encountered in hand-held transceivers, and modern speaker-mic accessory. With a typical sensitivity of -60dBV, it is some 5dBV up on the dynamic for which CAIRO is specified, so its position at the mouth is not critical. An out-of-sight position beneath the chin or alongside the cheek is perfectly adequate. Electrets are widely available (e.g. Tandy: 270-090). The correct polarity of the internal f.e.t. must be observed so that the drain becomes "mic-high" and the source, "mic-low". Close inspection of the terminals allows the source to be identified by the extra slender link passing from that pad to the capsule body. Because the body is common to "mic-low" which, in CAIRO, is not system earth, suitable insulation is required whenever the capsule is installed in metallic housings. If it is to be used as a replacement insert, one might employ liberal turns of draught-excluding tape around it to cushion it into position within a housing. The Rig-Adaptors, already explained, anticipate the regular use of electret microphones in CAIRO.

Complete Accessories

The telephone handset is a classic design for handling an earpiece and microphone together and has its place in radio operating as well normal telephone signalling. If using an item originally intended for use on the normal telephone network a push-to-make switch (e.g. [337-942]) may be mounted at the rear of the earphone housing where it serves as a thumb-operated p.t.t. The original wiring will not be correct for CAIRO so a signals-tail should be substituted. If the original microphone element is not to ones liking, or more accurately, if it receives adverse comments from friends, try replacing it with a telephone earpiece transducer, as a first substitution. The audio is reasonable for communications and any tendency to "boom" can be alleviated by placing two, 25mm strips of draught-excluding tape between the element and the mouthpiece grill.

In a similar vein, the communicator's handset having a p.t.t. pressel-bar formed on the inside of the handle portion, are quite frequently available on the second-hand or surplus market. Some versions also have a cradle base in which it may be possible to mount a pair of sockets wired, through the hook-switch, so they only become "live", to onward mic and p.t.t. connections, when the handset is cradled. If a volume control can be included as well, the base doubles as a single-operator outlet box. Likewise, an ex-GPO mechanical type telephone base may be similarly configured for monitoring. Remove the dial and set in a loudspeaker (e.g. [248-325]) behind the orifice with a suitable grill-cloth. Typically, we can hard-wire the handset line through to the base unit and then provide a signals-tail from that. The cradle switch may be used to route the speaker signal either to the "dial" speaker when the handset is at rest, or to the earpiece when the handset is raised. Overall volume adjustment may be achieved by installing a (NZ) potentiometer through the rear cable-anchor plate and it is useful to include a resistor, in series with the earpiece, to pre-set its close-ear acoustic level equal to the speaker output. Even with a very low monitoring level, the "cocktail-party effect" leaves you sensitive to anyone calling you by your callsign. As you begin your reply, you then increase the setting.

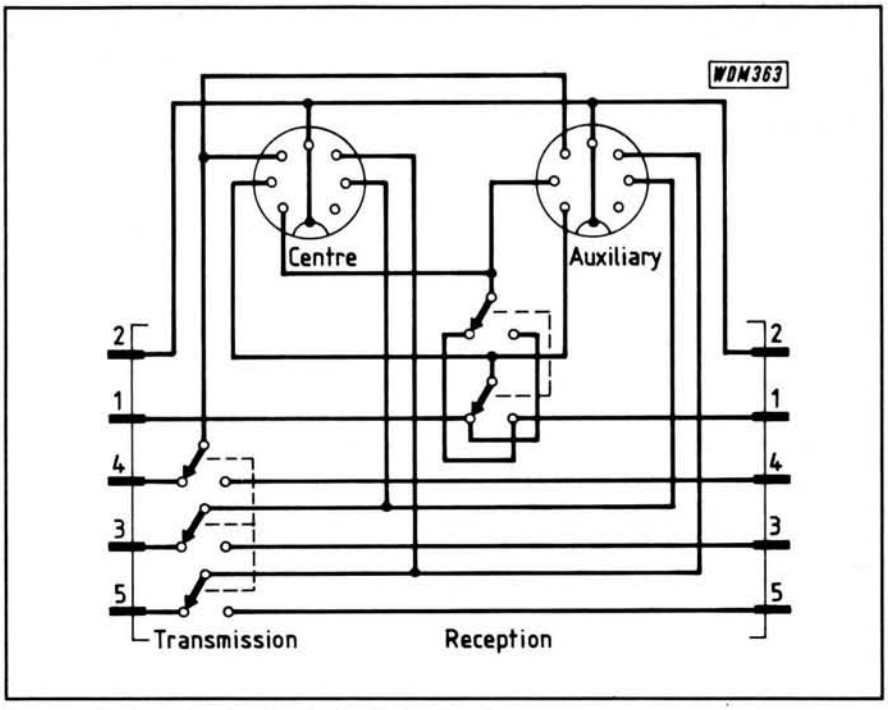


Fig.2.2: Wiring for the Dual Rig Selection Box

Speaker-Mic

Most manufacturers of v.h.f./u.h.f. hand-held transceivers provide a speaker-mic accessory and these owe their small size to the electret element. Inevitably they are plug-specific to that make of rig, but most need not be. The removal of the moulded plug(s), for replacement with a DIN plug, renders them a universal accessory in CAIRO. Some will have been pre-wired as series mic-p.t.t. items. To bring these into line with CAIRO it will be necessary to alter that wiring and, in some cases, this may require the original cable to be replaced.

Tulip Desk Accessory

First among the "home-brew" accessories is the tulip microphone. The most widely available model having been manufactured by Pye is easily modified into a desk-standing speaker-mic. Discard the original microphone element and replace it with a 50mm loudspeaker (e.g. [248-347]). Above this, but below the grill and its cloths, locate an electret by forming straightened paper clips into a mounting spider with the capsule at the centre. The tulip retains its appearance and behaviour as a microphone but has the added property of being a listening device as well.

Partial Accessories

A wide variety of headphones and headsets is available for concentrated operating. Almost any of the modern lightweight headphones, made for the personal hi-fi market, are compatible with radio transceivers if the nominal impedance of each earpiece is 32Ω or greater. This value gives a close-ear acoustic level which is approximately the same as that from an 8Ω speaker at arms reach. For dedicated use within CAIRO, one simply cuts off the moulded miniature stereo jack plug to replace it with a 7-pin DIN plug: pin-1; left, pin-6; right, pin-2; returns. CAIRO Outlet Boxes are designed as dual supplies (through pins 1 & 6) for "binaural" items.

Headsets, having a microphone arm suspended from one earpiece, are particularly convenient radio accessories. For many years the second-hand market has seen a flood of these, notably those from Clement Clarke who manufacture for aviation; e.g. the Airmed-Airlite range (which one of my friends calls his "Biggles Kit"!) Unfortunately, not all items in their range have a microphone element which is compatible with amateur transceivers but it is a simple task to unwrap the band around the microphone housing and substitute an electret. (The correct insert is their A/L 62-2700504.) The original and often bulky feed cable may be replaced with a length of CAIRO line, using what would normally be the p.t.t. core (red) for the secondary (right) earpiece. As a simple rule, the optimum length of cable on any

headset (or headphones) should be such that when you stand upright while wearing the item unplugged, the plug should hang just alongside your ankle, being about 100mm short of the floor, to prevent the ingress of dirt or mud.

For a modern lightweight headset, Maplin LH-375 is a value-for-money item. It employs an electret and the cables have moulded plugs which may be cut off for a 7-pin DIN plug to be substituted. (Please note that the mic cable's core is soldered to pin-3 and the mic-screen to pin-5.) The earpieces substantially cover the ears, but do not totally enclose them so you can hear clearly from fellow co-operators, alongside. In circumstances where it is essential to hear from co-operators, the single earpiece headset is advisable. Yaesu's YH1/YH2 is quite widely available and only requires the substitution of a 5-pin DIN plug to render it operable through CAIRO, without the Yaesu adaptors.

Cross-Talk Admittance

Dual-ear or binaural headphones and headsets are particularly versatile accessories for many styles of operating. Sometimes it may be necessary to de-power the secondary earpiece for short periods, particularly when working closely with co-operators. Otherwise, it can be useful to supply this earpiece with an alternative source, which may well be unrelated to the main radio traffic; e.g. operator-operator intercom. (The Dual Operator Outlet Box includes a simple provision for this.) However, over long periods in these modes, operators begin to tire sooner than expected, due mainly to disorientation caused by sounds which are perceived to be heard alongside only one ear. To overcome this, a cross-feed resistor can be included inside the DIN plug, between pins 1 & 6, of all binaural accessories. This has the effect of placing the sound at a position which is apparently inside and towards the rear of the head where it is less disorientating. The exact value needs discovering by experiment, because this is a personal correction, but a 680Ω resistor is a reasonable starting value for 32Ω earpieces.

Monophones/Earpieces

Single earpieces have long been useful for private listening or overcoming high noise levels. The types which might be described as ear-plugs, because they fit deeply into the auditory canal, must be treated as strictly personal items for the sake of hygiene. Personally, I no longer advocate the use of these offering, instead, the ear-hanger monophone as a modern successor. JVC supply one the TP-1E, which has a simple band for clipping behind the ear-lobe where it remains comfortable, even during lengthy operating sessions. Moreover, it remains comfortable inside Ear-Defenders in very high-noise settings; e.g. RAYNET at the Birmingham Superprix motor racing event.

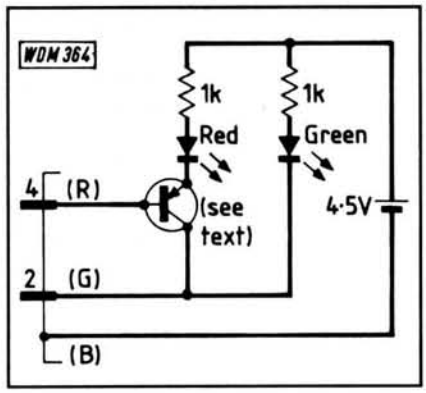


Fig.2.3 : Press-to-talk Indicator Box

Trample-to-Talk

To accompany headset operating where the hands may be occupied with clerical activities, even work at a computer keyboard, the p.t.t. is conveniently done with a foot switch (e.g. [316-901]). The simple trample action is quickly mastered but it is worth acquiring a heavy duty version for use, say, in muddy contest tents when boots are being worn. The second-hand market offers a good source of these, many having been originally intended for the control of sewing-machines or secretarial dictating machines.

Home Constructed Accessories

Whilst the electret lends itself to upgrading a favourite accessory, its compact size and good sensitivity suggests a selection of bespoke accessories as well. The Lavallier (neck-slung) style of accessory is not readily available for amateur radio but one can be made quite simply. The "Microlight" torch (Ever Ready: 6046) has a slender triangular body with an AA battery inside and a pre-focused bulb at one end. It so happens that the bulb collar is an exact fit for Tandy's electret capsule whilst a miniature push-button [336-731] may be mounted across the body, just below the slider-switch, as the p.t.t. The triangular base can be drilled to take a 1m CAIRO signals-tail and the lead to a TP-1E monophone. This lead should be cut to a length which is just sufficient to pass comfortably between mid-chest and head; all connections being made inside the now-vacant battery portion. Finally, the body may be wrapped, between the p.t.t. switch and the slider, with the bands of a spectacles' neck-cord so that the item normally hangs at the mid-chest position. From here it is readily available to be lifted towards the mouth for transmission. I can strongly recommend this accessory for hikers and bikers, and other occassions where a hand-held is used, but is not held in the hand. It served me well in my small contribution to the Lockerbie disaster where, in particular, the monophone was essential against the intrusive noise of low-flying helicopters.

Gooseneck Microphones

A slender gooseneck, with good stay-put properties, can be made from a magnetic retrieving tool [542-144]. The magnet on this item is glued into the head of the tool, and care must be taken when removing it, if the chrome on the head is not to be damaged. One method is to clamp the magnet in a vice, introduce a screwdriver blade between the vice jaws and the lip of the tools head shell and twist very gently. Remove any remaining traces of glue from the inside of the head shell and clear the orifice of the goosneck tube. At the other end, saw off the handle, leaving about 2mm of tube for easy extraction, if the handle is to be used for other purposes. Introduce a length of cable [367-224] through the gooseneck tube and terminate a Tandy electret capsule on the two inner conductors. Expose a short length of screen, about 3mm, wrap the capsule with a single, complete turn of a thin insulation and introduce a small blob of poster putty between the mic connection pads. Then, gradually draw the capsule into the head shell until it sits flush with the rim.

To use this gooseneck microphone in any of the following accessories, simply curve it towards you, recalling that it is somewhat more sensitive than dynamic type of microphone so its distance in relation to the operators mouth is seldom critical. A gap of about 15mm between mouth and capsule is about right for conversation-level speaking. (Should the stay-put property seem feeble after many periods of use, give the head a couple of clockwise turns to tighten the flexible helix.) For extra smartness in the final appearance and slightly increased rigidity, cover the helix (but not the collar) in heat-shrink sleeving [398-183], etc.

Desk Accessories

For a modern, miniature desk-accessory which is more versatile even than the tulip arrangement, the "Palm-Springs" unit is easy to build and simple to use. It is based on an abs plastics box measuring 85 x 56 x 40mm [502-348] with a gooseneck extending upwards from the lid to pass between the index and great fingers as it sits on the desk beneath the palm of your hand. A pair of p.t.t. push-button switches, set into the base, act as the front feet of the complete item which is then "palmed" down for transmission and released, to "spring" up again, for reception. Two versions are suggested, depending on how you prefer to take incoming audio with this item.

In the centre of the 56mm edge of the lid, drill an 8.1mm hole to mount a 4mm connector [444-618] having first removed the pin and reamed out the polypropylene very slightly. Prepare a 23mm gooseneck microphone and screw this into the connector's shell allowing the stay-put

helix to act as a self-tapping thread. This now becomes the edge which is placed at the rear of the reassembled box so that the gooseneck curves forward, over the hand, towards the mouth. Drill the front corners of the box base to take the pair of push-button switches [337-942] for the p.t.t. Later, fit a pair of stick-on feet [543-327] at the rear corners and add the weight of three strips of Plasticine (or similar modelling clay) inside the box, towards the rear. Divide the rear vertical (56 x 40mm) face and mark the centre points of each half panel. Drill one half for the grommet of a signals-tail and finish the other half in one of two ways. If headphone or monophone reception is preferred, drill for a DIN socket and wire accordingly. Otherwise, drill a 9.4mm dia. hole for a volume control (FO) and then drill the box base with a series of nine 4mm holes positioned to give a diamond shape grill for a 40mm speaker [248-476] to be fixed inside the box. The receive audio emerges through the base to be reflected at the desk surface, either side of the operating hand. In either version, you should wire the press-to-make contacts of both switches in parallel, so that the p.t.t. operates even if the palming action is unevenly applied. In the speaker version, connect the pot-wiper and the two press-to-break switch pairs in series to the speaker. This will ensure that the item can never satisfy an intercom or duplex operation where the close proximity of the speaker and mic element could otherwise result in acoustic feedback.

Dual Operator Outlet Box

In using CAIRO we should guard against the risk that two microphones may be connected together to one rig. We can assume that this is unlikely in single-operator working, but in dual or multi-operator working, the risk is greater particularly if both select headsets, say, and plug them directly into a multi-socket provision.

To avoid this, the principal function of the Dual Operator Outlet Box, the circuit for which appears in Fig. 2.1 is to provide a selection switch which determines who is the "active" operator and who is the "passive" operator or logger. The box, e.g. a diecast box [509-945], is designed for placement between two such operators, preferably being clipped under their shared desk, with each plugging his chosen accessories into the socket pair on the (89 x 55mm) side of the box nearest to him. The front panel (114 x 55mm side) has the central prominent switch, e.g. [316-591], wired and mounted sideways, so that its toggle points to the active side where the microphone and p.t.t. connections are presently routed. The opposite side is passive, having only speaker feeds, until the switch is thrown to favour this operator. Either side of this switch, on the front panel, two (FO) volume controls give independent adjustment of received audio for delivery at the near-by socket pairs.

On the rear panel, near to a third (NZ) volume control, a single socket supports auxiliary options. If neither operator needs headphone accessories, a speaker may be plugged here and its level adjusted. Conversely, when binaural headphones are in use, this socket becomes the in-feed for secondary audio (at pin-6) for connection to appropriate earpieces. This permits side-tone listening, for you to hear your own transmissions (received, for example, on a hand-held) to give a telephone-like reinforcement, or else an input from another source; e.g. an intercom between operators. Otherwise, a d.c. voltage may be fed in (to pin-7) for distribution at the other pin-7s. However, conflicts can arise with in-feeding so there is only ONE socket on the back-panel, so that only one type of in-feed can be implemented, at a time. (Generally in CAIRO, in-feeding through plugs into sockets, is strictly inadmissible for all signals and connections, other than this specific instance at this particular socket.)

Also, this socket has its further uses as a "break-in" to system signals. Tape-recorders may be plugged here to record incoming and outgoing traffic, via suitable buffer amplifiers, or p.t.t.-sensing lights showing the "On-Air/Stand-By" status of the link. Likewise, the many forms of non-vocal (data) communications terminals; e.g. Packet TNC, may be plugged here. However, this last option is usually required for single-operator, mixed-mode activities where typically, you would plug your voice accessories at one side and the non-vocal terminal(s) at the other, using the selection switch to make verbal identifications between the data exchange sessions, as required.

Along with the operator socket-pairs, the box sides include small switches, e.g. [316-973] to select the secondary audio into binaural headphones. In one position, these switches couple the normal received audio so that headphones behave monaurally. In the other position, auxiliary-socket audio is selected and, if none is provided, this mutes one ear. Without removing a headset, an operator may favour either ear for his "primary" listening simply by choosing which socket of the side pair to plug his headset; the sockets' pin-1 and pin-6 connections are crossed over. All remaining signals; mic, p.t.t. and d.c., are parallel wired, as shown in Fig. 2.1.

Dual Rig Selection Box

Shack or vehicle operating frequently involves a pair of rigs (e.g. v.h.f. and u.h.f.) and, for easy and speedy response to calls, our preferred accessory or accessory set should let us work either. The Dual Rig Selection Box is designed for this and leads to cross-band operating as well. Based on an abs box [502-348] two short signals-tails emerge one from each (56 x 40mm) side for connection to the adaptors of the two rigs. At the rear, a central CAIRO socket provides the speaker, mic and p.t.t. connections for a line to our accessories. On the front 85 x 40mm side, two purposely dissimilar sideways-mounted switches are for rig selection. One has a large d.p.d.t. toggle switch [316-519] and determines the source "receiver", from either the left or right transceiver, as pointed to. The smaller-toggle switch, a 3 p.d.t. type [317-190] determines which transmitter is operated in respect of mic and p.t.t. connections. If both switches point left, that transceiver is worked simplex and likewise for the right transceiver when both point to it. Alternatively, with the switch-toggles opposing each other, one rig is for transmission and the other for reception. With appropriate transceivers at the tails, this may become cross-band, or split-frequency, in-band working. Note that no combination of switches allows simultaneous transmission on both rigs.

Offset, but alongside the rear centre socket, an auxiliary socket is provided. Its primary audio (pin-1) output, being common with the secondary audio (pin-6) of the centre socket, delivers the deselected transceiver's output; the receiver switch being wired as a changeover for this purpose. This allows a speaker to be used to monitor the deselected rig, as required by good practice and licence conditions. All remaining pins are parallel wired so that, in all other respects, we again have a socket pair for two accessories. On a cautionary note, it will be seen, from Fig. 2.2, that the wiring unavoidably connects together the earth-screens of both rigs so they must be of the SAME polarity with respect to antennas, power-supplies, etc.

Active Modules

CAIRO opens up the opportunity of designing simple "active" modules, for in-line insertion, whenever some specific function, not normally present on a transceiver, is required. Active modules are characterised by their need for a d.c. supply, typically to integrated-circuit op-amps or comparators, of the type designed for single supply-rail operation, which ensure negligible loading effects and inject currents no greater than a micro-amp or so onto the line circuits. Such active modules could be gain blocks, side-tone oscillators, level detectors or active filters in fact the list is endless and beyond the scope of this article.

One active module worth considering is a p.t.t. indicator which can be used at the remote end of a CAIRO line. Where we are no longer able to see the rig we are operating, it can be reassuring to have an indication of the p.t.t. state, albeit a simple one. Although CAIRO makes provision for linking d.c., this is a case for a self-contained battery supply. As shown in Fig. 2.3, the battery return (-ve) passes to the body of a 5-pin DIN plug so the circuits are only completed when the plug is inserted; at the rear socket of the Dual-Op. Box, for example. A green l.e.d. [586-475], between (+ve) battery and pin-2, shows that the indicator overall is

operating. A red l.e.d. [586-475] is turned on, through a general-purpose *pnp* transistor switch, when the p.t.t. line is bottomed. The transistor ensures that l.e.d. conduction current does not appear in the p.t.t. circuit where it might compromise switching conditions or add noise to the mic signal in the series mic-p.t.t. configurations. If preferred, the flashing l.e.d. [587-080] may be used to make the "on-air" indicator more eye-catching still.

PW

Summary

In this concluding part, we have seen how CAIRO, through its use of standardised connectors and signals, can support many styles of radio operating and how it allows us to select the most appropriate accessories. Likewise, it simplifies our experimental design and testing of novel items. By the example of some boxes and modules, it has also been shown that items might be designed to enhance basic operating. Of course, it is not necessary to embark at once, on all of the items discussed but rather, to bring about a change to CAIRO as a series of piecemeal projects. Close friends who have done this already, say it's a rewarding experience when paced out over dark evenings. I hope that you find your personal journey "on the line to CAIRO" a pleasing one

Addendum

Please note that in Fig. 1.2 and Fig. 1.3 of this article, ohms signs were inadvertently added to the Mic low and Mic high notations. Mic high and Mic low, in fact refer to the signal potential and not the circuit impedance.

RS components are available from Electromail, PO Box 33, Corby, Northants NN17 9EL. Tel: (0536) 204555

All About Variable Capacitors

In these days of black boxes, not many amateurs want to undertake home-brew projects such as receivers or transmitters, but there are still quite a few interested in building their own antenna tuners or even their own linear amplifiers. Sean Lineham EI7CV looks at variable capacitors, a vital component in such projects.

Perhaps the most difficult components to find for such projects are wide-spaced variable capacitors. A few ideas about these may be of help to those who may be lucky enough to come across any of these rare animals at a rally or junk sale.

A typical case often met is the amateur who wants a 250pF wide-spaced capacitor and who locates a 500pF narrow-spaced unit which looks as if it could be dismantled and rebuilt. At first glance, leaving out the mechanical considerations, it might appear that if the vanes were to be extracted and reassembled to twice the original spacing that the new maximum capacitance would be 250pF. Unfortunately this isn't so.

The formula for capacitance in an air-spaced capacitor is:

$$C = \frac{\text{No. of gaps} \times \text{area} \times 0.0088}{\text{Dielectric thickness (mm)}}$$

where C is in pF and area is in mm^2

The total number of gaps equals the total number of fixed and moving vanes minus one. A typical example is shown in Fig. 1, and illustrates how the dielectric thickness is determined.

If the thickness of the individual vanes is 1mm and the original spacing between each pair of fixed or moving vanes was 2mm, then the dielectric thickness (or air-gap between fixed and moving vanes) was 0.5mm.

However, if we double up the spacers to 4mm and use the same number of vanes in the reassembled unit, the thickness of the dielectric has now been increased by a factor of three, from 0.5mm to 1.5mm. Referring back to the formula, the capacitance has been reduced to one third of its original value since the top line of the equation has been divided by 1.5 instead of 0.5 as previously. Thus, if we started with a 500pF capacitor and double-spaced it using the same number of vanes, the resulting unit would have a capacitance of 500/3 = 167pF and not 250pF as might have been assumed.

Reference to the diagram and the formula will show that if the original spacing had been 3mm with vanes of 1mm as before, the dielectric would have been 1mm. If these spacers were doubled to 6mm, the new dielectric would have been 2.5mm, so the reduction in capacitance would be by a factor of 2.5. This factor in each case will depend on the relative thickness of spacers and vanes.

In order to obtain the desired 250pF capacitance, while using the original number of vanes, new spacers would be required to give a dielectric thickness of 1mm, and it can be seen that 3mm spacers will give this result.

Alternatively, additional vanes would be required to make up the desired capacitance if the new spacing of 4mm was maintained. The number can easily be calculated using the formula given.

A word of caution to anyone planning a rebuilding job such as outlined previously, and particularly if the available capacitor is a receiver-type where the owner intends to pull out every second vane with a pliers (since these usually cannot be dismantled). Take care to ensure that the new wide spacing is not compromised by reason of the mechanical construction of the moving shaft and its clearance from the fixed vanes.

This point is illustrated in Fig. 2. A clearance point is from the fixed vanes where they are cut away to allow for the rotation of the moving shaft which carriers the moving vanes.

If this clearance is found to be less than that between the surfaces of the fixed and moving vanes, then there is a risk of flash-over in this area.

Next, a typical case of the capacitor whose value is not known and the purchaser has no access to a measuring bridge. A fairly accurate calculation can be made especially if the moving vanes are semi-circular. The area

$= \pi\ d^2/8$

where d = diameter of the vanes in mm.

A typical diameter might be 500mm, thus the area = $981mm^2$. If there were 15 moving and 15 fixed vanes then the number of gaps = 29. The thickness of the vanes must be determined. This can be done by comparing with feeler gauges or other pieces of known thickness. The dielectric thickness can also be checked with a feeler gauge. Alternatively it is easy to measure the total width across the complete bank of moving vanes. If for instance, there were 15 vanes and they measured 43mm across and if the thickness of each vane was 1mm, then the thickness of the 14 spacers between them would be 28mm - thus each spacer would be 2mm. The dielectric thickness is therefore 0.5mm. Referring back to the formula and inserting the values found we get:

$$C = \frac{29 \times 981 \times 0.0088}{0.5} = 501pF$$

A final word about minimum capacitance. This is the value when the moving vanes are fully un-meshed. This may be critical in certain applications such as antenna tuners to cover 28MHz where the design values of capacitance and inductance to give resonance are quite small. The actual value of the minimum capacitance will depend on the type of construction and the amount of metal in the framework. Some designs have a mere skeleton of metal bridged by slabs of ceramic or other insulating material. In theory, the minimum value should be zero, but in practice this will found to be at least 10 or 15pF. ***PW***

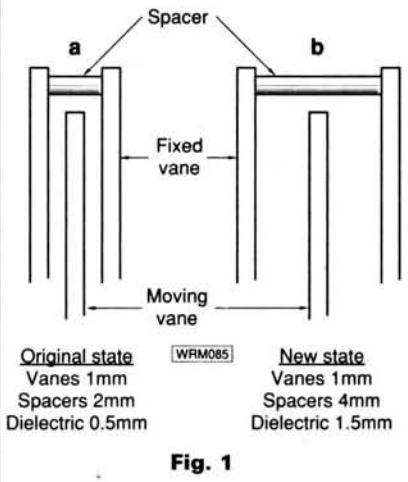


Fig. 1

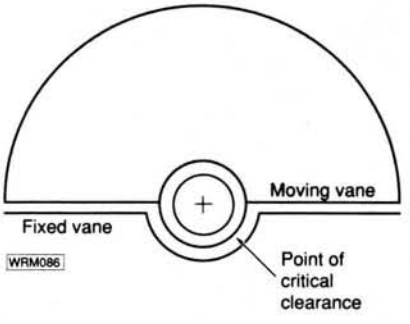


Fig. 2

Reading & Understanding Circuit Diagrams

(with a bit of theory thrown in)

In Part 16, R.F. Fautley G3ASG starts with frequency modulation and, later, deals with phase modulation.

We'll start with frequency modulation (f.m.) and go into a bit more detail than usual as this subject is more difficult than s.s.b.

Remember that for a.m., the **amplitude** of the modulating signal varied the **amplitude** of the radiated signal without varying its frequency. Well, for frequency modulation, the **amplitude** of the modulation signal appears to vary the **frequency** of the signal without varying its amplitude. Not quite so easy to visualise.

In Part 9, we looked at how an a.m. signal modulated 100 per cent by a 1kHz audio signal appeared on an oscilloscope and a spectrum analyser (Figs. 9.2 and 9.3). Here, in Fig. 16.1, is shown the spectrum analyser display for a carrier that has been frequency modulated by a 1kHz audio signal. The frequency f_c represents the carrier frequency signal and the dashed vertical line is the amplitude of the carrier when all modulation is removed. With f.m., there is no equivalent to a maximum or full modulation (like 100 per cent a.m.) as increasing the level of the 1kHz modulating signal only produces differing levels of carrier and sidebands spaced 1kHz apart (theoretically to infinity) above and below the carrier frequency. Increasing the modulation level increases the level of some sidebands, but it also **reduces** the level of others. In fact, at some particular levels of modulation, the amplitude of some side bands can actually be zero! The signal at the carrier frequency itself also changes in level and at some specific levels of modulation, like some sidebands, it can also vanish entirely. The power contained in the sidebands is lost to the carrier, with the **total** power remaining constant.

Earlier, it was mentioned that the audio modulating signal varied the frequency of the f.m. signal. How does this tie up with carrier and sidebands apparently being **static** in frequency but **changing** in amplitude? A bit of a paradox!

If we were to view the frequency modulated signal on an oscilloscope, the picture would tell us very little, it would just be a solid horizontal bar of r.f. signal. This shows that the **whole** output signal (as measured on an r.f. output power meter) does not change even when the level of the modulating signal is varied. However, if we were able to adjust the oscilloscope controls to show individual r.f. cycles, the change of carrier frequency due to the modulating signal would look something like Fig. 16.2c. The unmodulated carrier is shown in Fig. 16.2a and the modulating signal in Fig. 16.2b. The point marked "x" is the time when the modulation is switched on.

The three sketches are drawn to the same time-scale but the frequency differences have been exaggerated to show how the modulation affects the output frequency. Notice that at time "y" when the modulating signal is at its maximum amplitude for one polarity, the signal frequency is reduced to its lowest (cycles taking longer time). For the maximum amplitude of opposite polarity (time "z") the r.f. signal frequency is at its highest with the cycles taking less time and therefore closer together.

The **amplitude** of the a.f. input modulating signal determines by how much the carrier **frequency** is changed, i.e. if the a.f. signal level is doubled the amount of carrier frequency shift will also be doubled (provided that the frequency modulator stage has a linear relationship between a.f. level input and output frequency shift).

What effect does the **frequency** of the input audio signal have on the output signal? It determines the speed (or rate of change) at which the carrier frequency changes. Don't worry too much about that as we're concerned only with a simple explanation of how f.m. differs from other modes.

The amount by which the carrier frequency is shifted is called the "frequency deviation" and if this amount is divided by the frequency of the modulating signal, the result is called the "modulation index".

In UK amateur practice, the maximum deviation is limited to 2.5kHz and the highest modulating frequency to 4kHz. This results in a modulation index of 2.5/4 or 0.625.

With a modulation frequency of 300Hz and a maximum deviation of 2.5kHz, the modulation index becomes 2.5/0.3 = 8.333.

So what? What does this modulation index tell us? By use of Bessel functions (developed some time ago by a Mr F.W. Bessel) the amplitude of the various sidebands can be established for any value of modulation index.

As an example: For a modulation index of 2.405 the amplitude of the signal at the carrier frequency is zero, the first pair of sidebands is about 53 per cent of the unmodulated carrier voltage, the second pair of sidebands about 42 per cent, the third pair about 20 per cent, the fourth pair about 7 per cent and the fifth pair 2 per cent. Sidebands more remote from the carrier frequency are too small to cause much in the way of

Modulation Index	Value of Carrier	Sidebands 1st set	2nd set	3rd set	4th set	5th set	6th set	7th set	8th set
0.0	1.0000	0	0	0	0	0	0	0	0
0.4	0.9604	0.1960	0.0197	0.0013	-	-	-	-	-
0.6	0.9120	0.2867	0.0437	0.0044	-	-	-	-	-
1.0	0.7652	0.4401	0.1149	0.0196	0.0025	-	-	-	-
2.0	0.2239	0.5767	0.3528	0.1289	0.0341	-	-	-	-
2.405	0.0000	0.5300	0.4300	0.1900	0.0500	-	-	-	-
3.0	-0.2601	0.3391	0.4861	0.3091	0.1320	0.0430	0.0114	-	-
4.0	-0.3971	-0.0661	0.3641	0.4302	0.2811	0.1321	0.0491	0.0152	-
5.0	-0.1776	-0.3276	0.0466	0.3648	0.3912	0.2611	0.1310	0.0534	0.0184
5.52	0.0000	-0.3400	-0.1200	0.2700	0.4000	0.3100	0.1800	0.0800	0.0300

Table 1

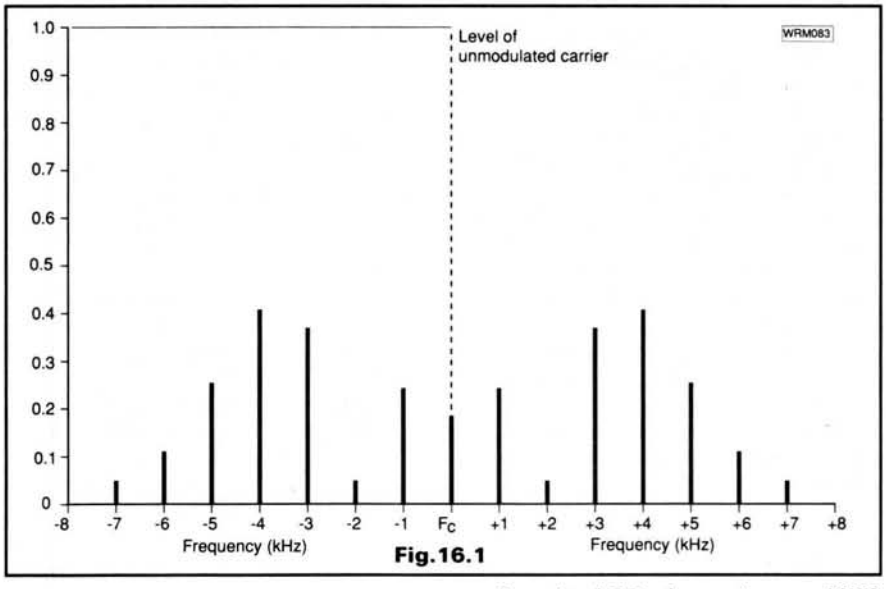


Fig.16.1

distortion when demodulated, but of course with high power transmissions those little bits of remote sideband power could cause interference with adjacent channel signals.

It was mentioned that the total transmitted power remains constant whatever the degree of modulation. Let's put in a few figures to see how this happens. For this we will have to put our trust in Mr Bessel's functions which appear in tabular form in the appropriate mathematical publications.

These figures (Table 1) are produced (for f.m. applications) for different values of modulation index. An unmodulated carrier is given a value of 1.0000 and all other values are relative to that value. All values given can be considered as voltage (or current), but not power, levels. Where a "-" appears it indicates that the amplitude of that particular sideband is negligible. A "0" means just that, zero.

What do the negative signs in Table 1 mean? Not a lot! They indicate that those particular sideband or carrier components are 180° out of phase with the others. They are just as real as all the others.

If we add up the **power** levels of each of the components for one value of modulation index, what do we find? Let's take the simplest case first - the unmodulated carrier. The value given in the table for the value of the unmodulated carrier is 1.0000. This means either a value of voltage or current. We'll use voltage for our examples and assume that the output power value is developed in a 50Ω load. A further assumption will be that 1.0000 or (100 per cent) represents 100V r.m.s.

Then, our umodulated carrier power will be:

$$P_{carrier} = \frac{100^2}{50} = \frac{10^4}{50} = 200W$$

So we have 200W of unmodulated carrier power. What happens when we modulate at a level where the modulation index is 2.0? This could be a modulating signal of 1kHz at a level to provide a frequency deviation of 2kHz.

$$\text{Modulation Index} = \frac{\text{Frequency Deviation}}{\text{Modulation Frequency}} = \frac{2kHz}{1kHz} = 2.0$$

Referring to the table for Modulation Index of 2.0. The carrier level is given as 0.2239, and as 1.0000 represents 100V r.m.s. then 0.2239 will be:

0.2239 x 100 = 22.39V r.m.s.

and the power level of the carrier:

$$\frac{22.39^2}{50} = \frac{501.3121}{50} = 10.026242W$$

Now look at the first pair of sidebands (which would be spaced 1kHz each side of the carrier). They are given a value of 0.5767 which corresponds to a voltage level of: 0.5767 x 100 = 56.67V r.m.s.

Thus the power in one sideband will be:

$$\frac{57.67^2}{50} = \frac{3325.8289}{50} = 66.516578W$$

That's the power in **one** sideband, so the power in **both** of the first pair of sidebands will be:

$$P_{1st\ sideband} = 2 \times 66.5165578 = 133.033156W$$

The level of the second pair of sidebands is given in the table as 0.3528. So the voltage level will be:

0.3528 x 100 = 35.28V r.m.s.

and the power in one sideband of the second pair:

$$\frac{35.28^2}{50} = \frac{1244.6784}{50} = 24.893568W$$

The power in the second pair of sidebands will be:

$$P_{2nd\ sideband} = 2 \times 24.893568 = 49.787136W$$

For the third pair, the level is given as 0.1289, so the voltage will be:

0.1289 x 100 = 12.89V r.m.s.

and the power in one sideband of the third pair:

$$\frac{12.89^2}{50} = \frac{166.1521}{50} = 3.323042W$$

The power in the third pair of sidebands will be:

$$P_{3rd\ sideband} = 2 \times 3.323042 = 6.646084W$$

For the fourth pair the level is 0.0341, so the voltage will be:

0.0341 x 100 = 3.41V r.m.s.

and the power in one sideband of the fourth pair:

$$\frac{3.41^2}{50} = \frac{11.6281}{50} = 0.232562W$$

The power in the fourth pair of sidebands will be:

$$P_{4th\ sideband} = 2 \times 0.232562 = 0.465124W$$

Power in sidebands further removed from the carrier, although there, would be very small and may be ignored.

Let us now add together the various powers that have been computed.

$P_{carrier}$	=	10.026242W
$P_{1st\ sideband}$	=	133.033156W
$P_{2nd\ sideband}$	=	49.787136W
$P_{3rd\ sideband}$	=	6.646084W
$P_{4th\ sideband}$	=	0.465124W
Total Power	=	199.957742W

In the first calculation we made for the unmodulated carrier we found the carrier power was 200W. Our last total was 199.957742W. Quite close! All the other small sidebands added together (remember there is an **infinite** number of them) only total 0.042258W.

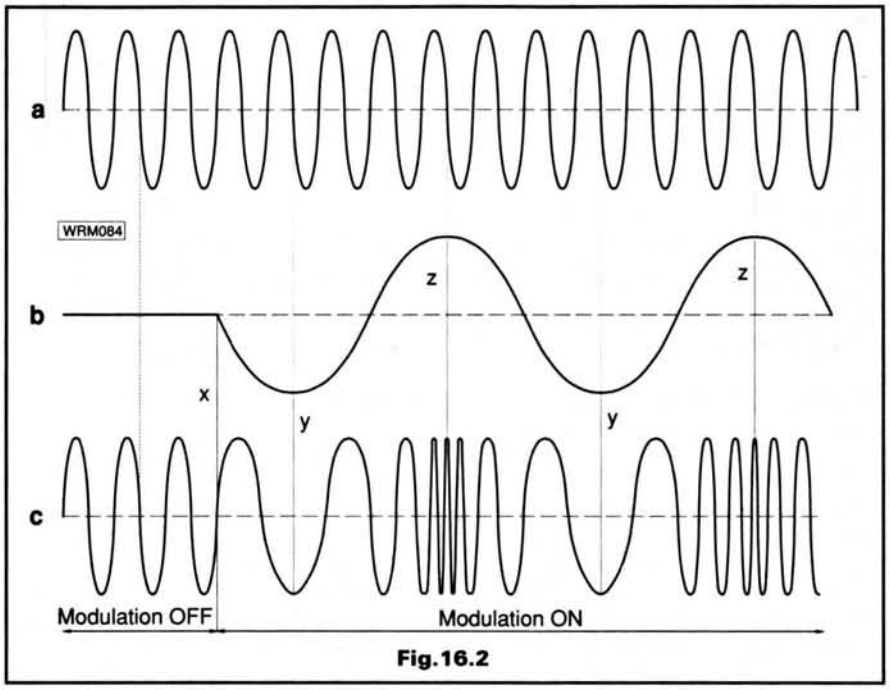


Fig.16.2

Even though we have modulated the carrier, there is no actual change in output power level.

In conclusion, let's restate the apparent paradox. For frequency modulation it appears that the amplitude of the signal does not change when modulated, but the frequency varies. Spectrum analysis of the frequency modulated signal shows that the carrier **frequency is constant** but varies in amplitude, and all the sideband are also **constant in frequency** but they also vary in amplitude!

In the a.m. case we found that the carrier was constant in both amplitude and frequency, the modulation only affecting the amplitude of the sidebands.

It's all a question of mathematics, dealt with in the standard text books. Yes, I suppose it is a bit if a get-out, but this series is **not** intended for the budding professional radio engineer, but for those who have followed other disciplines and want to learn more about the hobby. In other words it's written to try to help those without a formal radio or electronics background to recognise circuit diagrams and start them on the path of wanting to know a bit more about how bits of hardware used actually work.

Enough about frequency modulation - what about phase modulation? What's the difference between f.m. and p.m.? Well, one difference is that if the modulating signal were to be a square wave, in the case of f.m., the signal frequency would change rapidly up (or down depending on the polarity of the modulating signal) and then **stay constant** at the new frequency as long as the amplitude of the modulating signal remained constant. When the modulating signal reversed polarity during the next half cycle of the square wave the signal frequency would change very rapidly in the opposite direction through the original unmodulated value to a new frequency where it would remain constant until the modulating signal again caused it to change. This system can be used for frequency shift keying (f.s.k.) when sending teleprinter signals (another story!).

If that same square wave signal was applied to a phase modulator it would

produce a very different effect. During the **very short** period of time when the square wave was **changing** its polarity, the signal frequency would change **very rapidly**, first in one direction and then in the other, finally reversing again to finish at the same frequency it started at, the unmodulated frequency. The signal frequency would then remain constant until the modulating square wave reversed its polarity when it would go through a similar routine during the very short change-over period, again finishing at its original unmodulated frequency for the duration of the half cycle. For the mathematically minded this is a form of differentiation. Hopefully there are not many square waves in speech or the resulting distortion would be disastrous! Most speech waves are mixtures of bits of different frequency sine waves and as the maths fanatics will know, a differentiated sine wave is only a cosine wave, which is exactly the same shape just moved a bit in phase. In practice, as long as we limit the low frequency end of the audio band to be transmitted any distortion can be minimised. Why limit the low audio frequencies? Well, with pure f.m. we wouldn't need to because if we apply the very lowest frequency signal, 0Hz or d.c., to a frequency modulator it would simply shift the frequency to a new, constant, value until the modulating signal was removed or changed (f.s.k. again!). Using phase modulation, as we've already found, this doesn't happen, but if we ensure that low frequencies (like 0Hz, d.c.) never get near our phase modulator then we can happily transmit speech even if it has a bit of phase shift.

Another difference between p.m. and f.m. is that with f.m. the amount of deviation is dependant only on the **amplitude** of the modulating signal, whereas with phase modulation the deviation depends on the **frequency** as well as the amplitude of the modulating signal. This difference results in phase-modulated signals having a built-in pre-emphasis. This pre-emphasis is just another name for what audio people call "top-boost", with a 6dB per octave increase in output for constant amplitude audio input signals of varying frequency. A 6dB increase (as we discussed in the part about decibels at the start of the s.s.b. section) means a voltage increase of two across a fixed resistance. The phrase "per octave" simply means for each time the frequency is doubled.

That is, if the audio input signal frequency is doubled without altering its amplitude, the phase modulator output deviation will be doubled. If the same audio signal change was applied to a frequency modulator the amount of frequency deviation would not be altered. To overcome the p.m. pre-emphasis a **top cut** of 6dB per octave, applied either to the microphone amplifier of the transmitter or to an audio amplifier stage of the receiver, will restore the frequency response to make the speech sound more natural. As speech signals contain most of their power in the region below 500Hz and progressively less at the higher audio frequencies it is sometimes advantageous to allow the pre-emphasised signal to be transmitted and use the top-cut in the receiver. By this means the higher frequency noise introduced by the receiver circuits is attenuated without cutting the higher speech frequencies below their original level. Whichever method is used, a low-pass filter cutting the audio frequencies to the phase modulator very sharply above 3000Hz is necessary to avoid transmitting signals which could cause adjacent channel interference. Such a filter should be fitted as a matter of course to amateur transmitters whether a.m., s.s.b., f.m. or p.m. Filters will be the subject of a future article.

Finally, f.m. can only be applied to **oscillators** because the **frequency** of the output signal is actually changed, whereas p.m. can also be applied to stable frequency stages such as tuned buffer or frequency multiplier stages.

What about some circuitry to go along with the theory? That's in Part 17!

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What Gives?

First, let me acknowledge with thanks the efforts of the *DX Bulletin* (VP2ML), *DX News Sheet* from RSGB (G4DYO), *The Canadian Amateur* (VE3JLP) and *The DX Magazine* (VP2ML again), and of course the input from all you good folk out there - no column such as this could survive without this sort of help.

As usual, though, much of what I hear about will have come and gone by the time the column reaches you, alas .... if ONLY people would give adequate advance notice of their activity!

The Laccadives operation back in March yielded some 30 000 QSOs to VU7APR/NRO, while the T33, Banaba Is effort by Jim Smith and Co netted some 27,231 contacts in eight days - some 260 contacts an hour. Following the Banaba job, Bob KN6J has popped up as T27RA, though Jim Smith returned immediately to Norfolk Island.

At the time of writing, the Yasme expedition, Lloyd and Iris Colvin, are in Russia and signing with various Russian calls, while in a different part of the world, ZS1IS is on from Walvis Bay for which, I understand, new country status is being sought.

UB5JRR will be in North Korea during the first week of July, and I understand that while there he will attempt to organise a P5 licence; should this come to fruition, it only needs some activity for P5 to adorn the DXCC list.

Further ahead, there is news of a trip to Sable Island (CY0DXX) for August-time; no more details at the time of writing.

If you hear a station with a Canadian accent signing with a CH prefix, it is a "special" from Ontario; CJ1PEI is another VE special, on Prince Edward Island.

Those of you who worked 5R8VT, Vince Thompson, will be pleased to know that the DXCC Desk have now accepted his cards for DXCC credit.

Alas, there are always some people who have lost interest in life: this time it is UL7PAE who reckons and hopes he will be able to activate Spratly.

ZL amateurs may be signing ZM for the rest of this year, while T5CT is N4CT, in Somalia for two years. 9Q5NW, Tom Gregory, has now finished his African stint, while SU1EE is slated to move to Zaire later this year.

Finally, if you come across a 6Z, it's a special Liberian prefix.

The Bands - as You Saw Them

Let's make a start with the WARC Bands for a change. Here the first news is that by the time this reaches you there is a possibility that the 18 and 24MHz bands may well be fully released to us; the relevant date will be July 1. Since at the time of writing this isn't 100 per cent firm, I suggest you contact your RSGB RLO for the latest information, or just wait for the Good Word.

G4ZMI (Headless Cross) found W4BMO, VK7ZO, ZL1AIZ, ZC4BS, OZ1EUO, W1HXU, SM4GND, HB9KV, VE3FIN, PJ2AM, VK1FT, VK3BW, NR3V, HB9GDV, SM5IZ, DL1MEW/HA, VE3MRX, DK1KH, 9M2FS (the first-ever pile-up noted on this band!), VE1GI, 6W6JX and KA1PE.

Now we turn to **GM3JDR** up in Wick; Don offers 10MHz with UM8MBA and JA1FYC, 18MHz to AI6L, 4U1ITU, TU4CO and CR8CWT; as for 24MHz, the crop included OK1AEX/5N0, 3B8CF and ZD8IAN.

G2HKU (Sheppey) mentions an odd quirk of the 18MHz band, in that he has noted a dearth of VK2 and VK3 stations, although there are quite a lot of VK4s about. Ted still made his number with TA2B, VU2IN, HK7/SM5HV, ON6CW, VK4XA, LU4KV, K2LPO, VK4LX, VE3OZO, K1BDP, EA8ATB, VK4BRZ, N3EWF, PY6WT, W3DP, KR3Y and LU3HAN.

The 28MHz Band

Now here is a band that, until a decade ago, spent at least half of its useful life in slumber; but now the top end is filled with repeaters and the lower segment shows signs of activity even at sunspot minimum. However, it does show the seasonal variation more noticeably, at least at this QTH, than the lower bands.

GM3JDR first; Don stuck to s.s.b. on this band for a change, and this way raised UZ0AWB, ZP5JY, FG/DK8FZ, LU6ETB, LV3F, FM4EB, AZ5D, ZX5C, ZP0Y, C45A, ZV5JD, 6W7OG, HK7MQC, 5H1HK, P33ES, YC2EMK, S79T, DU1NH, YB1BI, TR8SA, HK1LOG, 4Z8UG, AZ4F, 3DA0DX, N5GMQ/DU1, TA3D, 5H3TW, UM8MK, 5N3BHF, LU6DWN, J52US, CE1LGD, TI2AOC, XF4L and VP8BFM.

Next we turn to **GM4XQJ** (Lauriston) who breaks a long silence to tell us he now has an Argosy 2 down below and a TH3 up aloft at 14m; while for the lower bands there are delta loops and a trapped dipole. Brian says his call is being pirated on 7MHz s.s.b. and more recently even on c.w. - if anyone knows anything, please let GM4XQJ know! As far as 28MHz goes, the c.w. managed K6CXB/MM, GM4TSI and ZZ5KP; while CX7BL, LU4UZ and VQ9LW were all raised on s.s.b. The last-named causing, naturally enough a little celebration!

Apart from his specialisation on 18MHz, G4ZMI does occasionally wander on to 28MHz, where c.w. raised CX7BBB, LU2FFV, 4X6DT, PT9BZ, LU1CMG and PY2JBS.

Now we must pick up another contributor who has not been heard of lately: **G0JBA** (Sittingbourne) has moved to a new QTH where he awaits a planning permission for a mast of 14m. Meanwhile, Phil either operates mobile with a G-Whip on 7 and on 28MHz with a modified CB while using the IC-735. The 28MHz mobile operation has yielded 5B4ES and UZ4AZG. A spot of portable operation from the QTH of a local s.w.l. friend, using a half-wave vertical, resulted in contacts on s.s.b. with CT3BX, C45A, HC2G, K5UA, LU1EYW, LU6ETB, LZ7W, N4ZZ, NP2CM, UO5GLB, VU2RX, ZP0Y, IX5C, 4Z8UX, 5H1HK, 8P6SH, plus W6AB/M and G4UGB/M both raised on a Chicago repeater!

Conditions have changed on this band, mentioned **G3NOF** (Yeovil); Don found hardly any North American signals on the direct path, although a few were heard when beaming south; Africans have been heard in mornings and afternoons. A few Asian signals were heard around 1400 on the short path, with JAs noted about 1000; South Americans have come through at various times between 1000 and 2100Z. Contacts using s.s.b. were registered with CE3ESS, CE9EVG on King George Is, S. Shetlands, HL5BDS in the same area, EL9X, FH/DL7FT, FS5DX, FS5T, FY4FM, HL1WP, JA3MDG, P4OYL, RF8V/UA9FXJ, S79J, TI2CF, TI0ARA, VE2YU, VO2AC, VP8BFM (Falklands), VP8AWA (Falklands), YB0CN, YE0AX and 4J1FS.

S. Wilson (St. Andrews) had the odd listen on the band and among the Europeans Stuart noted were LU7DID, SO1A, U6HY, YB2CTW, ZS8MI, ZC4AB and 3C1MB.

Just one contact on the band for G2HKU, namely c.w. with 5B4ES.

Top Band

It may be recalled that last time round I was discussing the improvement I was making to my l.f. band antenna; about all I need to say on that score is that I seem to have laid an even bigger egg this time!

G2HKU offers his s.s.b. contacts with ON7BW and F3NG, plus a c.w. one with ON4CW.

Otherwise, on this band, the silence has been quite deafening; but of course one must always recall that this is the time of year when many of the real DX types disappear until the static falls away a bit. That being said, though, there is little doubt that the chap who has a good antenna can still find some DX on the band if he knows his onions..... so where is all the news???

The 3.5MHz Band

The band where yours truly has been most active this month - twice, on the local Sunday net!

Seriously though, most of the DXers on this band seem to hide their lights under a bushel, and maybe rightly enough when one listens to what happens when a bit of DX pops up sometimes!

Stuart Wilson mentions hearing DK0HR and LA6MP, and then hastened off to the higher bands!

Angela G0HGA (Stevenage) wrote right on the deadline to note that she now had a couple of watts on 3.5MHz on loan, which one gathers had been lent by a member of the G-QRP Club. Once she got it home, the rest of the evening was devoted to connecting and tuning up, so a start was made on the morning of May 30, when between 0615 and 0730 Angie connected with G2CNN in Norfolk, ON4AGJ in reply to a CQ call and then G2BB for a long natter, after which the band was nodding if not actually asleep for the day! On a different tack, Angie still has the 27m of end-fed, but is thinking of trying a trapped inverted-vee for all bands soon.

The 7MHz Band

It was c.w. all the way for GM3JDR, who mentions S79M, UP0BB, DK6AS/J4, UA0ZDN, UA9CM, ZP5XDW/ZW6, JH1DTC, W7QK, W6TSQ, W7RK, W7ZX, VE7QH, VK5FE, UA9JEO, ZL1AZE, JA3MXE and VP8BFM.

The s.s.b. from GM4XQJ (the REAL GM4XQJ!) made it two-way with G2DSF, G3XZX and GM4BQF; c.w. was preferred for DL0KBM, F5MA, G3GVY, G4EZF, G4LDE, G4RAR, G4VFV, G4VPV, GI4VIV, G8PG and GB0WAV/MM.

As for Phil G0JBA, his mobile operation on the band yielded PA3BMJ, SM4SET, FD1MOO, GW4MNQ/MM and LX1EA.

Just one for G2HKU, namely c.w. with KP2J.

The 14MHz Band

G3NOF has the first go. Don reckons the band has been open day and night! From 0500Z the long path has been open to Western North America, VK/ZL, Pacific area and often South America too! In the afternoons the short path from 1500Z has been open to Asia, JA and VK. Africans were also heard in the afternoons and South Americans again in the evenings. Contacts using s.s.b. were booked with AH6EI, D68CY, DU1KWT, DX1MK, EO2R, EO0AAK, EP2HZ, EW0CL, FK8FB, FR4FA/P, FS5R, FS/JA8RWU, HC1EA, HK1HHX, HK0EFU, HL1WP, JAs, JW5E, KV7S (Arizona), N1DOH/KL7, NC7K (Nevada), OY1A, SU1ER, T77M, TI2JJP, TL8NS, TZ6MG, UA1OT (Frans Josef Land), UA0FAA (Zone 19), UZ1AWA/W6QL, V85AH, V85NR, V44KAM, V44KAS, VE3FBU/6Y5, VKs - VK0GC (Macquarie Is), VP2EXX, VP2E/JA2EZD, VR6KY - YN4CB, YS1FB, YS1GMV, Z22JE, ZL7TZ, 3D2ER, 4J1FS, 5T5CK, 9M2HB and 9M8PV.

For GM3JDR it was a c.w. band: contacts were made this way with ZS5FO, 1Z9A, LU1HDC, UA0IDD, UA0XAJ, U0GA, JX7DFA, UA0Y, US0SU, EK0BP, UZ0KWO, JL1DBI/JD1, HL1EJ, YN3CC, VK5KA, VK2BDS, SY8MO, TW0AA and XF4L.

Now to G2HKU who mentions VK3XB, VK3KS, VE3FXR, LW1EZK (=LU), KL7PJ, W8VSK, RA3YG/UA1 (Oblast 114, Arctic), K4KQ, HK3RQ, CM8LY, N6EA, VK3MJ, HK3HY, VP2MT, VK4XA and TA2BK, all on the key.

Next GM4XQJ and his QRP; his crop included DL1LZ, HQ7R, NK7V, UW9YS, W2JAJ and Y38TN.

The 21MHz Band

Stuart Wilson managed to find the odd Slim on this band, plus crops of W/A/K/N, BY7HY, CN2AQ, G3GJQ/5N0, JAs, J37AH, LU8DPM, LU1EYT, PY0FF, TP4OCE, TL8NS, various Russians, YB/YC signals, 4S7DK, 5H3RO, 5N7DH, 6W1NQ, 9V1XB and 9M2ZZ.

Now to G3NOF who notes his s.s.b. contacts with A35KB, CE0MTY (Juan Fernandez group), EU7L, EW6AA, FH/DL7FT, FS5DX, FS5R, IY0INU, JAs, KE9A/DU3, KG4FB, KH6IJ, KH6XT, KL7TC, KL7XD, NH6GC, NL7MF, P40P, RA3SS/R0B, RF8V/UA9FXJ, T33JS, T53RC, TL8NS, UA0FF for Zone 19, UA0QIO, UA0QO, UR1RWX/W6QL, UZ0OWF, UZ0QXU, V85AH, VKs, VK0JV at Casey Base, Antarctica, VP2EXX, VP2E/JA2EZD, VQ9LW, VU2AU, VU2WAP, XE1CB, YB/YCs, YI7EDZ, ZK1DD, ZK1XV, ZL4BO, ZL0AFY, ZY0SS, 4J1FS, 5B4WW, 5W1IB, 5T5CK, 6O1YD, 6W1NQ and 9M2ZZ.

The s.s.b. signal from GM3JDR was put out to ZV5JD, C45A, 6W7OG, HK7MQC, FG5R, UA0FF, US0SU, and some JAs, while the key was plugged in for KP2BL, ZL1BSG, UA0SKO, XF4L, YC6KOS, YB6ZAP, ER4L, RA100/RA0K, KZ5Z/DU1, VS6DL, UA0CDS, LW1EZK, VS6UW, DK6AS/J49, ZL1BAG, JX7DFA, ZL2ALJ, TL8TG, TP40CE, 5N0JKO, YC2UDH, LU3XPM, D68JL, S01DX, XE3ACQ, HL1WP, ZD8IAN, 3B8CF, OK1AEX/5N0, KN0E/KH3 and JAs.

Now to G2HKU, who says that he managed to hook JE5CXD, W2LZX, W5XJ, W8VSK/M, N5TP, LU1ICX, CE3HDI, W2RHQ, JA1AYC, K6GG and K7GE/M driving through Montana.

Finally GM4XQJ, who mentions his low-power raising 3D2YY, RB4IYO and YC0HET, leaving the keyer to deal with AA4VD, CX1AC, JA1FSN, JH1WIX, JI1PIL/MM, JP1ROA, K0CDJ, K1AR, K3IPK, KG5U, KU8E, KR2Q, PY1AJK, PY3DK, RT0U, UA4CBO, UA4CBD, UA6AQV, UL8LXQ, UV9WZ, and WD4EIZ.

Correction!

G0FGB (Cranleigh) writes to dissociate himself from the bit in April's issue from PA3EUS, whose G call I gave as G0FGB. Obviously a typo error for which I must apologise; alas for my checking system letters more than a few months old are consigned to the "Outer Darkness" so that I may have room to live here! So, to PA3EUS and G0FGB my apologies.

Vale

So many for mention this time, alas, so I shall have to be briefer than I should. First, A.E.J. Cooper G5VT, of Bishops Stortford. To talk to alone, Jack was a fascinating man; and yet in even a small company a person who would do his utmost to efface himself from memory. An odd make-up for a man who would be for many years nearly, if not, the top G on the Honour Roll. In his professional life, I am told he was also at the top of his tree, although he never ever spoke of it himself. His other hobbies were his stamp collection and his large garden. This was one of the greats in Amateur Radio, and for the few of us who knew him, a man who will sincerely missed.

Another one who will be missed by his friends was Ken Eddy G3TIO; for many years Ken lived in a breathing apparatus, and indeed he was so afflicted when he came to amateur radio, which is how I came to know him. However, his humour and personality was an inspiration. We will miss Ken, too.

F.H. Humphris G5IZ was another known personally to me; even from over thirty years ago I can recall being a member of RNV(W)R of whose Birmingham unit G5IZ was in command.

G. Garratt G5CS, one recalls for his occasional contribution to this column and in particular for his resolution of the technical mystery of how Marconi's signals managed to propagate across the Atlantic and be heard with the equipment of the time, which I ran in the old *Short Wave Magazine* a decade ago. Gerry was for long an adornment to the Science Museum of course, and was instrumental in the setting-up of the amateur radio station there.

Some others, less well known to me, but nonetheless to be missed, include OM Derrick, GM3OM, G2DMR whose dulcet tones we recall so well in Top Band pile-ups back in the sixties, G2KA and G5JL. All, in their various ways, put back into amateur radio far more than they took out, and all will be sadly missed.

Kitty Hurrell G0IMR, XYL of G3NBC died on May 25. She had not been licensed for long, though interested for many years. G0IMR had shown herself to be a fine DX-chaser and operator. Our sympathies to her family in sad loss.

THE NEXT THREE DEADLINES ARE JULY 26, AUGUST 23 & SEPTEMBER 27

VHF Up

David Butler G4ASR,
Yew Tree Cottage, Lower Maescoed, Herefordshire HR2 0HP.

Sporadic-E

Within the next few weeks the Sporadic-E season should be coming to a close. I only wish I could be giving details now of all those fantastic openings you have been experiencing recently on the v.h.f. bands but because of the necessary lead times for this column I am having to write this in late May, somewhat before the season really gets going. I hope you all managed to get some choice DX in the log book. If not, there's always next year to look forward to. Details of what you may have missed and what others worked will be featured in next month's column.

Meteor Scatter

The months of July and August provide not only an increase in the daily sporadic meteor count but also include periods of some of the better meteor showers. Some of the more usable showers are tabulated here with the day of maximum activity indicated in brackets. A word of warning though before you start using this mode of operation. A very large number of stations make invalid QSOs especially when using **random** operation. Particular attention must be paid to the exchange of information. For a QSO to be valid **both** operators must have copied **both callsigns**, the **report**, and also a **Roger (R)** to confirm that the other operator has done the same. Meteor scatter QSO procedures, as used within IARU Region 1, are occasionally modified at scheduled European VHF Managers Meetings and it is therefore very important that a copy of the very latest procedures are at hand. If you have any that are dated prior to 1988 send me an s.a.e. and I will provide you with the latest regulations plus the 'ASR guide to practical m.s. working.

Meteor Showers

Alpha Orionids	July 9-15 (July 12)
Nu Geminids	July 9-18 (July 12)
L Geminids	July 4-29 (July 12)
Capricornids	July 10-Aug 15 (July 25)
Delta Aquarids	July 12-Aug 18 (July 27)
A Capricornids	July 15-Aug 25 (Aug 2)
Iota Aquarids	July 15-Aug 25 (Aug 4)
Perseids	July 20-Aug 23 (Aug 11)
Chi Cygnids	Aug 19-22 (Aug 19)

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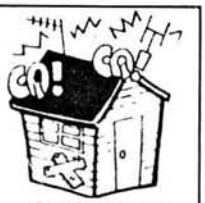

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The 50MHz Band

The month of May saw an upsurge in Sporadic-E (Es) openings allowing the normal European theatre up to 3500km to be worked with ease. On many occasions various countries could be worked via Es backscatter. The principle of this is very simple. Areas that are reflecting signals via the E layer may also scatter weak signals back in the direction of the transmitting station. Two stations, located in the same approximate area, such as G and PA, may communicate via this backscatter mode by aiming their antennas in the direction of the ionised layer. Signals are essentially weak, typically S1-3, but the advantages are that operators can work squares that are not easily worked on tropo, due maybe, to local obstructions on the direct path. Of more interest were the frequent two-mode openings consisting of Es plus Trans Equatorial (TE) propagation. This Es + TE mode occurred on many evenings from approximately 1700-2000UTC giving contacts into Africa and South America. It was interesting to note that in many openings some operators get stuck in the, "I must work him because he's so strong" mode and miss out on the rare countries. The moral is that whilst the boys are bawling and shouting at the S9+ local Europeans you should be tuning up and down looking for the real DX that is often present.

Dave Glover G1VJP (MSY) writes to say that his 50MHz equipment is now dismantled as it seems quite pointless trying to compete with stations supposedly running more than the legal e.r.p. levels. Dave's claim that his 20W to a 5-element Yagi isn't competitive enough is on first thoughts understandable. However, 50MHz is one of those bands where the important thing is to be in the right place at the right time. Another factor worth considering is that it is better not to compete with other stations but to winkle out the DX stations yourself before getting into a pile-up situation. Perhaps the following reports will give Dave second thoughts about leaving this exciting band.

Earlier in the year **Mike Chapman GM4IGS** (IO75) running 15W to a 5-element Yagi worked LW1EKH 559, LU7FA 53 and CX4HS 57 (GF17). LU8DIO and LU3EX were also heard but were too weak to make contact with. In another opening J52US (IK21) was easily worked as were a number of 9H1 and F stations.

Bill G6NB reports that his activity on all bands has been very low recently. The only contacts worth reporting were ZS6XJ and ZS6BMS on May 5, I4RPJ via crossband on May 15, CT1DTQ on the 20th and T77C on the 22nd. On May 15 both the ZB2VHF (50.036) and CT0WW (50.030) beacons were heard for most of the day but with no sign of any stations active from those areas. Bill mentions that all the above stations have been worked from his poor Bicester location with a maximum power of 10W from an FT-726 into a 3-element Yagi at 10m.

An upgrade to the 50MHz station has taken place at the QTH of **Paul Baker GW6VZW**. A 3-element MET Yagi at 10m above ground has replaced the original 2-element Yagi. An FT-690 and 12W amplifier complete the set-up. On May 5 Paul worked EA1MO and CT1DTQ and heard CR2LN, 9H1GB, ZR6A, ZS6BMS and ZS6XJ. A new county, Shropshire was all the good openings on 50MHz; worked a few UK stations but got no new counties. He had better luck on May 20 when on hearing Frenchmen on the band he fired up the 400 milliwatt p.a. and promptly worked F6BNX (JN33). Dave says he was quite happy with the results so far with the QRP system.

May 5 was a red-letter day for **Ela Martyr G6HKM** (ESX) as she not only picked up a new square KG46 by working ZS6LN but also got three new countries by working 9H1GB, CT1DTQ and EA1MO.

Clyde Hinton G1TCH (SXE) reports that his FT-726R is working again and that two new countries in the shape of ZS and SV have been worked. On May 5 Clyde worked ZR6A, ZS6BMS, ZS6WB, ZS6XJ and 9H1GB between 1620-1710UTC. Openings into France occurred on numerous occasions throughout the month allowing four new squares to be worked. ZS6CE was worked on May 11 and a new country, SV1OE was worked at 0700UTC on May 19. The period from May 20-29 included direct contacts with CT1DTQ, 9H3KD, 9H4W, 9H25CG, PE1MVJ/MM (JM85) and crossband QSOs with HB9AMZ, HB9MY, IK5EHR and AM7TSA a special event station in Spain.

At the station of **G4ASR** (IO81) the month of May started off favourably with ZS3E being worked on the 1st but all went quiet for nearly two weeks until the 14th when conditions picked up again and a number of stations in Southern France were worked. On May 16 the Es + TE propagation gave contacts with ZS6BMS and 5H1HK (KI93) on Zanzibar. Beam-headings for both stations was 135 degrees, and, although correct for 5H1HK, was 25 degrees east of true bearing for ZS6BMS. This is typical of some of the two-mode propagation paths. The band was in good shape on May 18 with widespread openings throughout Europe giving contacts with F, PA, OH, LA, 9H1 and PE1MVJ/MM in IM86. Propagation extended to Africa giving QSOs with ZS3E at 1727GMT and 5H1HK at 1750UTC. Within two hours the TE path had shifted to South America giving David contacts with LU8DIO, LU8AHW and LU9AEA between 1920-1945UTC. The opening was very localised at the Argentinian end with all stations being located in square GF05. Other openings throughout the month included 4X1IF worked via crossband and SV5TS heard on May 20, T77C worked and 5B4AZ & 5B4CY heard on May 22 and SV1AB, SV1EN & SV1OE worked on May 27. The beacon SV1SIX (KM17) on 50.039MHz was heard for nearly three hours during the opening to Greece. The ZS3VHF and ZS3E/B beacons were heard at 599 on May 30 but no other stations were active. An Aurora on May 24 gave contacts with GM0HSC, GM4JEJ, G4HBA, G3LTF & G3JVL and although GB3RMK was heard auroral throughout the evening no other stations were copied.

The Radio Amateur Association of Greece announced that up to 25 experimental 50MHz licences were made available from April 27 on a secondary non-interference basis. The permitted band is 50 - 52MHz with all narrow band modes being allowed, f.m. telephony is not permitted except in an emergency. The permitted power is 25 watts at the output of the transmitter and there are no restrictions on the polarisation, height or gain of the antenna. For the time being the licences are being issued to stations

	Band (MHz)			
Station	1296	430	144	Total
G3IMV	48	124	412	584
G4KUX	—	120	372	492
G3UVR	82	135	246	463
G4RGK	50	124	284	458
G0DAZ	27	128	277	432
G3XDY	89	147	196	432
GJ4ICD	59	119	254	432
G3JXN	87	134	179	400
G1EZF	—	93	263	388
G4XEN	—	111	274	385
G6DER	78	110	183	371
G6HKM	45	107	197	349
G4RRA	—	80	255	335
G3COJ	44	103	186	333
G4DEZ	48	37	248	333
G4SSO	—	93	229	322
G4FRE	72	146	102	320
G4TIF	—	110	200	310
G1KDF	37	98	174	309
G4DHF	—	—	307	307
G1EGC	23	80	198	302
G8HHI	38	110	148	296
G6MGL	59	89	141	289
G8PNN	63	98	128	289
G4NBS	63	105	119	287
G1LSB	—	133	150	283
DL8FBD	—	—	280	280
G8ATK	45	91	143	279
G4MUT	28	90	149	267
G4PCS	—	3	258	261
G1GEY	11	77	168	256
G3NAQ	—	80	175	255
G8LHT	6	83	156	245
G6DZH	—	87	154	241
G0EVT	—	56	184	240
G4IGO	—	—	238	238
ON1CAK	—	33	204	237
G3FPK	—	—	236	236
G0EHV	—	75	154	229
EI5FK	—	56	172	228
GM4CXP	—	31	196	227
G6STI	24	69	130	223
ON1CDQ	—	32	182	214
G4MEJ	—	—	213	213
G8LFB	—	—	209	209
GW4FRX	—	—	204	204
G8MKD	—	49	150	199
GJ6TMM	—	48	151	199
G4YCD	—	—	197	197
G4DOL	—	—	186	186
GI1JUS	—	—	181	181
G1SWH	—	49	118	167
G6MXL	16	45	91	152
G4AGQ	1	41	104	146
GW6VZW	—	6	128	134
G4ZTR	30	45	53	128
G1WPF	—	29	97	126
G0FEH	—	24	101	125
G1IMM	—	17	98	115
G8XTJ	—	—	110	110
G0FYD	—	—	108	108
GM0HBK	—	—	107	107
GI4OWA	—	—	103	103
G1TCH	—	6	88	94
G1SMD	—	—	93	93
GM0GDL	—	20	73	93
G8PYP	—	15	77	92
GW1MVL	—	20	72	92
G4WHZ	7	—	76	83
G1DOX	4		73	
GU4HUY	—	—	73	73
G1CEI	—	—	68	68
G0HDZ	—	—	64	64
G1NVB	—	—	58	58
G2DHV	2	7	33	42
G7CLY	—	—	38	38
GM0JOL	—	—	37	37
G7AHQ	—	—	34	34
GM1ZVJ	—	—	24	24

QTH Locator squares table

recently should think about this before claiming a new country! At the time of writing SV1AB, SV1EN, SV1OE and SV1UN had all been heard working into the UK and no doubt others will follow.

Peter van der Woude PA3EUI has sent information regarding activity from the rarer locator squares of Holland. Readers may care to note the following.

JO11, PA0FWS, PA0GHB, PA0XPQ, PA3EVA, PE1EKN; JO20, PA0EHA, PA0LPE, PA2HJS, PB0AII, PE1KTA; JO23, PA0TIM, PE1DAB, PE1DTU, PE1LDX; JO30 PE1BJQ, PE1ISP; JO31, PA0JOP, PA2NJC, PA3EAQ

Peter has recently completed the 1989 activity list containing more than 1400 calls and locators of european stations

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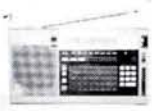

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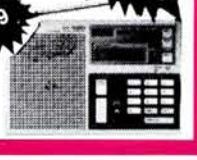

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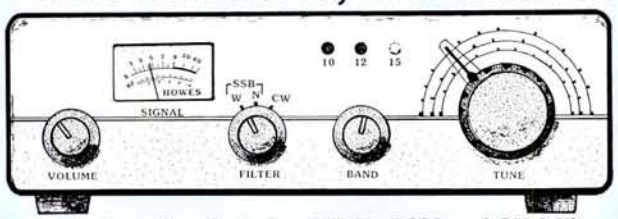

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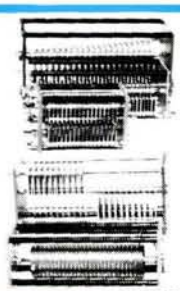

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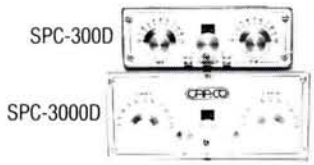

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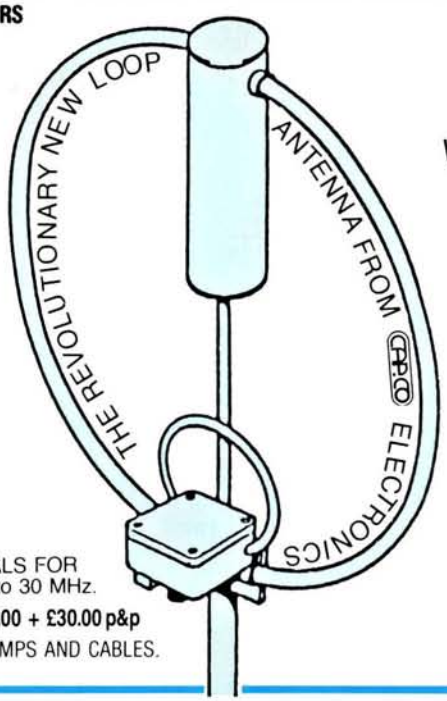

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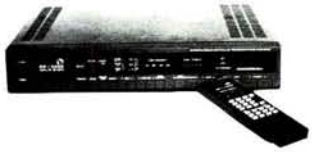

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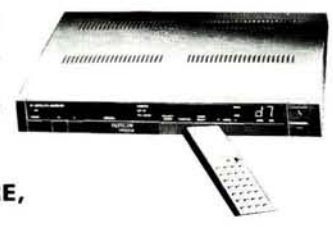

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The 70MHz Band

Not much news has been passed to me regarding conditions of late on the 70MHz band. During the May Bank Holiday I re-assembled my 10-element long Yagi on the tower and by the time you read this I will be fully QRV again having been off the air on 70MHz since last September.

The 4m Trophy Contest allowed G1DOX to increase his county score dramatically. New ones included G3NPI (BKS), G6APZ (DYS), G3LVP (GLR), G1SWH (MCH), G4HGI (MSY) and G0EHV (TWR).

Gerry Schoof G1SWH (IO83) is now up to 36 counties worked on the band. Recent additions in April/May included G3NPI (BKS), G3ZRK (DHM), G3WBN (LDN), G4YUZ (HFD), G3DAH (KNT), G8ESB (YSW), G0BBZ (SXW), G8TTI (WLT) and EI1CR (DBN).

The 144MHz Band

The first 144MHz Sporadic-E opening of the season was reported by **DK3UZ** to have taken place on May 5. The opening was from the East and West German border area to Southern Spain and occurred between 1530 to 1600UTC. At the QTH of G4ASR the m.u.f. was noticed to rise rapidly around this time but did not appear to go much beyond 120MHz. The first week of May saw an enhancement in tropo conditions on the 144MHz band. Conditions were also particularly good during the period May 26/27. An Aurora occurred on May 24 but activity levels were very poor. It is a pity so few people seem to lack the ability to be able to forecast, or at the very least, be able to check the bands to see what is happening. A lot of good DX can be missed when the receiver is switched off. A quick check at prime propagation times brings just rewards!

David Bond G1ZNR (MSY) writes enthusiastically about the number of stations that he worked with his 3 watt system. Amongst his numerous contacts were GB0IOS (SRK), GJ7AOG/P (JER) and G6MKB (CNL). David says that for about a week he was filling a page in the log daily, something never done since being licensed in 1985.

The day after installing a new Jaybeam LW10 Yagi, Ian **Wright GW1MVL** (CWD) saw the fruits of his labours by contacting the GB0IOS (SRK) group. The French contest on May 6/7 gave Ian QSOs with F1HRY/P (IN88), FF6KBF/P (IN98), F6CTT (IN97) FF6KCZ/P (IN99), F6HPP/P (JN19) and ON4AML/P (JO11). Conditions were also good during the period May 18/19 allowing GW1MVL to make contacts with F6FLB (JO00), ON1ABO (JO11) and ON1CAK.

Another operator who has also changed his antenna system is David G1VJP. Pride of place is now a 15-element Cushcraft Junior Boomer which seems to have made a remarkable improvement over the old un-optimised Yagi. Quite a number of new counties have been added to the tally and David now finds that he can regularly work the south coast with as little as 500mW from his QTH in Merseyside. In the period May 6/7 contacts were made with 11 French and three Belgian stations. A pleasant surprise came to David when, following a QSO with G1YLE in Suffolk, he was called by F6FLB in Calais and managed to have a good QSO for 20 minutes without any interruptions or stations trying to call in.

Down in West Sussex G1TCH was hoping to get up to 100 squares before moving to a new QTH in North Yorkshire. On May 26 he worked DL, OZ and SM in locators JO31, 32, 43, 44, 54, 65 and 76.

The best DX of the month for Ela G6HKM was Y26QI/P worked on May 5.

The favourable conditions during May gave Dave GD4XTT some new counties in the form of G1RER (LDN) and G7ATB (WKS).

A good contact for GW6VZW recently was EI4VBM/P (CRK) in IO61. Other contacts via tropo included G0LAK (LNH), G0BTV (NOT) and G1VKT (MCH).

At the QTH of G4ASR (HWR) a "Scottish" type Aurora on May 24 between 1800-1915UTC gave contacts with GM0BQM/P (IO85), GM0CLN/M (IO86), GM0LIR (IO85), GM0GMD (IO86) and GM4CXP (IO85). Tropo conditions were good during the evening of May 26 with many stations in SM6, OZ and Northern Germany (JO43, 44, 53) being worked.

Newcomer to the band, **John Hill G7CLY** (HBS) reports contacts earlier in the year with SM, OZ and F. Running a Trio TR-7010 and a 45W amplifier into a 16-element Yagi, John's best DX so far is EA1BCB in North Spain.

The 430MHz Band

Another forgotten band with only a handful of stalwarts keeping activity going. Tropo conditions perked up a little during May but the lack of stations made it difficult to ascertain what was really going on.

Gerry G1SWH is slowly notching up the county score. Additions in April/May were due to GOCJL (BFD), GW0DVV/P (CWD), GW8CMU/P (GNS), G3FVA/P (YSS), G3CKS (SFD), G6CSY/P (SRY), EI1CR (DBN), EI8EQ (KDR) and EI9BG (CLE). Bob G1KDF under the guise of EI3VVN/P gave Gerry his 45th county when he worked him from Co. Galway in the rare locator square IO43.

Following the results of a 144MHz QSO with G3GTW (WMD) when signals were S9+ bothways with 2W, Dave GD4XTT arranged a move to 430MHz. Contact was made immediately with G3GTW being heard at 59+. GD4XTT was given a report of 54 and asked why his signal sounded so weak. Dave explained that he was standing in the front bedroom window, running 1W from an FT-790R into a YHA44D whip on top of the rig!

John Acton G1DOX describes activity on the band as very poor but still managed to find a few new counties in the form of G1ZBJ (DVN), G1XJO (LEC), G1SGB (YSS) and GW1MNC (GNM).

GW1MVL not only has to put up with the poor activity but he is also hampered by having an 88-element Jaybeam fixed south-east in the attic. Despite this Ian had QSOs with G3CKR/P (IO93) and GW0DVV/P (IO83) during the recent 432MHz contest.

Station	50MHz Counties	50MHz Countries	70MHz Counties	70MHz Countries	144MHz Counties	144MHz Countries	430MHz Counties	430MHz Countries	1296MHz Counties	1296MHz Countries	Total Points
G1SWH	41	17	36	4	79	18	45	6	--	--	246
G6HKM	48	19	--	--	67	24	35	12	15	7	227
G0IMG	47	16	26	4	49	9	23	4	--	--	178
G1DOX	27	3	39	6	57	13	24	3	4	1	177
G4XEN	21	9	13	2	63	21	33	9	--	--	171
G6NB	45	22	--	--	50	10	22	3	--	--	152
G8LHT	10	8	19	4	33	18	29	7	2	1	131
GW6VZW	36	10	--	--	57	13	--	--	--	--	116
G4LDR	27	2	--	--	28	5	27	8	--	--	97
GD4XTT	33	6	--	--	37	7	7	3	--	--	93
GW1MVL	--	--	--	--	62	20	3	4	--	--	89
GM1SZF	16	9	--	--	49	14	--	--	--	--	88
G8XTJ	29	6	--	--	43	6	--	--	--	--	84
G4ZTR	8	6	31	6	20	11	--	--	--	--	82
G1VJP	15	4	--	--	54	8	--	--	--	--	81
G8PYP	7	6	--	--	30	13	18	6	--	--	80
G1TCH	17	14	--	--	34	12	--	--	--	--	77
G7CLY	--	--	--	--	57	14	4	1	--	--	76
G0EHV	--	--	20	4	39	11	--	--	--	--	74
G0FYD	--	--	--	--	52	19	--	--	--	--	71
G3FPK	--	--	--	--	51	19	--	--	--	--	70
G4VOZ	--	--	41	6	--	--	17	4	--	--	68
GW4HBK	--	--	44	6	--	--	6	2	--	--	58
G1GEY	4	2	--	--	--	--	34	8	2	2	52
G0EVT	--	--	--	--	13	17	1	4	--	--	35
G6MXL	2	1	4	1	7	4	8	5	--	--	33
GM4CXP	--	--	--	--	22	6	3	2	--	--	33
G0HOZ	--	--	--	--	25	4	--	--	--	--	29
G3EKP	4	3	11	2	3	1	1	1	--	--	26
G1CEI	--	--	--	--	14	4	--	--	--	--	18
G4AGQ	--	--	8	1	1	3	--	--	--	--	13

Annual v.h.f./u.h.f. table. January to December 1989

The Microwave Bands

John Acton G1DOX located near Bristol has been having some favourable success on the 1.3GHz band recently. He puts this down to a new antenna that gives him the gain he wants but within the constraints of boom length that his QTH dictates. John, who describes his results as overwhelming, is now using a 38-element loop yagi designed by G6VKA. Regular contacts are now being made with G6FK (WMD), G8SWZ (SFD) and and G6VKA (GLR). Tests are continuing with G1KDF (LNH) who can hear signals from G1DOX but has been unable to complete a two-way contact. Bob G1KDF is building a cavity p.a. to increase his power which will no doubt allow the Bristol to Ormskirk path to be bridged in the near future.

The u.h.f./s.h.f. contest on May 6/7 provided Ela G6HKM with a very valuable boost to her 1989 county score. On 1.3GHz, 10 new counties and 2 countries, PA and GW, were worked to give a total of 15 + 7 by the end of May.

John Tye G4BYV has been having a successful time on the middle microwave bands. From his QTH in Norfolk (JO02) John recently worked 5 Dutch stations on 2.3GHz. Conditions were also good on

May 4 with the beacon GB3WWH (IO91) on 2320.910MHz being heard at 579 and later in the day a QSO was made with G4EQD in IO93. The microwave contest on May 6/7 produced a new square on 3.4GHz in the form of GW8GDZ/P (IO82). Also worked on 3.4GHz was PE0MAR/P (JO21). An attempt earlier in the year with PE1MAR on 5.7GHz was not successful. However, as consolation John worked OZ1HDA (JO47) on May 17 for a first G to OZ contact on 3.4GHz.

Another station obtaining consistent results is **Simon Freeman G3LQR**. On May 23 contact was made with LA6LCA (JO59) on 5.7GHz for a first G to LA QSO on 5.7GHz. Earlier G3LQR (JO02) worked ON7YK (JO21) on the 10GHz band. This is believed to be the first time that Belgium has been worked from the UK on 10GHz. Does anyone keep records of microwave firsts?

Wet Squares

Want to boost your squares total on 144MHz? How does 10 new squares within easy tropo reach of most of the UK grab you? Much interest has recently been shown in the activation of rare locator squares within the North Sea area. LA0DT/MM for instance, is one of a growing number of regular operators active from various North Sea locations. Another maritime operative is **Andy Adams GW0KZG** who is 2nd Engineer on the Royal Research Ship *Challenger* which is about to carry out a 15 month Scientific Research Programme into the processes that effect the quality of the North Sea. During a 12 day survey cruise from July 24 to Aug 4, Andy will operate on 144MHz as GW0KZG/MM from some of the more rare North Sea squares. Equipment in use will be a Trio TR-9130 running 25 watts to an 8-element Yagi. Operating frequencies will be centred on 144.300MHz with a move to 144.310MHz when contact is made. Some operation may be possible on c.w. around 144.050MHz although this mode is not preferred! Operating times will have to fit in with work but Andy should be QRV between 1100-1200UTC and from 1600UTC onwards. Hopefully, some operation will be possible on Saturday afternoons from 1100UTC, depending on work loads. The following schedule is obviously subject to weather or operational delays and anyone wanting a particular locator square should listen several days earlier to hear if the programme has been changed. QSL cards can be sent either via the bureau, or direct to Mr A. Adams, 2nd Engineer, RRS *Challenger*, c/o The Natural Environment Research Council, Research Vessel Services, No.1 Dock, Barry, South Glamorgan CF6 6UZ.

July 24	JO02,JO12
July 25	JO12, JO22, JO02, JO01
July 26	JO01, JO11, JO12, JO22
July 27	JO12, JO13, JO23
July 28	JO23, JO24
July 29	JO33, JO34
July 30	JO34, JO35, JO25
July 31	JO25, JO15, JO05
Aug 1/2	JO05, IO95, IO94, JO04, JO03
Aug 3/4	JO13, JO14, JO04, JO05

Expeditions

North Rona - IO79 - July 12/19. If you're quick you might just catch this expedition. Full details were given last month but just to remind you again the callsign to listen out for is GB4XT on 50.350MHz, 144.028MHz, 144.215MHz and 432.215MHz.

Italy - JN56 - July 19 / August 7. Marcus DG2YEQ/IN3 will be active on 144MHz and 430MHz from the mountaintops of North Italy. During the Italian contest he will try to operate from a QTH 2135m a.s.l.

Iceland - July 20 / August 9. Johannes LA6HL has provided the following details for his annual trip to Iceland. He is hopeful that the callsign TF3XHL will be allocated but if this is not the case Johannes will revert to LA6HL/TF that has been used so successfully in the past. Frequencies to watch are 50.200MHz and 144.183MHz. Activity on 144MHz will mainly be via meteor scatter with TF3XHL taking the first 2.5 minute periods at a maximum speed of 1000 letters per minute. The full itinery is as follows:
July 20 - 21 - IP25; July 22 - 23 - IP15
July 24 - IP05; July 25 - Aug 3 - HP94
Aug 4 - IP03; Aug 5 - 6 - IP14; Aug 7 - IP24
Aug 8 - IP34; Aug 9 - IP25.

Corsica - JN42/JN43 - July 20/August 13. Further news has come to hand regarding the French expeditions to Corsica that were mentioned in last month's column. The island will be visited on two separate occasions. The first group will operate from locator JN42 between July 20 - 27 and the second group will operate from JN43 between July 27 - Aug 13. The spot frequencies to monitor will be the same for either group, .020 (c.w.), .220 (s.s.b. and c.w.), .420 (s.s.b. and c.w.). It is requested that DX operators use c.w. when calling on any of these frequencies. Operators in the first group will be F6CIS, F6HKA, FC1EHN and TK5EP. The equipment for each band is fairly comprehensive and consists of 144MHz 1kW and eight 9-element Yagis for tropo and e.m.e., 432MHz 1kW and sixteen 21-element Yagis for tropo and e.m.e., 1296MHz 200W and eight 23-element Yagis for tropo, 2304MHz 50W and a 1.2 metre dish, 10GHz 4W and a 1.2 metre dish. Skeds for the group will be taken via F6HKA on the v.h.f. net (14.345MHz) or write to F6HKA Bertrand Banlier, 7 Impasse de Solong, F-87170 Isle, France.

Operators in the second group will be F1FHI, FD1FLN, FC1DED and TK5EP. Apart from 144MHz where the system will be 1.5kW and two 17-element Yagis, identical equipment will be used. This group will be concentrating their activities on meteor scatter although they will be amenable to e.m.e. when the moon is on the horizon. Skeds will be taken by FD1FLN on the v.h.f. net or write to FD1FLN Michel Rousselet, Apt 1228 bat 17, St Hilaire, F-33310 Lormont, France.

Orkney Islands - IO88 - July 25/August 3. Clive Penna will be signing GM3POI/P from his second home in Orkney. Although concentrating on 50MHz he will also be preparing the site for the arrival of his 180-element collinear 144MHz e.m.e. array from Kent.

Finland - KP38/39/48 - August 1/14. The St. Claus VHF Group, OH9SCL, plan to be active from the Lake Inari region of Lapland on 50MHz and 144MHz. Activity will be biased towards meteor scatter but there may be a possibility of some e.m.e. activity from locator KP38.

Western Isles - IO67 - August 6/18. The Derbyshire Hills Contest Group consisting of G4HKS, G4VVZ, G4YBB and G6ABU will be active from the Island of Harris on 70, 50, 144 and 430MHz using the callsign GM4ZAP/P. The frequencies to watch are 50.220, 70.220, 144.220 and 432.220MHz. Meteor scatter operation will take place on 144.144MHz (c.w.) and 144.444MHz (s.s.b.). Random m.s. activity on 144.144MHz is scheduled every night from 2300 - 0000UTC. Skeds or further information can be obtained from either Nigel G4VVZ on 0602 231900 or from Martin G6ABU on 0602 626018. Alternatively the group will be QRV on the 14MHz v.h.f. net during the expedition.

Shetland Isles - IP80 - August 9/14. The Island of Foula, one of the Shetland Island group will be activated by the Aberdeen Amateur Radio Society on 70, 50 and 144MHz during the peak of the Perseids meteor shower. They will be QRV on 50.160MHz and 70.170MHz using the callsign GM0FRT/P, and on 144.080MHz and 144.180MHz with the callsign GM4CAN/P. Skeds may be arranged via packet to GM4AFF @ GB7CQV or daily 1400 - 1600UTC on 14.330MHz during the expedition.

Faroe Islands - IP61 - August11/14. Johannes LA6HL will depart Iceland on Aug 10 arriving in the Faroe Islands on Aug 11 for three days of 144MHz operation from the club station OY6FRA. On Aug 14 he sets sail for Norway with a possibility of some maritime operation on the way. No schedules before the event but you can arrange tests via the European v.h.f. net on 14.345MHz.

Greenland - GP35 - August 14/26. Not really an expedition but OZ1DJJ will take the opportunity to activate this locator whilst working in Greenland. Signing OX3LX he will be QRV on 50MHz with 10W to a 2-element Yagi. This system was sufficient for him to work ten UK stations on 50MHz last year.

Sable Island - GN03 - August. An expedition to Sable Island by VE1AL, VE1XT and W5KNE is expected sometime in August. The group will be active on 50MHz using the callsign CY0DXX.

THE NEXT THREE DEADLINES ARE JULY 26, AUGUST 23 & SEPTEMBER 27

QRZ Contest!

July 16	10GHz cumulative	0900-2100UTC
Aug 1	144MHz Scandinavian activity	
Aug 3	432MHz Scandinavian activity	
Aug 5	144MHz Low Power	1500-2300UTC
Aug 6	432MHz Low Power	0900-1500UTC
Aug 7	Scandinavian microwave activity	
Aug 13	Barking R & E S 144MHz	1300-1700UTC
Aug 13	10GHz cumulative	0900-2100UTC

Details of the Barking Radio and Electronics Society 144MHz contest can be obtained from Mick Toms BRS31976, 32 Wellington Road, Rayleigh, Essex, SS6 8EZ.

Reports to Mike Richards G4WNC
200 Christchurch Road, Ringwood, Hants BH24 3AS

Rally Calender

Now that our daughter Ruth is old enough to travel with us, I will be attending a lot more radio rallies around the country.

Our first rally this year was the northern rally at Harrogate on May 21 which we thoroughly enjoyed. The organisation at this rally was really excellent and our life was made very easy with a tractor supplied to get the stand and all the books from the car to the hall and vice versa which was really good. The final point which really won us over was that they even supplied a child minder to look after Ruth for a couple of hours in the afternoon!

One of the main reasons for attending these rallies as far as I am concerned is to meet some of my readers and hear your views on what you want from the magazine in general and my column in particular. So, if you are able to come along, please look me up and have a chat.

The dates and venues that have been booked so far are shown here:

August 13 (p.m.) - Hamfest, Wimborne, Dorset.
September 3 - Telford
October 27/28 - Leicester
November 4/5 - Llandudno

19th SARTG World Wide RTTY Contest

This popular annual h.f. contest run by the Scandinavian Amateur Radio Teleprinter Group (SARTG) will be held on the weekend of the August 19/20. The basic rules and conditions are as follows:

Periods: Saturday August 19, 0000-088UTC and 1600-2400UTC
Sunday August 20, 0800-1600UTC
Bands: 3.5, 7, 14MHz, 21 and 28MHz
Classes: Single operator, all bands
Single operator, single band
Multi-operator, Single TX, all bands
SWL stations
Message: RST and QSO serial number beginning 001
Points: Own country 5 points
Own continent 10 points
Other continent 15 points

The same station may be worked once on each band for QSO and multiplier credits.

Multipliers: Each country by the DXCC country list and each call district in Australia, Canada and USA will count as one multiplier on each band.

Scoring: Sum of points x sum of multipliers = total score.

For s.w.l. the same rules apply but based on stations and messages copied.

Awards: To the top stations in each class, country and district provided the number of QSOs is reasonable (no guidance as to what is reasonable).

Logs: Must be received by October 10 and contain band, date, time, callsign, message sent/received, points and multiplier. Separate sheets should be used for each band and the calls of all the operators must be stated.

All logs should be sent to: Bo Ohlsson SM4CMG, Skulsta 1258, S-710 41 Fellingsbro, Sweden.

The Versaterm

This month I am continuing the column with another review. The choice this time is a RTTY terminal unit - namely the "Versaterm" from BARTG. Although this is not really a new design, it's appropriate to review it now as BARTG have recently made the unit available in kit form.

Fig. 1

I'm sure readers who have been involved in RTTY for any length of time will have heard of the ST5 terminal unit, which seems to have become something of a benchmark. The Versaterm takes its origins from that design, but has moved away from the use of inductors for the tuned circuits and now uses rather more modern op-amp active filters.

The object behind the design of the Versaterm was to develop a replacement for the ST5 which would be able to compete on performance terms and also to make the interfacing as flexible as possible. There seems to be an additional bonus in that the Versaterm is smaller and cheaper that the ST5. So, providing the performance is up to scratch, the Versaterm has the potential to be a worthy successor to the ST5.

Construction

The review model was supplied ready built by Ted Hatch G3ISD, so I haven't actually built the kit myself. The supplied documentation comprised 12 sheets of A4 covering many aspects of the Versaterm, with most of the information having been extracted from the *Datacom* articles first published in late 1987 and early 1988.

The first section was a complete components list which struck me as a slightly odd way to start. This was followed by some brief constructional notes and alignment instructions. The final section comprised detailed diagrams of the main unit and the various options.

Having studied the documentation I have to say that this is not really a project for the raw beginner. The documentation assumes that the reader is familiar with the components, can read a circuit diagram and can work direct from a diagram and screen printed p.c.b.

Having said that provided you have some constructional experience and have a friend, perhaps at the local radio club, who can help you should be ok.

For the alignment of the Versaterm you will need the following

(1) Oscilloscope or audio millivolt meter
(2) Audio oscillator.
(3) Frequency counter.
(4) Multimeter.

The alignment seemed to be quite straight forward and was described well in the documentation.

The assembled version comes all ready to go, though you do have to specify which of the options you require, i.e. internal or external p.s.u. etc.

The connections are very straight forward allowing for easy interfacing. The audio output from the rig is fed to one of a pair of 3.5mm jack sockets on the rear panel. The instructions did not give a clear indication of the level requirements at this stage but my tests on the review model indicated that signals above 5mV into 500Ω were perfectly OK.

Moving on to the other direction, there are several options available. The first and probably the most popular is to use a.f.s.k. by utilising the tones generated by the on-board tone generator. These are wired out to a five pin DIN socket on the rear panel. If you are using the G3WHO RTTY/AMTOR/c.w. program you can of course still use the computer generated tones if you wish.

Personally I prefer to use true f.s.k. and providing you have the facility on your rig, this can also be achieved quite easily by by-passing the tone generation stages and linking directly from the t.t.l. output of the computer to your rig.'

If you are using a BBC computer with the G3WHO software, you will need a couple of extra features for the AMTOR section to work. These are a 1kHz clock and a data delay circuit. The Versaterm is well equipped here as both these options have been included on the main p.c.b. This obviously makes the Versaterm very attractive to anyone using G3WHO software.

The final connection to the rig is the p.t.t. which used the normal convention of ground to transmit so should suit most rigs.

Circuit Description

The receive audio is fed to a 709 operational amplifier which in this case is used as a limiter. This part of the circuit is virtually identical to the ST5 except that it is running from ±5V instead of ±12V. The only problem with this voltage change is that the 709 is running outside its spec., but Ted is happy that the advantages of using the 709 justify this move. The output of the limiter is passed to a pair of dual op-amp active filters for mark and space filtering. The filter type chosen is a development of a National Semiconductor application note and was originally described by Alan Hobbs G8GOJ in *Datacom*, so has been well tested.

The next stage was a slicer which processes the combined output of the two filters to produce the raw data.

Before being passed to the output, this raw data is fed to a 7400 quad NAND gate for conversion to t.t.l. levels. If however you require RS-232 levels, there is a small conversion p.c.b. which is supplied free with the kit which performs this task.

As I mentioned earlier, there are several enhancements provided on the

Versaterm which have been designed to make life easier.

The first of these is the autoprint feature which, when enabled, helps to prevent the screen filling with garbage when tuning around or receiving noise in between transmissions. This feature utilises half a 1458 op-amp which is used to control one gate of the 7400 level conversion NAND gate.

The generation of transmit tones is also carried out on the main p.c.b. using a 555 oscillator followed by two stages of RC filtering.

For use with the G3WHO RTTY/CW/AMTOR program, an accurate 1kHz clock and data delay circuit is required. Again, this is provided on the main p.c.b. using a 4.096MHz crystal and a 4060 divider i.c. The data delay circuit uses a 74121 monostable to give the required adjustable delay.

The power supply options available are ±5V, 5V or 7.5 to 13.8V d.c. If using ±5V then no additional power supply components are required. The other supply options utilise a 7660 voltage invertor to derive the -5 volt supply and a 7805 regulator to tame the incoming supply.

The original designs made provision for an internal mains power supply, but in the interests of safety this has now been abandoned.

Operation

The operational side of the Versaterm was very straight forward with only five switches to play with! For amateur use the most common shift is of course 170Hz and this was the standard operating mode for the Versaterm. If you wanted to monitor signals with a wider shift you could select 450Hz shift via a switch on the front panel. If you are a keen utility station listener you may also need an 850Hz shift and although this was not provided as standard, it would be a relatively easy job to add this in. On the transmit side the internally generated tones were fixed at 170Hz spacing, so the wider shifts are for receive only.

Another operational feature which is essential, is to be able to quickly and easily reverse the polarity of the receive data. This is achieved with another front panel switch.

Tuning RTTY signals can be quite an art and over the years there have been many devices designed to make the operators life that little bit easier. The Versaterm used a pair of high brightness l.e.d.s for the tuning indicator and these responded to the outputs of the mark and space filters respectively. Although a very simple system, it actually worked very well and I was able to use these l.e.d.s as my main tuning indication. If you prefer to use a more advanced tuning aid, there were two high impedance outputs provided from the mark and space filters for the connection of a RTTY tunerscope.

The G3WHO decoding software has the facility to decode c.w., but tends to come unstuck when using a RTTY terminal unit for the audio to digital conversion. This is because noise in the gaps between the dots and dashes causes the terminal unit output to swing between mark and space which is then interpreted as extra characters by the software. The solution provided in the Versaterm was to bias one input of the slicer so that the digital output follows the output of one filter only. I found that this worked remarkably well and completely solved the problem. The switching between RTTY and c.w. reception was by a toggle switch on the front panel.

The final feature was the autoprint that I described earlier. This also worked very well, though I found that it had to be disabled when using AMTOR or when receiving very weak RTTY signals.

Before I connected the Versaterm to my rig I took the opportunity to see just how clean the internally generated tones were. I was pleasantly surprised to find that they were quite close to a sine wave! The output level was also adjustable via a pre-set on the main p.c.b.

As the Versaterm has been designed with the G3WHO program very much in mind I tested its performance with my version of the program and my Icom IC-720A transceiver. Everything worked perfectly first time and I made many contacts both on RTTY and AMTOR. I purposely chose some particularly poor conditions for testing the performance and the Versaterm came through with flying colours.

Summary

The Versaterm, although not revolutionary in design, performed very well during the review and is likely to become a favourite with RTTY enthusiasts. As well as being ideally suited to the BBC B/G3WHO software combination, the provision of RS-232 interface levels means that can also be used with IBM PCs and the like. This compatibility is particularly important as the new IBM RTTY program is now available from BARTG.

The Versaterm is available in kit form from BARTG(1) and costs £50.95. My thanks to Peter Adams G6LZB and Ted Hatch G3ISD for their help and the loan of the review model.

(1) Peter Adams, 464 Whippendell Road, Watford, Herts WD1 7PT.

THE NEXT THREE DEADLINES ARE JULY 26, AUGUST 23 & SEPTEMBER 27

Amateur Satellites

Reports to Pat Gowen G3IOR
17 Heath Crescent, Hellesdon, Norwich, Norfolk NR6 6XD

Amateur Satellite Update

RS-10/11: **Andy Mirinov**, operator of RS3A, the USSR satellite command station advises that, in order to help overcome the present solar cycle maximum downlink signal attenuation, from May 4 the a.g.c. limiting restricting RS-10 to 0.4 watts per channel will be commanded out for an elongated experimental period. Feedback from users would be appreciated to help evaluate the test, and to find if this mode is preferred to that used up to now.

RS-12/13: **Leonid Labutin UA3CR** advises that the new COSMOS and Radio Sport satellite launch is imminent, and is set at mid-June this year. Although no exact date has been given for the launch of the COSMOS navigational satellite that will be carrying the two new amateur radio transponders, it is quite possible (indeed probable) that they may be on and active when you receive this issue. The new satellite will be placed into a 1000km (621 mile) high circular polar orbit at 83 degrees inclination.

Full details of the frequencies, modes, powers, beacons, passbands and ROBOTs of RS-12 and RS-13 can be seen in this column on page 69 of the December 1988 issue of *Practical Wireless*. Final in-orbit parameters, exact frequencies and operational findings will be given once the satellite and it's transponders have been evaluated in orbit.

OSCAR-10: A-O-10 continues to perform well, but still with far less activity evidenced compared with A-O-13. The satellite will be in darkness until July 20 between mean anomaly 226 through perigee to MA 024, so it is essential that all would-be transponder users stay off between these times. After July 20, when OSCAR-10 completes all orbits in full sunlight, the battery should be capaable of supporting continuous transponder operation, and on the usual proviso that no frequency pulling is evidenced by the 145.810MHz beacon, modestly powered users are welcome.

OSCAR-13: **Peter Guezlow DB2OS** reports that on May 14 the A-O-13 attitude was measured by VK5AGR at Bahn co-ordinate longitude 212 and latitude +2.4 degrees. On June 14 an attitude change was due, giving a new transponder use schedule from that date until 16 August 1989, e.g. Mode B transponder on from mean anomaly 145, through perigee (0) to MA 110. Mode JL will be on from MA 110 to MA 145. Mode S will be on between MA 150 to MA 160, when earth pointing is optimised.

Peter sadly also reports that the RUDAK will not be active, as despite many attempts to awaken the system to life, all attempts so far have failed. Further rescue attempts have now been postponed until the end of the year. It is firmly believed that a crack occurred in a p.c.b. during the traumatic conditions of lift-off, but, that this break may eventually re-seal by an expansion of the copper plate in the continuing space environment, as the gravity free condition can promote "creep" of the laminated conductor across the open track.

The current lack of eclipse and good sun-pointing means that the A-O-13 satellite will have its transponders on continuously, even around perigee, and, on the proviso that the battery is not depleted, can be used full time. The omni-directional antennas will be switched in from MA 20 to MA 45, and whilst perigee passes will not be "seen" from the northern hemisphere, this is great news for the southern hemisphere operators.

Whilst the three month all-systems-go is theoretically and technically feasible, it is just possible that the battery charge

optimum may not support continued hyper-activity, so, users should observe the 145.812MHz general beacon messages, which will give updated information on any need to change this planned long term schedule.

A study of Fig. 1, the passes for the UK of OSCAR-13 from July 12 until July 26 inclusive, will show that our access time from the northern hemisphere is now increasing considerably as the apogee heads north. Apogees on the opposite side of earth are now visible and workable, and are excellent for DX. It is a strange and unusual occurrence to have to point ones beams to the north east in order to work W6, W7 and VE7 stations at the same time as the JA and Pacific island stations are booming in from the same point source.

Note also that passes re-occur after eleven days, less some fifty minutes of UTC time, so the Fig. 3 table may be extended to cover future dates by using this factor.

Phase III Satellite Activity

Vin Thompson G4ULS of Long Bank, Bewdley, the very active OSCAR-13 user who reported in last month's column his in-range listing of active stations times since it's post-launch switch-on, writes to throw further light on his log of stations worked. Vin writes that in addition to the breakdown given for Europe, 20 stations logged were in the UK, mainly "G" operators. In addition to the general DX breakdown, he has worked 15 stations from outside his last month's general listing, including some of the rarer callsigns such as HL, HZ, PJ9, TU, etc.

Vin's activity is confined to the c.w. end of the OSCAR-13 transponder passband, so it is just possible that the inclusion of stations operating s.s.b. only could modify the figures, and particularly reduce the percentage of the total activity by the stations in eastern Europe, who demonstrate a marked preference for c.w. operation.

Vin writes, "The figures must be a reasonable reflection of satellite activity in the northern hemisphere. I suspect from what I have heard and read that a similar analysis of the s.s.b. end of the satellite passband would show more variety. While matters such as squint angle play an obvious part in successful contact, my clear impression from some long CQ calls in apparently favourable situations is that the principal determinant is who is asleep and who is awake within the footprint".

Vin uses between 7 and 20 watts of 435MHz r.f. power into a 17-element crossed Yagi with continuous phasing for the uplink, and for the downlink a six-element crossed Yagi, also continuously phased, with a pre-amplifier for the Mode B downlink.

One of the world's most active stations on both OSCAR-10 and OSCAR-13 is undoubtedly Ed Steeb WA2RDE of Buffalo, New York. Most any newcomer to the satellite scene will find that if not Ted W4FJ, then Ed is their first "W" contact, as WA2RDE keeps a very close ear to the elliptical orbiters, and never lets a new station go by. Ed has sent in a listing of every first callsign that has ever been known to appear on OSCAR-10 and 13 since the transponders came on, which serves as a fully comprehensive following table upon which to base our own findings.

Stations (all time) known to be or have been active on OSCAR-10 and OSCAR-13, updated to 31 May 1989

3A2LF	3D2JS/KA7APJ	3D6QL	4S7AVR
4U1ITU	4X1AS	5B40A	5N0/JR8BUU
5R8ADA	5Z4DJ	6W1NQ	J1ACH
706CAD	7P8CM	7X2AJ	8Q7AV
9H1EJ	9K2DZ	9M2CR	9M6
9X5HN	9Y4NP	A71AD	A92P
AE3T	AL7C	AZ5ZA	BY1PK
C30BBO	C6A/K4WSB	CE0A/K6MYC	CE6EZ
CN8EO	CO2JA	CT1CRS	CT3BX
CX/LU1AHC	CY0SAB	DP0GVN/DJ4SO	DU2/K6LNP
EA5SP	EA6QB	EA8SK	EI1CR
F5ID	FK1RF	FM7AB	FO0XX
FO8LQ	FR7DA	FS7/WA2ZIS	FT8X
FY0EK	G4JUJ	GD4CUO/P	GI1EEF
GJ4TAF	GM1AHR	GU6EFB	GW1MNC
H44PT/G8BCG	HB0/ON7HP	HB9RHV	HC1BI
HC8E/P	HG5AIR	HI8/WA0NZI	HK4CZE
HL9KT	HV2	HZ1AB	I8CVS
IC8EGJ	IS0DWX	J37AB	JA1ANG
JD1/JA1YWX	JY5CI	KH2/W1YRM	KH6JJI
KL7JAI	KP4EKG	KP5/KB6AFZ	KV4AD
KX6BA	LA1K	LU1EHC	LX1SI
LZ2AR	OA4ZV	OE1WIS	OK1DMS
ON7HP	OX3AM	Y9JD	OZ1BJF
P29ZFS	P40 (due)	PJ2/W1BIH	PJ7/ KA2MUM
PY2BJO	PZ1AC	SM1NUU	SP5EPT
SU3AM	SV1GE	T70A	TF/WB9ZIF
TI2ALG	TK/F9FT	TR8CA	TU4DA
TZ6FE	UA0ALA	UA6LJV	UB5EAG
UC2AAB	UK5MBY	UL7DD	V3CAE
V85GA	VE6LQ	VK0	VK5AGR
HK0AC	VK9ZMV01DI	VP2ESE	
VP2V/K9PW	VP5D/W3HNK	VP8ALJ	VP9FH
VS6HH	VU2DVP	XE1XA	XQ0ZFZ/ EA4LH
Y23TI	YB0QC	YI1BGD	YJ8RG
Y02IS	YU3N	YV4WT	Z25
ZD7KD	ZD8MG	ZF1GC	ZK2RS
ZL1A0X	ZL8AFH	ZR1L	ZS3AK
XF4L	DB1DI	OH5LK	PA0ZM
9X5NH (due)	7XQAJ (due)	4J1FS	9M2DT

Not all of the full callsigns were recallable by those known to have worked them, e.g. G3IOR cannot remember for the life of him the full call of the station he worked on Macquarie Island, VK0, so some like these are included as just the callsign prefix only. Allowing for some prefixes that may not be actual DXCC countries, e.g. IC8EGJ probably counts the same as Italy, and UK5MBY most probably is Ukraine as is UB5EAG, 9M2DT may be a duplicate Malaysia for 9M2CR, and further allowing for those stated to be due, we still have over 150 DXCC countries that have been or are still active on the high elliptical orbiting satellites. Even with the currently superb DX conditions being manifested on the higher frequency amateur bands, it would still appear that DXCC is quickest, best and easiest accomplished by satellite. Rod Clewes G3CDK reports that his regular schedule with his friend 9H1EJ has been rained off several times in the past month by the path failure on both 14 and 21MHz, but a move to OSCAR-13 provided a perfect QSO each time.

If any keen OSCAR user has worked, heard, or knows of any country known to have been activated that is not on the above list, would he/she please advise me, or drop a line to Ed at 15 Groveland Street, Buffalo, NY 14214, USA, so that the current list may be updated.

Mystery Satellites

Since the raising in last month's column (under "Space Invaders") the presence of the pair of mystery satellites transmitting on 435.973MHz, first spotted by GM4IHJ whilst looking for FO-12, a number of observers have made some interesting findings. **Birger Lindholm** (who provides our Keplerian elements) has been listening from Dalsbruk, Finland, and makes the following observations: "I think the inclination is around 83 degrees. One satellite has a period slightly below 101 minutes, whilst the other appears to have a 105 minute period. I had some difficulties to get a proper aquisition of signal from the South, as both birds were switched on apparently shortly after my AOS. At first I thought that they were the old P-76 satellites that also used to transmit carrier at approximately this frequency, but I doubt this now".

Ron Pearson G3CAG measured some doppler curves to get the TCAs, e.g. the time when the frequency was nominal, taken as 435.975MHz, and recorded the following:

20 May 1989: 1137, 1321, and 1507UTC.

21 May 1989: 1350:30 and 1537:30UTC.

28 May 1989: 1950, 2136 and 2326UTC.

This latter was an overhead pass, with passes for the "other" satellite at 2044, 2229 and on the same day and at 0011UTC on May 29.

Dave Rowan G4CUO also recorded similar times, and followed them by using his Oscarlator for OSCAR-8 to produce the times when orbits from the far equator would be southbound over the UK. He was able to accurately predict a set of these and the northbound passes of the most active one of the mystery satellites the following morning. He thus discovered the period to be some 104.9 minutes, the increment 26.26 degrees west per orbit, the inclination close to 82.5 degrees, and the centre frequency 435.973MHz with a doppler shift of ±8.2kHz on an overhead 13 minute pass.

It is still not yet known if these satellites are a re-occurrence of the old Stanford University P-76 satellites, a new source from that or a similar stable, or if they are from the USSR as ELINT satellites. When a fine and accurate set of Keplerian elements can be evolved, and an accurate period, drag and increment assured, comparison to the NORAD/NASA listings should give some strong evidence of origin.

The most recent data of early June comes from their discoverer, **John Branegan GM4IHJ**, who feels sure that the 435.974MHz satellites are of two distinct types. John writes: "The 105 minute period 89.56 degree inclination bird is, as I am almost certain, the American Polar Bear Arctic Communications Experiment. I get excellent Polar Front scans from it". John is anxious to find a source of it's other operating frequencies, as he is able to follow most any transmission up to 12GHz.

John continues: "There are two 101 minute period, roughly 80 degree inclination birds which are quite different (from the 105 minute orbiter). They are switched on and off, and sound more like ELINT, Store and Dump covert communications, or Soviet Polar Ionosphere satellites. The 105 minute period bird is on daily 1030 to 1700 and again from 2200 to 0500UTC. One 101 minute period bird is usually switched on just before 1500UTC daily as it starts the near overhead pass, and is left on usually until approximately 0400. The other 101 minute period bird is on only on rare morning orbits". Hopefully, with sufficient input, we shall soon have a firm definition of the source and purpose of these strange orbiting signals which are sharing our amateur satellite service 435MHz band.

Stop Press Update

Here follows the very latest additional sets of the Keplerian elements for two satellites. MIR is produced so that you may get a good idea of passes when 145MHz f.m. amateur radio activity recommences in late August, and OSCAR-9 is supplied to give you the latest basis for a good input to the re-entry time contests, which (plus the SPOT-II launch date) will also will give you a clue when I say that your entry will need to be in soon now to qualify.

Satellite:	MIR	OSCAR-9
Epoch Year:	89	89
Epoch Day:	129.00322511	136.09422780
Inclination:	51.6207	97.5587
Right Asc.of Ascending Node:	199.1234	187.7271
Eccentricity:	0.0011161	0.00020507
Argument of Perigee:	283.3842	198.6348
Mean Anomaly:	79.5506	161.4877
Mean Motion:	15.53316355:	15.56010620
Decay rate or Drag Factor:	2.6899E-04	0.00084611
Epoch Orbit Number:	18507	42399
Beacon Frequencies:	As given on Keplerian Elements	

Keplerian Elements

The latest batch of data for all the major satellites of general interest is included again this month to update your tracking systems. The tables emanate again from Birger Lindholm, who collates the raw data from NORAD via NASA, and types it all up into neatly labelled columns for our ease of application.

Users will note the presence of two additional parameters for each satellite this time, namely Period Drag and Increment Drag. These have been added for the benefit of those who wish to track by applying the period well ahead of that given on the Epoch Day, by which time it would have reduced slightly due to friction. By applying the factor and calculating by the number of orbits and days that have occurred since the epoch supplied, then by reducing the period by this amount, an approximation of the new period will be given for the new time. Similarly, when the period shortens, then naturally the increment shortens accordingly, so a further similar factor is given by which the new increment may be approximated. This brings us on to the problematic topic of using (or otherwise) the given drag factor itself, which, as promised on page 68 of the May issue of this column, will be fully covered next month.

AMSAT AMS-81 TRACKING SYSTEM
ACCESS SKED FROM 12JUL89 110000
G3IOR VIA OSCAR 13

DAY	AOS	LOS	MAX	DX/EL	AZ
12JUL	1128	1503	1128	18065*	049
12JUL	1727	0312	2141	14564	[illegible]
13JUL	1109	1354	1109	17937*	[illegible]
13JUL	1620	0203	2034	13721	[illegible]
14JUL	1042	1244	1042	17757*	[illegible]
14JUL	1519	0053	1928	13128	[illegible]
15JUL	1002	1137	1002	17569*	[illegible]
15JUL	1425	2343	1821	13025	[illegible]
16JUL	0920	1040	0920	17326-	[illegible]
16JUL	1338	2233	1715	13455	[illegible]
17JUL	0811	0950	0811	[illegible]	[illegible]
17JUL	1300	2122	1606	14241	[illegible]
18JUL	0647	0855	0647	17528*	[illegible]
18JUL	1229	2012	1501	15167	[illegible]
19JUL	0506	0755	0506	[illegible]	[illegible]
[illegible]	1205	1900	[illegible]	[illegible]	[illegible]
20JUL	0017	0652	0121	18062	295
20JUL	1142	1750	1246	16943	031
20JUL	2046	0548	0015	17245	[illegible]
21JUL	1119	1639	1141	17716	[illegible]
21JUL	1910	0441	2303	15417	[illegible]
22JUL	1058	1528	1058	18124*	[illegible]
22JUL	1754	0334	2202	15509	[illegible]
23JUL	1038	1417	1038	13071*	[illegible]
23JUL	1640	0226	2055	14560	[illegible]
24JUL	1019	1306	1019	17952*	[illegible]
24JUL	1534	0117	1948	13589	[illegible]
25JUL	0948	1158	0948	17800-	[illegible]
25JUL	1433	0007	1842	13082	[illegible]
26JUL	0916	1051	0916	17553*	[illegible]
26JUL	1337	2257	1735	12964	171

Fig. 1

Satellite	NOAA 9	NOAA 10	NOAA 11	METEOR 2-15
International Designation	84-123A	86-073A	88-089A	87-001A
Object Number	15427	16969	19531	17290
Element Set Number	366	216	70	243
Epoch Year	1989	1989	1989	1989
Epoch Day	122.14677923	114.50409837	111.54455513	115.22528347
Inclination	99.1416	98.6403	98.9351	82.4706
Right Ascension of Ascending Node	108.1958	146.0116	55.8418	196.2522
Eccentricity	0.0016467	0.0014573	0.0013218	0.0014190
Argument of Perigee	82.7989	49.4956	34.9329	55.6694
Mean Anomaly	277.5052	310.7489	325.2707	304.5815
Mean Motion	14.11981070	14.22958934	14.10953152	13.83708811
Decay rate or Drag Factor	7.590E-06	7.770E-06	8.980E-06	3.43E-06
Epoch Orbit Number	22595	13630	2948	11629
Nodal Period	102.040756	101.254976	102.115398	104.126732
Period Drag	3.887E-05	3.888E-06	4.609E-06	1.866E-06
Increment	25.507654	25.313898	25.528056	26.161063
Increment Drag	9.780E-06	9.781E-07	1.160E-06	4.665E-07
Beacon Frequencies	137.620=APT 137.770=DSB	137.500=APT 136.770=DSB	137.620=APT	137.850=APT
Reference Equator Crossing	07 May 1989	29 Apr 1989	29 Apr 1989	04 May 1989
Reference Orbit Number	22128 22664	13694	3054	11751
Time (HHMM.MM)	0052.15 Utc	0006.19 Utc	0128.32 Utc	0107.82 Utc
Degrees West	124.71	68.05	175.75	49.68

Satellite	METEOR 2-16	METEOR 2-17	METEOR 2-18	METEOR 3-02
International Designation	87-068A	88-005A	89-018A	88-064A
Object Number	18312	18820	19851	19336
Element Set Number	263	105	29	184
Epoch Year	1989	1989	1989	1989
Epoch Day	115.39952766	115.91107135	119.10025885	121.01046131
Inclination	82.5529	82.5448	82.5291	82.5476
Right Ascension of Ascending Node	261.3540	322.1108	198.3252	209.0222
Eccentricity	0.0012524	0.0018343	0.0016753	0.0016064
Argument of Perigee	351.1259	56.9733	89.6634	263.3975
Mean Anomaly	8.9663	303.3185	270.6447	96.5314
Mean Motion	13.83456337	13.84148812	13.83788336	13.16922605
Decay rate or Drag Factor	2.19E-06	2.44E-06	1.16E-06	3.91E-06
Epoch Orbit Number	8521	6245	829	3670
Nodal Period	104.145840	104.093764	104.120838	109.403577
Period Drag	1.192E-06	1.326E-06	6.311E-07	2.468E-06
Increment	26.165208	26.152254	26.159142	27.479623
Increment Drag	2.980E-07	3.315E-07	1.577E-07	6.170E-07
Beacon Frequencies	137.400=APT	137.400=APT	137.300=APT	137.850=APT
Reference Equator Crossing	04 May 1989	04 May 1989	04 May 1989	04 May 1989
Reference Orbit Number	8640	6357	897	3710
Time (HHMM.MM)	0008.63 Utc	0010.40 Utc	0024.58 Utc	0111.20 Utc
Degrees West	329.49	268.78	33.60	32.83

Satellite	OSCAR 9	OSCAR 10	OSCAR 11	OSCAR 12
International Designation	81-100B	83-058B	84-021B	86-061B
Object Number	12888	14129	14781	16909
Element Set Number	537	396	436	141
Epoch Year	1989	1989	1989	1989
Epoch Day	121.09898916	118.08889975	114.23701940	112.36835661
Inclination	97.5604	26.3399	98.0075	50.0159
Right Ascension of Ascending Node	171.8782	268.1164	174.5965	109.9094
Eccentricity	0.0000897	0.6055304	0.0013581	0.0011193
Argument of Perigee	147.6401	37.3937	125.0138	203.0127
Mean Anomaly	212.4697	352.2227	235.2245	157.0209
Mean Motion	15.53859889	2.05880716	14.63403308	12.44399273
Decay rate or Drag Factor	6.8785E-04	-2.0E-08	2.712E-05	-2.5E-07
Epoch Orbit Number	42166	4418	27465	12245
Nodal Period	92.733310	699.1793	98.459732	115.652698
Period Drag	2.644E-04	-	1.248E-05	1.866E-07
Increment	23.178692	175.3514	24.615761	29.239415
Increment Drag	6.653E-05	-	3.139E-06	4.625E-08
Beacon Frequencies	14.002/21.002 29.510/ 145.825/ 435.025 MHz	145.810 MHz 145.987 MHz	145.826/ 435.025/ 2401.5 MHz	435.797/ 435.913 MHz
Reference Equator Crossing	06 May 1989	06 May 1989	30 Apr 1989	04 May 1989
Reference Orbit Number	42243	4435	27550	12390
Time (HHMM.MM)	0121.44 Utc	0817.29 Utc	0110.30 Utc	0020.08 Utc
Degrees West	67.13	81.77	55.29	152.78

Satellite	OSCAR 13	R S 10/11	SALJUT 7	MIR
International Designation	88-051B	87-054A	82-033A	86-017A
Object Number	19216	18129	13138	16609
Element Set Number	34	744	552	824
Epoch Year	1989	1989	1989	1989
Epoch Day	89.37166448	121.86700973	121.69579074	121.73239582
Inclination	57.2895	82.9233	51.6104	51.6211
Right Ascension of Ascending Node	213.9669	272.3646	184.9249	235.3272
Eccentricity	0.6688587	0.0011914	0.0000756	0.0011312
Argument of Perigee	201.4192	173.7751	311.0022	250.7323
Mean Anomaly	106.6281	186.3514	49.0387	109.2326
Mean Motion	2.09699506	13.71969700	15.40446949	15.52941335
Decay rate or Drag Factor	-2.80E-07	-1.11E-06	3.542E-04	2.0734E-04
Epoch Orbit Number	606	9304	40102	18394
Nodal Period	686.6470	105.017651	93.417775	92.665570
Period Drag	-	9.196E-07	1.393E-04	7.962E-05
Increment	172.1950	26.380311	23.735746	23.550539
Increment Drag	-	1.549E-07	3.430E-05	1.959E-05
Beacon Frequencies	145.812/ 435.651 MHz	29.357/.403, 145.857/.903, 29.407/.453, 145.907/.953 MHz	19.953 MHz	143.625=voice 166.125=data (AM)
Reference Equator Crossing	29 Apr 1989	05 May 1989	06 May 1989	04 May 1989
Reference Orbit Number	669	9347	40169	18430
Time (HHMM.MM)	0947.28 Utc	0004.26 Utc	0100.32 Utc	0110.51 Utc
Degrees West	154.17	313.86	75.27	15.74

Propagation

Reports to Ron Ham
Faraday, Greyfriars, Storrington, West Sussex R20 4HE

The Radio Sun

Although 1984 was a relatively "quiet" year for solar activity, I recorded noise storms on January 12, 15, 16, 24-27 and 29-February 2; February 5, 8-11, 14 and 24; April 1-6, 13-18 and 25-30; May 3, 11-14 and 23; June 18, 19 and 23; September 1 and 3; November 21 and 24 and December 10 and 11. "Severe" was marked in my log to describe the storms on January 16 and 31, April 2 to 5, 16 and 17. In addition to a few really large individual bursts of noise which occured during the storms on January 10 and 11, a variety of low-amplitude, short-life, bursts appeared on 46 other days during the year.

Cmdr Henry Hatfield (Sevenoaks) received solar noise at 136 and 197MHz on January 31 and bursts were heard in the 28MHz band while the late April storm was in progress.

Terrestrial radio signals were influenced by Aurora on January 4 and 10 and February 26. Henry, using his spectrohelioscope, observed "2 large and very angry spot groups and the remains of a flare at 1130 on January 31 and **Patrick Moore** (Selsey) reported "a trail of sunspots" on March 29 and large spots on April 3 and 24.

By the end of 1984, I had learnt and written a great deal about radio emissions from the sun and at this point in time the telescope's antenna and framework, underground cables and some of the electronics had completed over 16 years work and was in need of major repairs or replacement. So, with some reluctance, I decided to cease regular observation and, when time permitted, dismantle the installation. However, the last big event that I recorded before actually dismantling the telescope was a massive, sometimes violent, noise-storm which began on 3 February 1986 and ended on the 14th. During its peak, auroral reflected radio signals were reported on the 7th and 9th and the TV weather presenter spoke of the "auroral glow" during their programme at 2125 on the 8th. Next month, I plan to start explaining how, for 4 years, Joan and I counted meteors by radio, but for now, it's back to 1989.

Solar

"The monthly mean sunspot number for April was 129," wrote **Neil Clarke G0CAS** (Ferrybridge) and enclosed his computer print out for the month, Fig. 8, showing the daily variations of solar flux units. "The monthly mean was 188.9 and like the sunspot numbers is down on last month," said Neil.

During April, **Ron Livesey** (Edinburgh), using a 2.5in refractor and projection apparatus, identified an average of 4 active areas on the sun on days 1, 9, 10, 15, 16, 23, 24 and 26 and 8 on the 8th and 16th and from his observatory in Sussex, Patrick Moore, sent his drawings of the sunspots and groups which he saw on April 20 (Fig. 2) and 30 (Fig. 3) and the wide distribution of spots on May 15 (Fig. 4). In Bristol, **Ted Waring** counted 25, 47, 35 and 33 sunspots on May 2, 7, 14 and 23 respectively. The details of the observations made by Henry Hatfield with his spectrohelioscope are listed in Fig. 5. Henry also recorded a variety of individual bursts of solar radio noise, at 136MHz, on April 27, May 3, 4, 5 and 21 and periods of continuous noise on days 3 and 6. **Dave Coggins** (Knutsford) heard a small burst of solar noise, lasting a few minutes, on 28MHz around 0630 on May 22 and writes, "after the burst, 28MHz on the following day was dead at 0630, whilst at noon there were only a few stations audible and those, plus the beacons, were fairly weak." **Fred Pallant G3RNM** (Storrington) reports "very high noise level" on 28MHz between 0800 and 1030 on the 24th.

For propagational studies, Dave Coggins checks the strength of the Canadian time-signal, CHU on 7.335MHz, three times per day and noted a rapid type fading at 0630 on May 12, 15 and 17. In Plymouth, **Ern Warwick** heard the background noise on 28MHz "surging and fading" on May 11, 14, 15, 16 and 17 and a high noise level on the 19th and 20th.

Aurora

The reports of auroral sightings received by Ron Livesey, the auroral co-ordinator for the British Astronomical Association, in April are listed in Fig. 1. He learnt from Doug Smillie (Wishaw) that tone-A signals were heard on days 7, 14, 16, 23 and 29. "A feature of recent auroras has been the amount of red structures observed," said Ron.

Magnetic

"April was still active to stormy, but nothing like the big storm and aurora last month," wrote Neil Clarke. He pointed out that the Ap index was quiet (below 10) on days 10, 12, 19, 21/22 and the 24th. Neil's print-out for the whole month can be seen in Fig. 9. Between them, Karl Lewis (Saltash), Ron Livesey and Doug Smillie measured magnetic activity on days 1, 2, 3, 4, 5, 6, 7, 14, 15, 16, 17, 18, 22, 23, 24, 25, 26, 27, 28 and 29.

Sporadic-E

Dave Coggins received short skip signals, via Sporadic-E, on 28MHz from Italy and Spain on May 5, Crete on the 7th, Germany, Holland, Italy and Luxembourg on the 11th, Czechoslovakia, France and Spain on the 14th and Italy on the 20th. Also on the 20th he logged stations from Dodecanese Is and France on 50MHz. During a Sporadic-E opening at 1730 on May 30, I logged the usual very strong f.m. signals from East European broadcast stations between 66 and 73MHz and good quality pictures and sound, in Band I, from the USSR on 49.75MHz and 56.25MHz respectively. The f.m. stations and the TV sound were received on my ex-military R216 v.h.f. communications receiver fed by a chimney-mounted horizontal dipole antenna.

The 28MHz Band

From his home in Bransgore, **John Levesley G0HJL** heard signals from Argentina and/or Brazil on May 1, 3, 6, 14, 18, 20 and 21; Australia on days 15, 17 and 21 and Japan the 15th and 21st.

"28MHz has been really fabulous for DX these last two weeks," wrote Dave Coggins on May 24. He continued, "I am now using a home-brew VK2ABQ beam for 28MHz and it does really work. It is very light indeed and it does pull the signals out of the noise very well." Dave likes its "deep nulls" on the sides and reports that one station was S8-9 when beaming directly toward it and then went right down into the noise as he rotated the antenna. Among the countries he logged during that fortnight were Central African Republic, Chagos Is, Falkland Is, India, Japan, Juan Fernandez Island, Kenya, Patagonia, Peru, Phillippines, Maldive Is, Mauritius, Reunion Is, Seychelles and South Georgia. Dave also heard the Sydney beacon VK2RSY (28.262MHz), via the long path, between 2100 and 2300 on May 9, 11, 13, 14 and 21 and says, "I have found that VK2RSY becomes audible via the long path after a good day of DX on 28MHz." That's interesting Dave, because many years ago a number of us found that a 2.5W beacon signal from Iceland (TF3EA), on 70.26MHz, often appeared, at good strength, around 2200 after a super Sporadic-E opening to the south-east had occurred during the day. Ern Warwick noted a small echo on most of the Soviet stations that he heard on the 14, 21, 24 and 28MHz band at 1100 on May 7.

Propagation Beacons

First, my thanks to **Mark Appleby G4XII** (Scarborough), **Chris van den Berg** (The Hague), Dave Coggins, **John Coulter** (Winchester), **Vaclav Dosoudil OK2PXJ** (Kvasice), Henry Hatfield, **Don Hodgkinson G0EZL** (Hanworth), **Ken Lander** (Harlow), John Levesley, **Greg Lovelock G3III** (Shipston-on-Stour), **Ted Owen** (Maldon), Fred Pallant, Ted Waring and Ern Warwick, for their 28MHz logs and interesting comments which enabled me to compile Fig. 7.

Most contributors, like Don Hodgkinson and Ern Warwick heard the Cape Town beacon on 28.242MHz sending

D/NIGHT	VISUAL REPORT	OBS	OBSERVERS LOCATION
APRIL 1/2	ACTIVE	3	N. SCOTLAND
APRIL 2/3	GLOWS	3	N. SCOTLAND
APRIL 3/4	ACTVIVE, ARCS, CORONA	7	HELSINKI, SCOTLND, WINNIPEG
APRIL 4/5	RAYS & ARCS, CORONA	4	SCOTLAND, WINNIPEG
APRIL 7/8	GLOW, ARC	2	CUMULUS, N. ENGLAND
APRIL 8/9	QUIET ARC	1	N. SCOTLAND
APRIL 10/11	GLOW	1	N. SCOTLAND
APRIL 14/15	ACTIVE STORM, CORONA	4	SCOTLAND, WINNIPEG
APRIL 16/17	RAYED ARC	1	ARGYLL
APRIL 23/24	QUIET ARC	2	SCOTLAND
APRIL 24/25	RAYS	4	CENTRAL SCOTLAND
APRIL 25/26	BRILLIANT CORONA	15	CARDIFF, C. SCOT, WINNIPEG
APRIL 26/27	ACTIVE; RAYS	4	CUMULUS, SCOTLAND, CO. CLARE
APRIL 27/28	RAYS, ACTIVE, CORONA	6	CO,CLARE, SCOTLAND, WINNIPEG
APRIL 28/29	GLOW	1	CUMULUS
APRIL 29/30	GLOW	1	N. SCOTLAND

Fig. 1

WRM094

Fig. 2

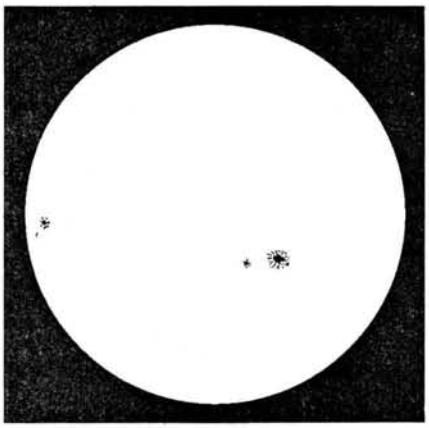

Fig. 3

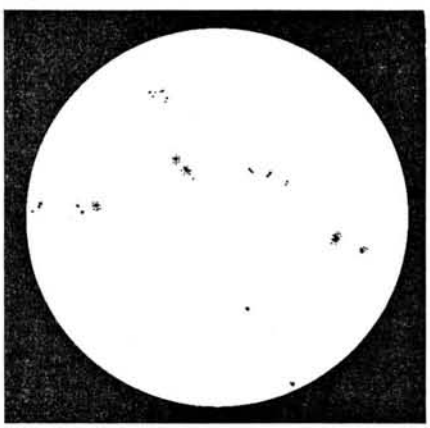

Fig. 4

"SEINDE ZS1CTB" and Greg Lovelock added EA6AU to his first-timers list. Mark Appleby and John Coulter added FX5TEN (28.225MHz) to our chart and several logged a couple of old friends OA4CK (28.240MHz) from Peru and 4N3ZHK (28.250) from Yugoslavia. "ZS1CTB is on the air again and some Europeans. Also GB3RAL (Slough on 28.215MHz) is audible often here," said Vaclav Dosudil.

Ern Warwick frequently logged PY2AMI on 24.931MHz; CT3B, OH2B, 4U1UN/B and 4X6TU/B on 14.100MHz and DK0WCY on 10.144MHz between April 25 and May 20 and occassionally, IK6BAK on 24.915MHz and KH60/B, JA2IGY and LU4AA on 14.100MHz.

Tropospheric

The slightly rounded atmospheric pressure readings shown in Fig. 6, were taken at noon and midnight from the Short & Mason Barograph installed at my home in Sussex. In Essex, Ted Owen's barometer peaked at 1033mb (30.55in) on May 6 and was low at 1006mb (29.75in) on the 11th.

Date	Groups	Filaments	Quiescent Prominences	Notes
28.04.89	2	16	10	bright patch almost flaring
30.04.89	1	24	12	
02.05.89	2	21	10	
03.05.89	2	27	6	small eruptive prominence on w.limb
04.05.89	2	18	8	small flare & small eruptive filament
05.05.89	2	22	12	
06.05.89	2	26	6	
07.05.89	4	23	11	
08.05.89	5	24	10	small spray prominence on e.limb
09.05.89	4	20	11	
10.05.89	3	23	11	small patch nearly flaring
19.05.89	5	27	9	
21.05.89	3	19	7	
23.05.89	3	23	9	much activity, no flares visible
24.05.89	4	20	6	
25.05.89	2	16	10	high thin cloud hampered observation
28.05.89	3	24	16	

Fig. 5

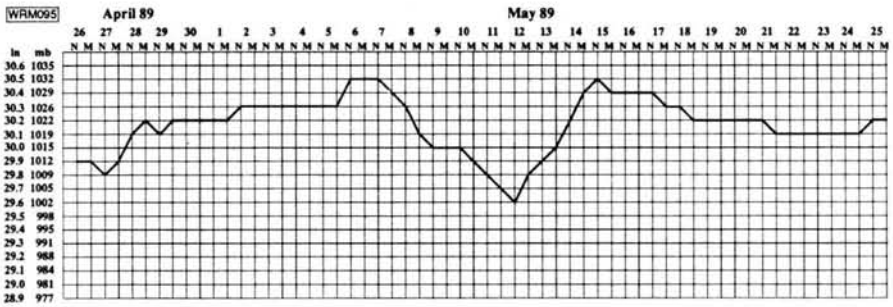

Fig. 6

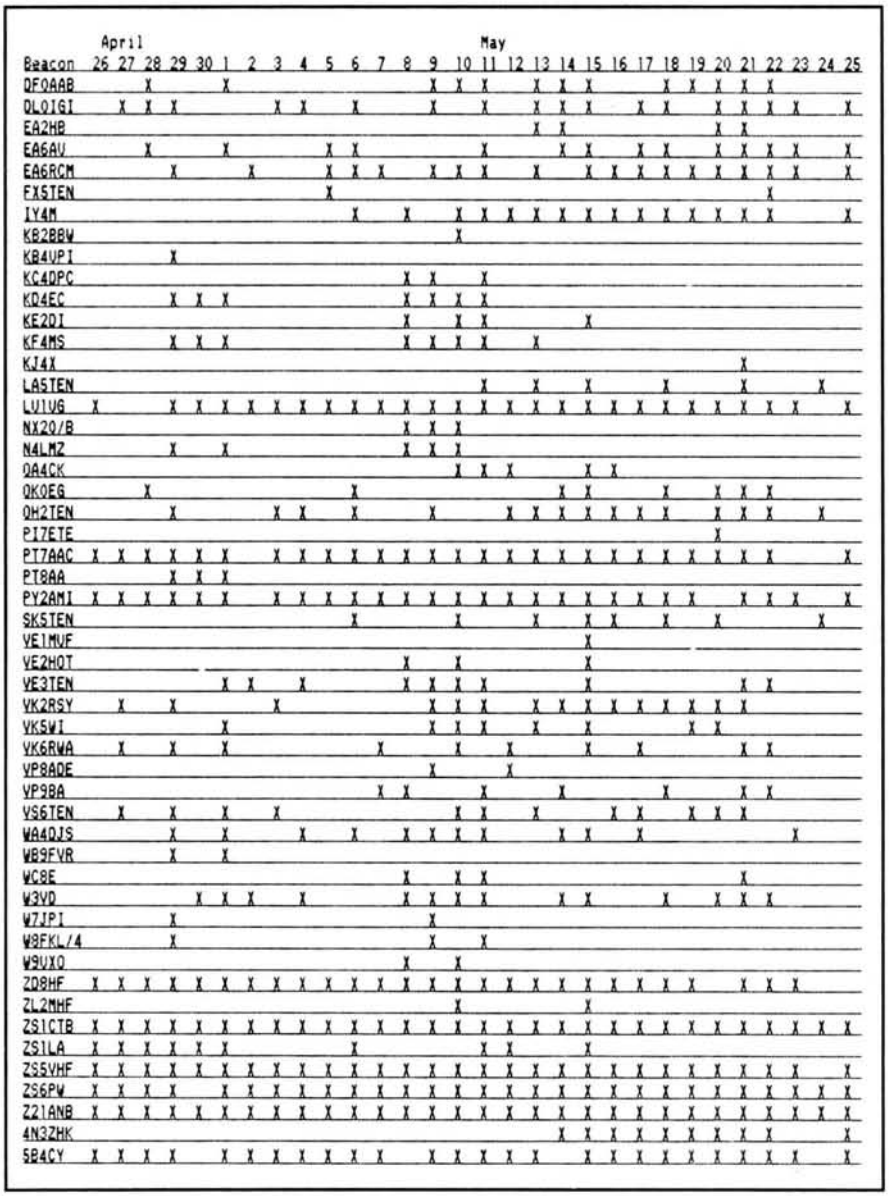

Fig. 7

As the high pressure fluctuated toward the end of May, a variety of continental broadcast stations were heard in Band II in many parts of the UK on days 20, 25 and 27 and, as the sun was rising between 0400 and 0500 on the 28th, I received u.h.f. pictures, in colour, from Anglia TV, Central TV and HTV.

934MHz

While on holiday in Deal, using a Cybernet Delta-One transceiver and 12-element loop quad and 4-element colinear antennas, at almost sea level, **Les Jenkins GB-37** worked stations in Ashington, Canterbury, Canvey Island, Deal, Detling, Eastwood, Felixstowe, Fobbing, Hadleigh, Hockley, Minster and Sittingbourne during the week prior to April 29.

"High pressure of 1026mb (30.3in) on May 4 brought a tropospheric opening and I worked stations on the Essex and Kent coasts, also Bedfordshire, wrote **Terry Wyatt UK-845** (Walton-on-Thames). This opening was very satisfactory for Terry because, together with BH-172 (Weybridge), their longest distance contacts so far were made with UK-859 in Canterbury and UK-717 in Felixstowe.

John Levesley UK-627 worked stations in the Channel Islands, at a distance of about 164km, on May 1, 4, 5, 20 and 21 and while conditions were so good on the 4th he contacted a motor vessel, using NG-01/MM, at 265km. Both stations were using collinear antennas. While operating from Shaftesbury on the 14th, John made 20 contacts in some 90 minutes ranging from Jersey to Brixham and from the Quantocks to Weston-Super Mare.

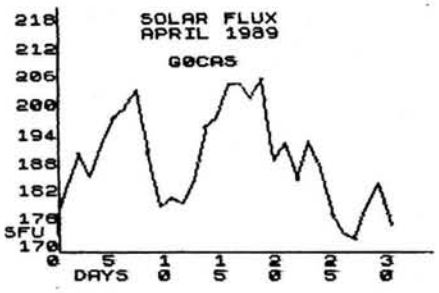

Fig. 8

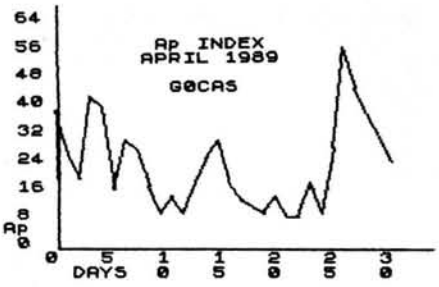

Fig.9

THE NEXT THREE DEADLINES ARE JULY 26, AUGUST 23 & SEPTEMBER 27

Broadcast Round-up

Peter Shore

Jamming has once more come into the news, this time from the Far East. Following the student unrest in Beijing and some other cities in the People's Repulic of China, Mandarin language broadcasts from the Voice of America were jammed from Monday May 22 on around four out of five frequencies. It is thought that the jamming transmitters were located in Canton. Transmissions from other broadcasters were also affected, including Radio Australia and, sporadically, BBC Chinese language programmes relayed from the East Asia Relay Station in Hong Kong. Strangely, Deutsche Welle and Radio Moscow were not affected. Voice of America added new frequencies for Chinese services towards the end of the month and the jamming intensified, making reception difficult in metropolitan areas. Placards appeared in Tiananmen Square thanking the BBC for broadcasting news of what was happening there - something which the official media failed to do. This yet again proves the power of international radio.

Meanwhile, Radio Beijing has started a Business Show in its English language section, sponsored by all sorts of companies including Finnair.

Radio Moscow is running a competition to celebrate the sixtieth anniversary of its Foreign Service, which is on October 29. To enter, answer these questions:

(1) When did you start listening to Radio Moscow?
(2) Why do you listen?
(3) What features do you prefer?
(4) What interests you in the life of the Soviet Union?

Answers should be submitted before October 1.

Radio New Zealand is to have improved transmission facilities. The New Zealand authorities have granted the organisation NZ$3 million to build a 100kW transmitter at Tapo, a site suggested in this column some months ago.

Radio Bras in Brazil has suffered cuts to its foreign service, and French and Spanish language broadcasts have both been dropped.

The International Telecommunication Union has been holding its Plenipotentiary Conference in Cannes, France to discuss the future of the Union and regulation of the frequency spectrum in the coming years. It is though that a recommendation to hold a Restricted Reallocation Conference will be made, which will take a close look at certain parts of the bands, including 1-3GHz (for mobile services and satellites), 22.5-23GHz (for HDTV allocation) and the spread of short wave broadcasting in the lower bands where there is currently overcrowding.

European Stations

All times UTC (=GMT)

We have reported that programmes of the Soviet Republic are now heard in Europe, aimed towards the Moscow area, on short wave transmitters previously used for jamming. Here is the current schedule:

Estonian SSR	0230-1900 on 5.9MHz
	1905-2100 on 9.56MHz
Latvian SSR	0300-1755 on 5.92MHz
	1800-2100 on 9.695MHz
Lithuanian SSR	
	0300-1600 on 6.01MHz
	1610-2200 on 6.975MHz
Moldavian SSR	
	0215-1800 on 6.075MHz
	1805-1950 on 15.36MHz
Belorussian SSR	
	0215-1700 on 6.15MHz
	1705-1900 on 15.27MHz
Ukranian SSR	0000-1415 on 6.03MHz
	1420-2315 on 15.385MHz
Armenian SSR	
	0453-1630 on 7.175MHz
	1035-1900 on 15.11MHz
Georgian SSR	0058-1655 on 7.125MHz
	1700-1900 on 15.42MHz
Azerbaijan SSR	
	0200-1720 on 7.30MHz
	1735-2000 on 15.18MHz
Kazakh SSR	0000-1700 on 9.69MHz
Kirghiz SSR	2259-1554 on 9.735MHz
	1550-1750 on 17.785MHz
Turkmen SSR	0415-1555 on 7.145MHz
	1600-1800 on 17.635MHz
Tajik SSR	2315-1705 on 9.785MHz
Uzbek SSR	0100-1625 on 5.945MHz
	1630-1900 on 17.84MHz
Tatar ASSR	0230-1455 on 11.945MHz
	1500-1800 on 17.81MHz

The European service of Radio Finland in English has a current schedule of:

0630 on 11.755, 9.56 & 6.12MHz
1405 on 17.8, 15.185 & 11.925MHz
1830 on 15.185, 11.755 & 9.55MHz
2100 on 11.755 & 6.12MHz

Programmes are also transmitted on 963 and 254kHz medium wave.

Programmes for the summer months from the Red Cross Broadcasting Service, based in Geneva, are to be heard:

Sunday June 25, July 30 and August 27 at 1100-1130 on 7.21MHz

Monday June 26, July 31 and August 28 at 1700-1730 on 7.21MHz

African and Middle East Stations

Radio France International via Gabon has moved from 4.89 to 4.86MHz in the evening, with 6.175, 7.16 and 9.76MHz in parallel.

RTA Algiers is on once again using 6.145MHz during the night with music programmes, noted with an i.d. at 0400.

BBC World Service Lesotho relay is now on 11.94MHz between 0430 and 1745.

Yemen Arab Republic is heard on 9.78MHz (a 50kW TX) and irregularly on 4.853MHz.

A station calling itself the "World Movement for the Liberation of Lebanon" has been heard on 27.555MHz u.s.b. with a five minute transmission at 0815 and 1015. The station protests against Syrian involvement in the Lebanon, but it has not been confirmed as coming from the Middle East as yet.

Asia and Pacific Stations

Radio Australia's morning programme heard in Europe on 9.655MHz between 0700 and 1000 is now coming through clearly. The frequency was occupied for some months by Radio

Moscow, but the Soviet station has now moved.

All India Radio's General Service in English schedule is presently:

0000-0115 on 17.725, 15.11, 11.745, 11.715, 9.91 & 9.535MHz
1000-1100 on 17.74, 17.387, 15.335, 15.155 & 11.86MHz
1330-1500 on 15.335, 11.81 & 9.565MHz
1800-1845 on 15.36 & 11.935MHz
1845-1945 on 15.36, 11.935 & 7.412MHz
1945-2000 on 15.36, 11.935, 11.86 & 9.755MHz
2000-2045 on 11.86 & 9.755MHz
2045-2230 on 11.715, 11.62, 9.91. 9.55 & 7.265MHz
2245-2400 on 15.11, 11.745, 11.715, 9.91, 9.535 & 7.215MHz

Radio Pakistan's slow speed news at 1105-1120 is now using 21.575MHz.

North and South American Stations

Radio Bras is broadcasting English to Europe at 1800-1900 on 15.265MHz and to North America at 0200-0300 on 11.745MHz.

The BBC World Service relay of English and Spanish via the RadioBras facilities is now 0900-1130 on 15.175MHz.

Broadcasts from Greenpeace are now being relayed via KUSW in Salt Lake City on 15.66MHz. Transmissions are heard Mondays and Thursdays at 1830, Tuesdays and Fridays at 1830, Wednesdays and Saturdays at 1730 and Sundays at 1915.

Stop Press

As this column went to press it was announced that BBC World Service Chinese Language transmissions had been increased to four hours daily broadcast via the Hong Kong relay.

ATV

THE NEXT THREE DEADLINES ARE JULY 26, AUGUST 23 & SEPTEMBER 27

Reports to Andy Emmerson G8PTH 71 Falcutt Way, Northampton NN2 8PH.

Welcome again to the wide world of ATV activity, with news from far and near. Most, though, is from far - so how about a bit more input from Great Britain? As I write these notes we are in our third week of really lovely weather - ideal for portable and contest working, and most unseasonal. Despite the clarion calls of gardening, house painting and barbeques I am sure you are all devoting your spare time to what really matters!

International Contacts

No, not on the air this time, but in a figurative sense. I have often stressed the advantage of building bridges with ATVers overseas and building our ATV hobby into a world-wide organisation. Only our AMSAT friends have really achieved this so far, and it is high time we built up something similar. With this in mind, I am delighted that we had an American visitor to our (almost too) successful BATC convention this year. Our guest was Henry Ruh KB9FO who, apart from being a high-profile ATVer in the States, is publisher of *ATV Quarterly*, the USA's equivalent of *CQ-TV*.

Henry appeared to be suitably impressed with the way we do things over here and returned to Chicago laden with plenty of video plunder. He says he will be back (is this a threat or a promise?) and accompanied by several other ATVers if we can only arrange that our convention no longer clashes with the Dayton Hamvention. Yes, indeed - we were thinking along similar lines as well.

Incidentally, *ATV Quarterly* is a very good read, full of technical goodies in its large colour format. You can subscribe by writing to the UK agent, Mike Wooding (5 Ware Orchard, Barby, Rugby, Warks CV23 8UF). An s.a.e. will get you details while £2 will buy you the latest issue.

Repeater News

The fine weather during May led to some impressive ducting and tempted **Richard G4YTV** (yes, he does work for Yorkshire!) to take a look for the Emley Moor repeater GB3ET. Richard is at Skirlaugh, near Hornsea and Hull and some 130km distant from the repeater. It came in well on his Sandpiper helical and Wood & Douglas pre-amp system. A couple of days later both he and **Clive G8EQZ** (Hull) provided on-air inputs to a talk on f.m. ATV given by **Trevor G8CJS** to the Hornsea radio club.

Now here is a letter I had best quote verbatim! It comes from **Jean Fletcher G0AWX** and says: "To inform all those that know her ... G1IXE, Viv has recently been appointed chairman of the Severnside TV Group and knowing how all of you enjoy having fun with Viv I though it only right to let you know.

"Genuflection is a must!!! ... as I feel sure she is the only lady chairman of a TV repeater group in the country. I am t'other female of the group so wish to support her wholeheartedly."

(I don't think any further comment is necessary except well done!)

Foreign News

Stanislav Pazur sends a welcome letter from Warsaw describing the fifth jubilee meeting of the Polish Radiovideograph Club (held on May 6 and 7 in Torun). They settled on a new badge and heard lectures on SSTV and RTTY techniques. A particularly interesting talk was on packet radio by Bartosz SP3CAI and Piotr SP9BWJ, who are leaders in this mode in Poland. The club chairman Wojciech SP2JPG encouraged everyone to work in ATV techniques. Some computer groups held demonstrations and seminars on Commodore, Atari and Sinclair computers: this was a great occasion to exchange experiences and some computer programs.

The station with the occasional callsign SP0RVG was operational during the meeting; this is one of the first stations with permission for packet radio working (a special permit is also required for SSTV in Poland). On May 6 this station made its first packet link-up with a British station, G0CIO, on the 14MHz band and using a Commodore 64 computer.

Richard VK4XRL writing from Brisbane, Australia, says: "Things have hotted up here as we have had our 50cm amateur segment taken away from us as from March 1. We are, however, allowed to keep our ATV repeaters operational until they require the frequencies for that area.

"However, a lot of questions have been raised about 1.3GHz, but at this stage the Australian bandplan does not allow for f.m. operation. Also the bandplan for Queensland is different again. I wrote a letter to the Wireless Institute of Australia, which has been passed onto DOTC to look into our requirements. So far I think I am the only one with a 1.3GHz f.m. ATV transmitter and receiver. I have been doing some experiments with satellite receivers which cover the band and seem to work quite well, although a little down on gain."

Still in the bottom half of the world, some ATV news from New Zealand, where **Michael Sheffield ZL1ABS** resides. "The Auckland ATV repeater has been operating for two weeks now from the beacon hut site in the Waitakere Ranges to the west of Auckland City.

The input is 443.25MHz vision a.m. and 448.75MHz sound f.m., with output on 615.25MHz vision a.m. and 620.75MHz sound f.m. The antennas are double quad radiators, with screen reflectors, horizontally polarised, of course. Belden 9913 coaxial cable is used. From this site there have not been any interference problems with the airport radar (602MHz).

"The repeater's 2C39-equivalent p.a. has been eating up Zener diodes rapidly and is not functioning at present. The 2 watt solid-state driver is feeding the antenna direct at present. Beacon mode operates continuously when the repeat mode is not being brought up by incoming signals. The beacon is 3 minutes of test card/callsign, then 3 minutes of colour bars and back to test card.

"The a.m. squelch did not work too well as the hut has a high v.h.f. noise level, so a video sync squelch (from *The Best of CQ-TV*) has been built and installed. Strangely no-one has been able to work through the repeater since the new squelch has been fitted, but it is suspected the receive antenna was unplugged during testing and forgotten when leaving the site!

"At my QTH, 23km line of sight away, I get P4.5 using a 9-element Yagi, 15 metres of UR57 and my barefoot v.c.r. tuner. Also the audio beacon comes in S4. It is a digital stepped frequency tone derived by dividing the FD and switching the outputs so that eight tones are sequenced. This site gives stronger signals locally than the Klondyke site (80km to the south, trialled in 1986 but abandoned due to radar interference), but the DX possibilities are more limited.

"This means that there are two ATV repeaters operating in ZL now. Wellington is back on the air after a year QRT for rebuilding. Wayne ZL1TVW reports that activity is returning quickly, with some five stations using the repeater. Further repeater news later."

Contest Reminder

Finally, don't forget there are still three TV contests to enjoy this year: the International, the Slow-Scan and the Winter ATV. First up is the IARU contest from 18.00 Saturday September 9 until 12.00 noon on Sunday 10: it's for all fast-scan bands. The slow-scan contest is from all day November 12 (midnight to midnight), while the winter contest is another all-band, fast-scan affair from 18.00 Saturday December 9 to 12.00 noon the next day.

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WR240	.. ..	..	2.90
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WR226	.. ..	..	
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WA002	"TEME" (RECEIVER)	JAN 85	4.30
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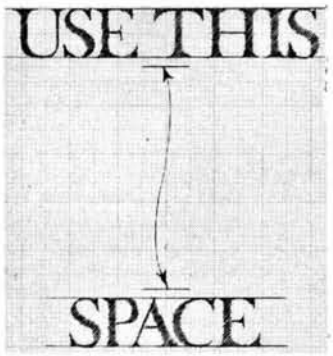
WR166	"SEVERN" (RECEIVER/AUDIO)	JUN 83	6.50
WR165	"SEVERN" (VFO)	JUN 83	5.20
WR167	RTTY TERMINAL UNIT FOR ZX81	JUN 83	7.80
WR160	LMS REGENERATIVE RECEIVER	FEB 83	5.20
WR158	REPEATER TIME-OUT ALARM	NOV 82	5.20
WR143	ATV CONVERTER	APR 82	7.10
WR144	IAMBIC KEYER	MAR 82	6.50
WR126	"EXE" 10GHz TRANSCEIVER	AUG 81	7.70
WR095	TRANSCEIVER POWER SUPPLY	SEP 80	3.85
WR068	AF SPEECH PROCESSOR	JAN 80	5.20



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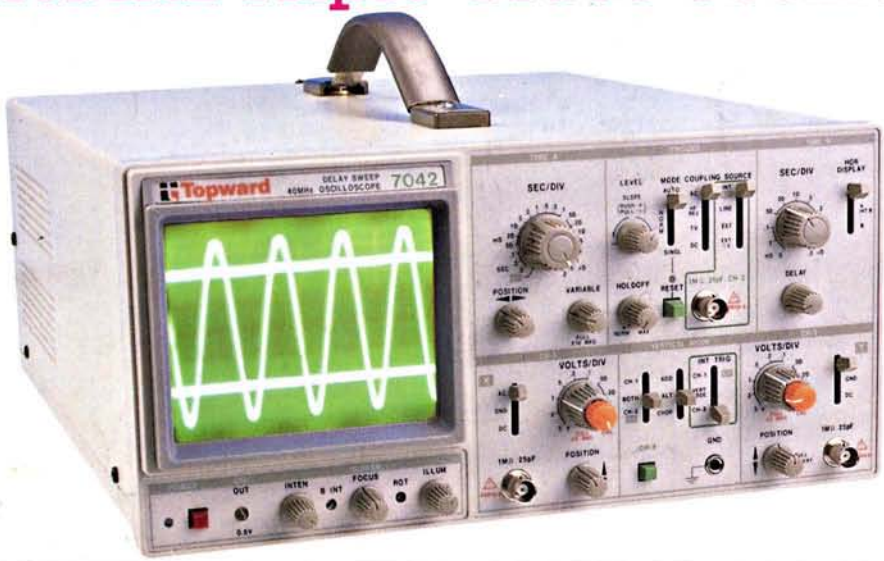

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