MARCH 1989 £1·30

ISSN 0141-0857

Practical Wireless

The Radio Magazine

FREE WITH THIS ISSUE
HF BAND PLANS DATACARD

PW REVIEW
ICOM IC-3210E DUAL-BANDER

NEW SERIES
PACKET RADIO UPDATE

NiCad BATTERY PROTECTOR

"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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YAESU

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

Practical Wireless
The Radio Magazine

MARCH 1989 (ON SALE 9 FEBRUARY 1989) VOL. 65 NO. 3 ISSUE 984

THIS MONTH

NEXT MONTH

Transmitter Two-tone Testing

Modifying the Realistic DX-100 Receiver

Pre-publication Offer—Newnes Short Wave Listening Handbook

plus All the usual features

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

On sale March 9

Contents subject to last-minute revision

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Count on us!

IC-575, 28/50MHz Dual band multimode.

The ICOM IC-575 base station has been developed to meet the demand for advanced communications for the recently acquired 6m band. Similar in appearance to the IC-275/475 2m and 70cm base stations, the beauty of this new transceiver from ICOM is that it gives you the best of both worlds, 6 & 10m in one compact unit. The IC-575 covers 28-30Mhz and 50-54Mhz. Operating modes are SSB, CW, AM & FM. Power output is 10 watts (AM 4 watts) with a front panel control to reduce output for QRP operations. A pass band tuning circuit narrows the I.F. passband width, eliminating signal in the passband. A built-in notch filter eliminates beat signals with sharp attenuation characteristics.

Some PLL systems have difficulty meeting the lockup time demands placed on them by new data communications. This is why ICOM developed the DDS (Direct Digital Synthesizer) method. With a lockup time of just 5msec the DDS method allows the IC-575 to handle data communications such as packet or AMTOR. 99 programmable memories can store frequency, mode, offset frequency and direction. A total of four scanning functions for easy access to a wide range of frequencies, memory scan, programmed scan, selected mode memory scan and lock out scan. The IC-575 has an internal A.C. power supply, but can also be used on 13.8v DC for mobile or portable operation.

Optional accessories available are the UT36 voice synthesizer, the IC-FL83 CW narrow filter, SM7 external loudspeaker, HP2 communication headphones and SM8/SM10 desk microphones. Other transceivers available in this range are: IC-275E 2m multimode 25w, IC-275H 2m multimode 100w, IC-475E 70cm multimode 25w, IC-475H 70cm multimode 75w.

IC-505, 50Mhz Transceiver

The IC-505 is a 6mtr BAND SSB, CW, FM (Optional) transceiver. It can be used as a portable or like other transceivers of this type as a base station unit. When used with an external 13.8v power supply the 505 gives 10 watts RF output, 3 watts or 0.5 watts on low power is available when using internal batteries. Other features include 5 memories with memory scan, program band scan, dual VFO's with split operation.

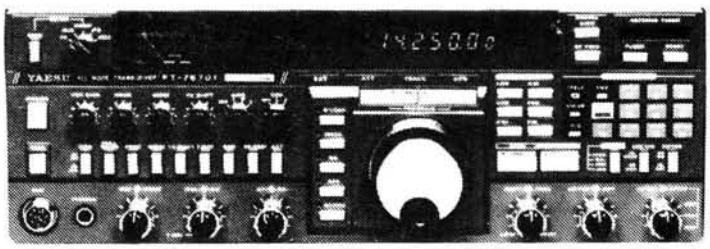
The easy-to-read LCD readout includes frequency, memory scan and call modes. Full metering of battery condition signal strength and power output is provided. When fitted with the optional EX248 FM unit the IC-505 offers 50MHz operation at an affordable price.

SMC South Midlands Co

SCHOOL CLOSE, CHANDLERS FORD IND. EST., EASTLEIGH, HAN

*FREE FINANCE - BUY NOW SAVE M

NEW IMPROVED FT767GX



Yaesu have upgraded this popular HF and VF/UHF base station transceiver. The improved version is now available with enhanced synthesiser performance and VFO tuning rate. Read Chris Lorek's review in "Ham Radio Today".

- ★ ALL MODE LSB/USB, CW, FSK, AM & FM
- ★ All BAND Transmit, General Coverage Receive
- ★ Optional VHF/UHF units (6M, 2M & 70cms)*
- ★ 100% DUTY CYCLE (Key down CW for 30 mins)
- ★ Built in AUTOMATIC ATU (One memory on each band)
- ★ Computer & Packet radio compatability

OPTIONAL ACCESSORIES

50/767	6M Unit 10W O/P	£169.00	FL7000	500W PEP HF Linear £1600.00
144/767	2M Unit 10W O/P	£169.00	SP767	External Speaker £69.95
430/767	70Cms Unit 10W O/P	£215.00	FIF232C	Computer Interface £75.00

For existing owners of the FT767GX who purchased their sets through Yaesu's official UK distribution network, Yaesu are offering an upgraded local unit for a nominal charge. Please contact us for details.

NEW NEW NEW NEW NEW NEW NEW NEW

An FT23R with a KEYPAD – NEVER! OH YES . . .

Yaesu have done what some thought was impossible with a miniature handheld, yet Yaesu's engineers complacently claim, "Well wasn't it the next logical step!!".

Let us introduce you to the new FT411 2m and FT811 70cm handhelds.

- 5 Watt RF output
- 49 Memory channels
- Built in vox
- Adjustable powersave
- Automatic power shut off

Are just a few of the many features and whats more all the accessories are the same as the FT23R range.

FT470 DUAL BANDER

Yaesu with their pioneering FT727R dual band handheld have studied the market and watched their competitors for some time, now they have introduced a new handheld with so many outstanding features that it would put to shame even some of their competitors dual band mobiles. Outstanding features such as:

- Full duplex cross band operation
- Dual band receive
- Dual display indication
- Programmable powersave
- Automatic power shut off

All accessories compatible with FT23 range.

"Well done Yaesu we think the lights will be burning late at your competitors factories."

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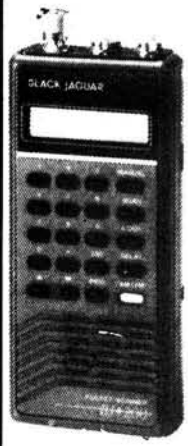

BLACK JAGUAR MkIII

The new Mark III is probably our most popular handhold scanner with 16 channels of memory and a sensitive receiver. Selectable AM or FM reception and the facility to power the set from the mains or car using one of the many accessories now available.
Frequencies: 28-30 MHz, 50-88 MHz, 115-178 MHz, 200-280 MHz, 360-520 MHz

£199 NEW LOW PRICE

Black Jaguar Accessories

(suitable for all models: BJ200, Challenger etc.)

Mobile Mount	£6.95
Base Mount	£5.95
BJ1 Car Supply (Mk III version only)	£14.95
BCA6 Mains Slow/Fast Charger	£14.95
Airband Rubber Duck Antenna	£6.00
SA7 UHF Stub Antenna	£4.95

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Base/Mobile Scanners

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Bearcat 580 XLT	£199.00
Bearcat 800 XLT (including 900 MHz)	£229.00
Bearcat 950 XLT (including 900 MHz)	£269.00

New Models – Just Arrived

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AOR 900 Handheld with 900 MHz	P. O. A.
AOR 2002 Base with full coverage	£487.00
AOR 3000 New Broadband Base Model	P. O. A.
SAB9 MW and Airband Handheld	£19.95
Sony Air 7 Handheld - Airband	£249.95
Sony Pro 80 Handheld - Wide band	£349.95

NEW LOW LOSS JAPANESE COAX

Essential for best performance with wideband UHF scanners. We have directly imported this cable which has exceptional low loss.

Frequency	5D	8D	10D
Loss/mtr @ 100 MHz (dB)	0.055	0.039	0.031
Loss/mtr @ 400 MHz (dB)	0.121	0.085	0.068
Loss/mtr @ 1 GHz (dB)	0.187	0.130	0.105
Price per meter	£0.56	£1.40	£1.99

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Nevada WB1300 (25-1300 MHz) Wideband Top of the range stainless steel £59.95

Nevada Discone (50-700 MHz) High Quality 8 Element **£24.00**

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EBF80	1.50	GY501	3.00	PY801	1.50	6AT6	1.25	6SC7	2.75
EBF89	1.50	GZ32	4.00	QQV02-6	38.00	6AU5GT	5.00	6SG7M	2.50
EC91	8.00	GZ33	4.75	QQV03-10	26.25	6AU6	2.50	6SJ7	3.25
ECC33	4.50	GZ34	5.00	QQV03-20A		6AW8A	3.75	6SK7	3.50
ECC35	4.50	GZ37	4.75		48.38	6B7	3.25	6SL7GT	3.00
ECC81	1.75	KT61	5.00	QQV06-40A		6B8	3.25	6SN7GT	3.00
ECC82	1.75	KT66	15.00		46.00	6BA6	1.50	6SS7	2.75
ECC83	1.75	KT77 Gold Lion		QV03-12	6.80	6BA7	5.00	6U8A	2.25
ECC85	1.75		12.00	R18	3.00	6BE6	1.50	6V6GT	4.25
ECC88	3.50	KT88	15.00	R19	9.24	6BH6	2.50	6X4	3.00
ECC91	8.93	N78	15.00	SP41	6.00	6BJ6	2.25	6X5GT	1.75
ECF80	1.50	OA2	3.25	SP61	4.00	6BN6	2.00	12AX7	1.75
ECH35	3.00	OB2	4.35	U19	13.75	6BQ7A	3.50	12BA6	2.50
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ECL80	1.50	PC86	2.50	U37	12.00	6BS7	6.00	12E1	20.00
ECL82	1.50	PC88	2.50	UABC80	1.25	6BW6	6.00	12HG7	4.50
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EF42	4.50	PCF86	2.50	UF89	2.00	6CD6GA	5.00	572B	65.00
EF50	2.50	PCF801	2.50	UL41	8.00	6CL6	3.75	805	45.00
EF54	5.00	PCF802	2.50	UL84	1.75	6CH6	13.00	807	3.75
EF55	3.50	PCF805	1.70	UY41	4.00	6CW4	8.00	811A	18.33
EF80	1.75	PCF808	1.70	UY85	2.25	6D6	3.50	812A	52.50
EF86	5.00	PCH200	3.00	VR105/30	2.50	6DQ5	7.50	813	65.00
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EF92	6.37	PCL83	3.00	Z759	25.00	6EA8	3.00	872A	20.00
EF183	2.00	PCL84	2.00	Z803U	25.00	6EH5	1.85	931A	18.50
EF184	2.00	PCL85	2.50	2D21	3.25	6F6	3.00	2050	7.50
EH90	1.75	PCL86	2.50	3B28	50.00	6GK6	3.50	5763	6.80
EL32	2.50	PCL805	2.50	4CX250B	58.00	6H6	3.00	5814A	4.00
EL33	5.00	PD500	6.00	5R4GY	5.50	6HS6	3.77	5842	12.00
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EL81	5.25	PL82	1.50	5Z3	4.00	6JB6A	7.50	6550	12.50
EL84	2.25	PL83	2.50	5Z4GT	2.50	6JE6C	7.50	6883B	12.50
EL86	2.75	PL84	2.00	6/30L2	1.75	6JS6C	9.00	6973	7.50
EL91	7.39	PL504	2.50	6AB7	3.00	6K6GT	2.75	7025	4.50
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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.

£329

ALINCO DJ-100E 2M FM

DJ-100E 2M FM

NEW

IN STOCK

Latest rig from the ALINCO stable, this handheld has been developed from the successful ALX-2E. Now incorporating LCD display and 10 memory channels it will fit into even small pockets! The extended receive range cover 140-170MHz and there are no extras to buy. Chris Lorek says in Ham Radio Today, "a lovely little transceiver with a very impressive technical performance.

£219

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.

£449

ALINCO 2M AMPLIFIERS

SSB/CW/FM

These amplifiers will give you the means of boosting the output from any handheld into a full blown 30-50 watt signal. Each one has a built-in receive pre-amp and requires approx 3 watts of drive. Rugged construction, full protection and both hard switching and RF sensing are features you'll appreciate. They also provide a 10V output for direct operation of handhelds from car supply. Send for details.

ELH-260D 50W **£119**
ELH-230D 30W **£75**

QRP HF TRANSCEIVERS

SSB/CW

Single banders for 80; 40; or 20m with 2 Watts output SSB/CW. Fits into the pocket but can work the DX. These rigs have provided us with some fun recently, and they could do the same for you. Ideal for holidays, hotels or just a new challenge. Go anywhere, no TVI and beautifully engineered. VXO control, IRT, and a host of other features. We got 569 for LA2 on 80m with an indoor wire and W's on 20m! Send for specification.

***£179**

*80M Model **£189**

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Complete Guide to VHF/UHF Frequencies 25 to 2GHz	£5.95
VHF/UHF Airband Guide to Commercial & Military. Pub Aug 1988	£5.95
HF Oceanic Airband Communications 1988	£3.50
The Secret of Learning Morse Code	£4.95
Pocket Guide to RTTY & FAX Stations	£2.95
Marine Radio Frequency Guide HF & VHF (available end of February)	Phone
Airband Radio Handbook Second Edition	£5.95
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Send for spec. sheet.

ADONIS MICROPHONES

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AM-503G

As above but with speech compressor. **£65.95**

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2M Handhelds for £179

This is your chance to make a big saving. We've purchased the end of production runs of ALINCO ALX2E micro handheld and ALM203E models. Both fully guaranteed for 12 months. We've got leaflets but limited stocks. So act now as we doubt that stocks will last beyond 4 weeks!

ALX2E £179 ALM203E £199

SONY COMMUNICATIONS

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ICF7600DS	150kHz - 30MHz SSB/AM + FM	£157.00
ICFSW1	150kHz - 30MHz AM Compact	£147.00
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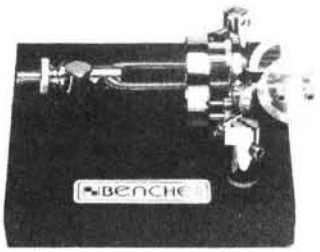

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The Future of Amateur Radio

With a new piece of legislation which came into effect on 8 August 1988, the rights of the British radio amateur have been irrevocably undermined.

The RSGB is now taking up pages of *RadCom* trying to appease thousands of angry amateurs in an attempt to close the stable door after a team of horses has bolted.

It was not their fault, of course, and the clause in the new licence was for advice only. It was all due to something called a Statutory Instrument put through Parliament in July totally unopposed by the RSGB because they presumably knew nothing about it. Even if they did know about it they did not fight it as they have a good relationship with the DTI and it wasn't really aimed at the amateur fraternity but at those CB pirates, who don't exist as far as the RSGB is concerned anyway.

The purpose of the Statutory Instrument was to prevent pirate radio users from acquiring equipment designed for 10m and using it on the neighbouring 26.065–28.000MHz band, but it also prohibits the assembly of 10m apparatus or the conversion of illegal multimode CB equipment to legal amateur use—why?

I would have thought it was in the interests of the DTI for amateurs to soak up these rigs and put them to legal use.

The DTI are kindly going to allow individual amateurs the privilege of converting any such sets in their possession, but first they have to admit in writing that they are in possession of transmitting apparatus in contravention of the Wireless Telegraphy Act 1949 and subsequent legislation. This privilege will not continue indefinitely but will be withdrawn in the not too distant future. Thereafter, the men from the RIS will be seizing such apparatus from the amateur and presumably following through with court action.

What next? Will there be another Statutory Instrument banning the importation and possession of h.f. transceivers with general coverage receive capability, on the grounds that these are also used by the 6.5MHz pirates who have them modified for general coverage transceive use. What about all those old FT-101s with 11m transceive included as standard? And the modern black boxes covering well outside the h.f. amateur band limits?

With the vast majority of amateurs using black boxes to exchange generally meaningless jargon, and undertaking little construction or development work, their contribution to Britain's technology is small compared to their nuisance value to their neighbours. BCI and TVI is still a great problem for most amateurs, and many cases occur solely due to the inability of domestic hi-fi and TV equipment to cope with any sort of nearby radio transmission. The poor amateur is put in an almost impossible position, as to obtain proof of the cause of the interference, the neighbour has to pay a substantial sum to the RIS. Rather than do that he gets a petition from the rest of the street and presents it to the local MP to get the amateur station closed down.

The RSGB is apparently

PW COMMENT

The Future

IN OUR STAR LETTER THIS MONTH, Tony Nailer paints a gloomy picture of the future facing amateur radio at the present time.

Taking his last point first, of the decline in home construction, this is very much a vicious circle of ever-reducing levels of supply and demand for radio components, with a seemingly insatiable demand for all-singing, all-dancing, lights-flashing, beepers-beeping, black boxes, rather than the personal satisfaction of using a piece of home-built equipment.

With the increasing sophistication of modern communication techniques, it is pointless to hanker after the total home-build situation of 50 years ago. It is equally unrealistic to demand that anyone with an interest in amateur radio must prove themselves capable of building and aligning an s.s.b. transceiver before they can hold a licence. The black box is here to stay. We must, though, encourage and maintain an interest in home construction at all technical levels if newcomers are to be drawn into the hobby, and if amateur radio is to continue to be looked upon favourably by governments in the battle for spectrum space.

For that reason, I find the facts surrounding the infamous clause (aa) in the new UK Amateur Licence particularly worrying. I can understand why the DTI wanted to have yet another try at closing all the loopholes in the ill-drafted previous legislation aimed at curbing illegal CB operations. What I question is whether this is an effective and fair way to do it. From the RSGB's pronouncements on clause (aa) and the related Statutory Instrument, it is fairly obvious that they knew nothing about either of them until the new licence format was made public.

We had heard nothing of the new Statutory Instrument at our editorial offices prior to that, either, but that is perhaps not too surprising. It has long been my experience that some pieces of new legislation are trumpeted from the rooftops for months or even years in advance, with full-page newspaper adverts and ministerial TV interviews, whilst others, frequently just as important and often more so, are slipped quietly into effect. To monitor them all is an expensive and time-consuming business unless you are regularly in touch with the corridors of power, as the RSGB claims to be with the DTI.

Certainly, there has been legislation, in the form of Acts of Parliament and Statutory Instruments, in existence for some years which limited dealings in or use of transmitting equipment which includes coverage of the 28–29.7MHz amateur band. I doubt though that it was known about, let alone understood, by more than a handful of UK licensed amateurs, especially since equipment covering that band was apparently freely imported, advertised and sold. The new UK Amateur Licence makes reference to no less than eight items of national and international regulations and law, and these are by no means all that affect a radio enthusiast. It is a long-established principle that "ignorance of the law is no excuse", though it is questionable how fair that may be when much of the law is unpublicised, and even more of it is all but incomprehensible.

Finally, on the question of the proposal for a Novice or Student licence (I notice from the January 1989 issue of *RadCom* that a majority favour the Novice title), *Practical Wireless* supports the principle of such a licence, in the hope that it would attract new blood to the hobby.

I think that the decision by RSGB Council some years back, effectively to ignore the existence of CB, was probably one of the most damaging which they have ever made for our hobby. Some of the affiliated clubs and societies ignored this official line, thank goodness, and welcomed keen local CBers with open arms, teaching them the benefits and the responsibilities that come from the wider scope of amateur radio. Many of those clubs have been strengthened as a result.

Again, I can understand that there was a wish in Council to stress the differences between CB and amateur radio. It is interesting to speculate, however, what the state of amateur radio in the UK would have been now, had they decided upon a positive, rather than a negative, line of action to achieve that end.

Geoff Arnold

putting great effort into attracting new blood into the hobby, and at last putting strong emphasis on the practical aspects rather than just portraying the average shack as being filled with commercial boxes. The only time the average amateur uses a soldering iron is to put a plug on the end of a piece of coaxial cable.

The cost of transceivers continues to rise and as they do so the type of person who can afford them also changes. When the elders of our hobby ask where is the new blood, the answer is that many otherwise interested persons are put off by the cost of the equipment.

I believe that there is little in amateur radio to compare with the feeling of achievement when a contact is made using a piece of home-built apparatus. Obviously, there are different problems encountered with home construction these days compared with the valve era. Though chassis-bashing may have gone, it has been replaced by the problems associated with making printed circuit boards. Luckily, there are a few firms who supply components or kits for radio equipment or accessories via mail order, and tried and tested designs are published in the various magazines, but the handy local shops full of components and technical assistance have nearly all died out due to lack of trade.

If amateur radio is to have any future we all must start to experiment and construct more and exchange useful information about radio science both on the air and through our journals. Otherwise, we are not meeting our prime directive, viz: The self-training of the Licensee. Will the last British amateur please turn the lights off and lock the shack door behind him!

A. Nailer G4CFY
Dorchester.

Customs

Following the review in May 1988 *PW*, I sent for a SuperSCAF kit from AFtronics in Longwood, California. I am pleased to say that the kit arrived safely after five weeks, having been delayed by UK Customs. The SuperSCAF is an excellent product and I endorse everything said by Christopher J Page G4BUE in his review.

It may be worth pointing out to your readers, however, that the overall cost is around £125, a trifle higher than suggested in the article. The reason is UK Customs duties, which can add between 4 and 14 per cent to the basic kit value, and then good old VAT on top of this.

If any UK amateurs are considering purchasing any components, kits or complete equipment from overseas it would be as well to bear the overall costs in mind. A phone call to your local Customs and Excise office might be worthwhile before sending for the merchandise. According to Joe Fikes of AFtronics, the British Customs delays are commonplace now, so potential purchasers from overseas beware. The goods arrive, eventually!

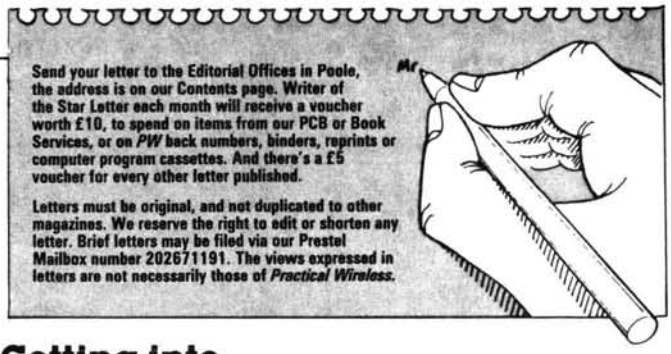
Peter Lonsdale G3PVX
North Harrow

Research

May I congratulate George Pickworth on his article "Learning from the Pioneers" (December 1988 *PW*). I'd like to explain what I see as the difference between empiricists and researchers.

Empiricists observe what happens, without trying to form an explanation of why it happens. Researchers try to establish why certain effects are observed, and seek supportive evidence for their theories. Electronics is an excellent example of how this incremental addition to the knowledge of a subject may largely govern viable areas of research today within education and industry, but I'd like to advocate a return to research for research's sake, rather than for financial gain.

N. J. Burton G0KLM
Poole, Dorset



Getting into Packet

I am prompted to write to you after talking to many amateurs who have more than a passing interest in packet radio. I was shocked to hear that many complained that the packet community was a very closed shop, and that a lot of cliques were apparent. These people were quite reticent about talking about their hobby, and this was interpreted as snobbishness.

Getting equipped for packet couldn't be much easier today. Everyone will have the rig; all they need is a computer and a TNC. It is then that the problems arise for the newcomer, for there is very little in print about packet radio as compared with other modes. The subject is a little more complex than the chappy at the local emporium would have you believe, and getting more so.

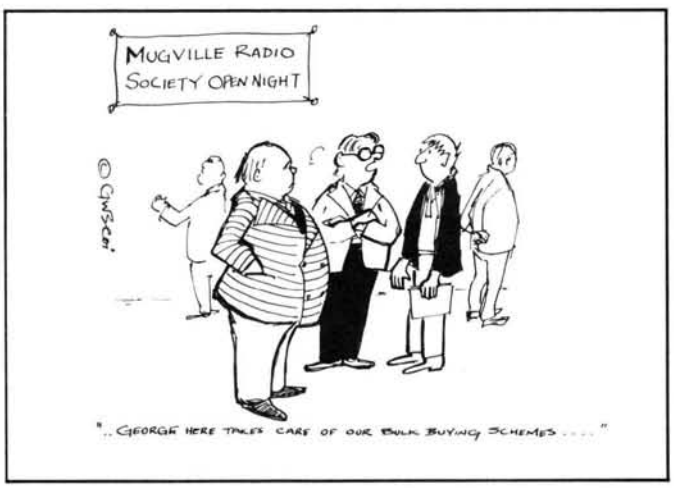
Where then does this leave our friend who has purchased his kit? Not really anywhere, as his only recourse is to ask people, and this is where the problem occurs. It is very difficult to give one-line answers to some questions that are posed, and usually one question answered leads to three or four more, which may be difficult to explain over a pint and a bag of crisps at your weekly meeting.

A lot of prospective "packeteers" tend to have a go for a few weeks, then give it up as being far too complicated. This is unfortunate as it is a great mode that deserves more than a passing interest or a "dabble". In the final analysis it seems that as a mode, packet requires a little more commitment than some other modes, and also an active interest in computing helps a lot.

Perhaps the best solution is to ask a friend who runs packet if you can sit alongside him and observe a few sessions. The questions you may have can then be answered by demonstration.

Mark Flett G7BGS
Buxton

In this part of the country, packet enthusiasts will bend your ear on the subject at the drop of a hat! For readers not in that situation, our new series "Packet Radio Update", beginning this month, should help to answer your questions. It is also worth getting in touch with BARTG, who have a new publication entitled Beginner's Guide to Packet Radio *available price 95p plus 20p post and packing. Write to BARTG c/o John Beedie, Ffynnonlas, Salem, Llandeilo, Wales SA19 7NP.—Ed.*



NEWS DESK ... compiled by G4LFM and G8VFH

QRP HF Transceivers

Three single band models are currently available offering 3.5MHz (80m), 7MHz (40m) and 14MHz (20m) s.s.b./c.w. with a power output of two watts. Made by Mizuho of Japan, each unit is completely self contained with built-in speaker, microphone and even Morse key. The size of the unit is approximately 64 x 38 x 140mm and the weight is 590g.

Frequency control is by VXO with a coverage of 25kHz on each segment of the 3.5 and 7MHz models and 50kHz on the 14MHz model. The circuitry is built around an 11MHz crystal filter providing a single superhet receiver circuit and a transmit signal with full a.l.c., etc. Power requirements are 6 HP-7 dry cells, 7 NiCads or external 9.6V.

Prices are £179 for the 7 and 14MHz versions and £189 for the 3.5MHz model. Each unit is supplied complete with one crystal segment. Optional extras include external microphone, noise blanker, c.w. break-in unit, carrying case, whip antennas and d.c./d.c. converter.

Waters & Stanton Electronics.
18–20 Main Road,
Hockley,
Essex SS5 4QS.
Tel: 0702 206835.

Hallicrafters Data

A frequent problem for anyone trying to maintain or repair radio equipment from the valve era is getting hold of the relevant circuits and data.

Recently, a reader in Australia has commended to us a company specialising in the supply of manuals for Hallicrafters communications equipment. The company concerned is **Ardco Electronics, P.O. Box 95, Berwyn, Illinois 60402, USA**, who will quote prices in response to a letter specifying the equipment model you are interested in. No doubt a couple of International Reply Coupons with your enquiry will be greatly appreciated.

Can You Help?

Mr A. Parvin has a Veritone DX Mates CR-150 made by the Star Company, Tokyo and is keen to obtain a circuit diagram for it. Some work has been carried out on the set and he feels with a circuit diagram this could be improved. If you can help, write to: ***A. Parvin, 55 Prestwick Road, Castle Vale, Birmingham B35 6PG.***

Mr T. Jenkinson has quite large quantities of old radio magazines. Titles Like: *Practical and Amateur Wireless* 1945–1986, *Wireless World* various years 1950–1985 and *Radio Constructor* odd issues between the years 1954 and 1979 as well as more modern electronics magazines. They belonged to his father and he would like to get rid of them. If you're interested, send an s.a.e. to ***T. Jenkinson, 8 Richmond Avenue, Morecambe, Lancashire LA4 5XU.***

Mr A. Wright has a Philips Stereogram model No. F6G40A. He requires a "last-in-line i.f. coil". This is no longer available from Philips, does anyone know where to get one from. If so, please contact: ***A. Wright, 33–3rd Avenue, Bonhill, Alexandria, Dumbartonshire, Scotland G83 9BJ.***

New Ownership

As from 16 November 1988, Revco Electronics Ltd., has been under new ownership and management following the retirement of the founding directors Dennis and Patricia Reeves.

The new directors are Peter and Mary Longhurst of Startop Communications Ltd—better known by its trading name of Garex Electronics.

The takeover marks the culmination of many years of collaboration between the two companies. It is anticipated that the two companies will continue to trade as separate entities, although there will be some logical rationalisation of their activities.

Type Testing

The DTI intend to charge manufacturers, suppliers and importers for type approval testing of radio equipment submitted from 12 December 1988.

Charges will range from £650 for testing low power receivers, up to £8000 for certain combinations of maritime equipment. These charges are intended to reflect the true cost of testing which until now has been paid through licence fees for users of radio equipment.

All radiocommunications equipment manufactured in the UK, or imported here, must be type approved by the DTI or by one of three approved commercial testing centres. This ensures that equipment complies with appropriate performance standards and does not cause interference to other radio services.

Full scale fees will be charged for re-testing but DTI's Kenley Radio Technology Laboratory can carry out pre-test assessment on a repayment basis.

Details of testing conditions and fees for fixed links can be obtained from:
DTI,
Radiocommunications Division,
Room 309,
Waterloo Bridge House,
Waterloo Road,
London SE1 8UA.
Tel: 01-215 2099.

For all other equipment
DTI,
Radio Technology Laboratory,
Whyteleafe Hill,
Whyteleafe,
Surrey CR3 0YY.
Tel: 01-660 8456.

The CW Novice Award

The CW Novice Award is administered by the G-QRP Club on behalf of the European CW Association and the World QRP Federation.

The objective is to encourage newly licensed radio amateurs to use the c.w. mode. To qualify you must, during the first 12 months of holding an amateur licence, work 50 different stations using the c.w. mode.

There are two classes of award, A: maximum power to be used when making the 50 contacts of 3 watts and B: any licensed power.

Applications must consist of a log extract giving details of the 50 contacts made and be certified as true by the applicant and one other licensed radio amateur.

Applications from outside the UK must enclose three IRCs with their application, UK applicants must enclose three first class postage stamps.

A. D. Taylor G8PG,
37 Pickerill Road,
Greasby,
Merseyside L49 3ND.

Special Event Station

GB4VBP: This station will be on the air during the weekend of February 18/19 to celebrate Thinking Day on the Air. The Verwood Brownie Pack, assisted by *Practical Wireless* and *Short Wave Magazine* staff, will be talking to Brownies and Guides the world over. A special QSL card is available for all contacts and reports.

Forthcoming Rallies

February 26: The 2nd Taw and Torridge Rally will be held in the BAAC Halls, The Pill, Bideford in North Devon. These premises are larger than last year. The doors open at 10.30am with talk-in available on S22. There will be trade stands, a bring & buy, refreshments and a bar as well as ample parking. More details are available from: ***G0AYM. Tel: 0805 23776.***

March 5: The Bury Radio Society Annual Hamfeast will be held at the Castle Leisure Centre, Bolton Street, Bury. It's only three minutes from the M66 and there will be talk-in on S22. Doors open at 11am and entrance is by programme costing 50p. Refreshments are available. Contact: ***C. D. W. Marcroft G4JAG, Mosses Centre, Cecil Street, Bury.***

March 19: Wythall Radio Club will be holding their 4th Annual Radio Rally at Wythall Park, Silver Street, Wythall, Worcs. This is on the A345 south of Birmingham. Doors open at 11.30am. There will be three large halls, the usual trade stands, a flea market, a large Bring & Buy, snacks available and a bar. Talk in on S22 with more free parking this year. Admission is 50p with more details from: ***Chris G0EYO on 021-430 7267.***

March 26: The Cunningham & District ARC are starting a new rally at the Magnum Leisure Centre in Irvine to combat the shortage of rallies for Scottish amateurs. Doors open at 10.30am. More details from: ***Bob Low on 0563 35738.***

May 7: The Southend & District Mobile Rally will be held at Roach Way Youth Centre, Rochford, Essex. Doors open at 10am. More details from: ***Ted G4TUO. Tel: 0702 202129.***

June 11: The Royal Naval Amateur Radio Society's annual rally is scheduled to be held at HMS Mercury again this year. More details nearer the date.

July 9: The 1989 Droitwich Strawberry Rally will take place at the High School, Droitwich. There will be trade stands, a Bring & Buy, family entertainment and strawberry fields (weather permitting). There is both free entrance and car parking. ***Derek Batchelor G4RBD. Tel: Worcester 641733.***

If you are organising a rally write at least six weeks in advance (marking your envelope Rally Calendar) and we'll give it a mention.

Digital Pocket Multimeter

New from Electronic & Computer Workshop Ltd. is the Pan 50. This is a digital multimeter with high resolution and handy compact size. The main features of this instrument include 3200 counts, auto power off, continuity test by buzzer and diode test.

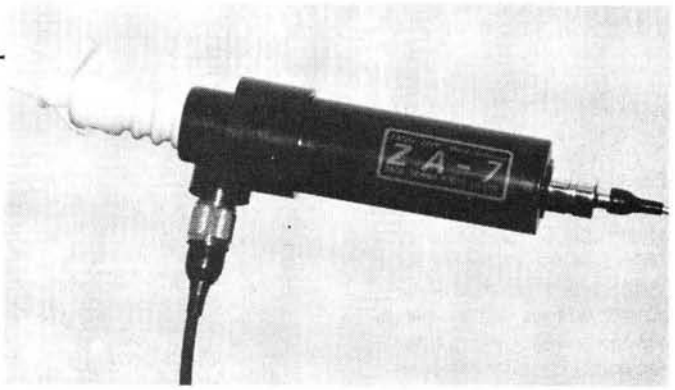
The Pan 50 has a $3\frac{3}{4}$ digit l.c.d. numerical display with automatic indication of symbols and functions. Range selection is also automatic.

Features include over-range indication, auto-polarity indication, battery warning indication and automatic switch off after one hour non-use.

Reading can be taken in the following ranges: d.c. volts—320mV, 3.2V, 32V, 320V, 500V. a.c. volts: 3.2V, 32V, 320V, 500V. resistance: 320Ω, 3.2kΩ, 32kΩ, 320kΩ, 3.2MΩ, 32MΩ to a basic accuracy of ±0.3% reading ±4 digits.

The multimeter has a battery life of 120 hours continuous operation. It measures 108 × 54 × 11mm and weighs 90g. It comes supplied with a hard cover case, two batteries and an instruction manual. The Pan 50 costs £36.55 excluding VAT plus £3.50 P&P.

Electronic & Computer Workshop Ltd., Unit 1, Cromwell Centre, Stepfield, Witham, Essex CM8 3TH. Tel: 0376 517413.



End-fed LF Antennas

The end-fed "Zepp" antenna was at one time a very popular antenna, deriving its name from the fact that it was originally designed for use on the Zeppelin airship. In essence it comprised an end-fed half-wave dipole and therefore had no untidy feeders hanging from the centre. Its disadvantage was the need for an open wire feeder and an a.t.u.

Sagant have just produced the modern-day version of such an antenna. Each one covers a single band and incorporates the missing "a.t.u." in an encapsulation at the feed end. An additional bonus is the r.f. filtering provided by the matching circuit.

Two models are at present available, one for 7MHz (40m) and the other for 3.5MHz (80m). The dimensions are similar to a full-size dipole. The antennas are complete with a special pvc covered multi-strand copper wire, matching unit with SO239 socket, insulators, support cord, weather sealing tape and tuning instructions. The antenna element is pre-tuned and fully assembled. ***Waters & Stanton Electronics, 18–20 Main Road, Hockley, Essex SS5 4QS. Tel: 0702 206835.***

GB75CIS

The activities of GB75CIS on the Isle of Sark, from 17–20 July 1988, resulted in donations totalling £136.22, which has now been forwarded to the BBC's "Children in Need" appeal.

Total operating time was 31 hours 38 minutes and 417 QSOs took place. In all, 38 DXCC countries were worked.

The rig used was an IC-735 kindly loaned by Icom and the antennas were a 3.5MHz dipole and a 7MHz Delta Loop.

Bob G3UTX and Tudor GW4OYD would like to thank all operators for their forbearance and they regret that they were unable to make contact with all those who called due to the heavy pile-up. QSLs have now been dispatched, but should any be outstanding, please forward details plus an s.a.e. to: ***Bob Ridley G3UTX, 9 Greenacre, Worlebury, Weston-super-Mare BS22 9SL.***

Syledis

Early in 1988, the MoD announced that, with effect from 1 January 1989, the Syledis radio position fixing system could no longer be used within 100km of the UK coastline. Strong representations were made by the oil and surveying industry, and as a result a replacement frequency had to be found for 432 and 432.5MHz.

From 1 February 1989, the main Syledis frequency around the UK coastline is 438MHz. On the east coast between Scarborough and the North Foreland other frequencies will be used though these also will be outside the amateur 70cm allocation.

east coast between the North Foreland and Beachy Head the frequencies will be 432 and 438MHz. The DTI is currently negotiating these frequencies with its partners in the Oslo Agreement on position-fixing. Efforts to find an acceptable alternative to Syledis have so far met with no success.

Lifetime Guarantee

ITW Keyboards have announced that they are now providing a lifetime guarantee for their special contactless keyboard switches. The company has developed the Series 54 switch for use in applications of heavy use, where reliability is paramount or the environment is dusty or humid.

The switch contains a tiny magnet and a ferrite core. When up in the Off position, the magnet saturates the core and no current can be induced to flow from one pair of contacts via the ferrite core to the other pair of contacts. However, when the switch is depressed in the On position, the magnet moves away from the ferrite core and a current can flow.

The switch measures 0.73in square and 0.36in high. Five different curvatures of keytop are available in addition to flat tops. Parallel motion keyboards are also available which present a larger keytop area for space bars, etc.

The keytops can be printed on the front surface as well as the top, the keyswitches are available either as individual units or ready made-up in a complete keyboard.

ITW Switches,
Norway Road,
Portsmouth,
Hampshire PO3 5HT.
Tel: 0705 694971.

144/146MHz Contest

The 3rd annual Derby & District Amateur Radio Society National 144/146MHz contest will take place on Sunday 12 March 1989.

Time: 1300–1700UTC.

Mode: Any mode is permitted, but the band plan must be observed. Fixed, alternative and portable entries are permitted.

Exchange: Contestants will exchange callsign, RS(T), serial number starting at 0001, as well as administrative county (Scottish contestants will send region). Metropolitan areas, e.g. Greater London, are still considered counties.

Scoring: Contacts with G3ERD count 10 points all others score 2 points. The final score is the total number of contact points, multiplied by the number of counties worked. Each country outside the UK is scored as a county.

Logs: Logs must be sent to ***Derby & District ARS, 119 Green Lane, Derby DE11 1RZ*** to arrive by March 29. RSGB log and cover sheets are preferred, but any neat alternative is acceptable. Logs must show: Time (UTC), station worked, RS(T), serial number sent, RS(T) and serial number received, county received. Please head each sheet with callsign of station entering and county. Check lists of stations and counties worked would be appreciated. Short wave listeners' entries must show; Time, station heard, station being worked, RS(T) sent and county sent.

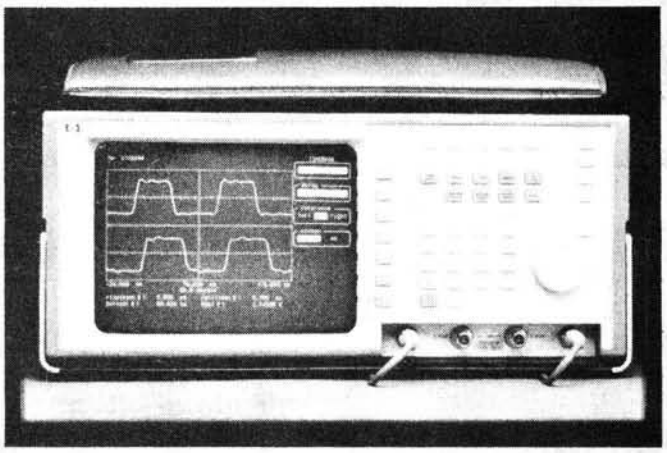
Awards: There will be three sections: Full legal power limit, low power (30W max output), s.w.l. Please specify whether single or multi operator. The winner in each section will receive a certificate.

Disputes: The ruling of the DADARS Contest sub-committee shall be final and binding in all cases of dispute.

If you require a list of results, please send an s.a.e. to the contest address.

Rallies

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.***



Available for Rental

Instrument Rentals have the Hewlett Packard 54501A 100MHz digitising oscilloscope available for rental, and they believe they are the first UK company to do so.

Features of the 54501A include a 10 megasample per second sample rate. This provides a single-shot bandwidth of 1MHz, which is a useful feature in the analysis of mechanical and acoustic phenomena.

Advanced logic triggering capabilities allow the oscilloscope to be triggered on a wide range of user-specified conditions. TV and video triggering are also possible and, using a time-qualified pattern trigger, it is possible to capture infrequent glitches.

The 54501A is fully HP–IB programmable and has facilities for instant hard copy output. Other features of the digitising oscilloscope include automatic measurements. Sixteen pulse parameter measurements are made automatically allowing the simple characterisation of signals.

The HP 54501A has four channels, 8-bit vertical resolution, 5mV sensitivity and superior timebase accuracy. An autoscale function instantly scales the time, voltage and trigger level for a stable display.

The data throughput is faster than ten waveform acquisitions and HP–IB transfers per second, making the instrument ideal for production test environments.

Instrument Rentals (UK) Ltd.,
Dorcan House,
Meadfield Road,
Langley,
Slough SL3 8AL.

Liquid Crystal Thermometers

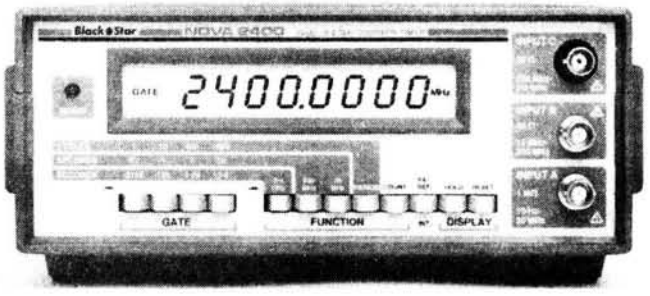
The liquid crystal thermometers take the form of self adhesive squares and strip labels measuring 60 x 60mm or 12 x 100mm. They contain a calibrated range of 9 or 11 sealed heat-sensitive elements which change colour at the given calibrated temperature. When each segment of the indicator is exposed to heat at its calibrated temperature, it turns green. The reaction is fully reversible, therefore each strip can be used over and over again.

In addition to the thermometers, ETI Ltd. also offer a range of Thermax self-adhesive, non-reversible, temperature indication labels which cover the temperature range 37°C to 254°C. The indicating area changes from silver to black at the given calibrated temperature. The labels measure 51 x 18mm.

The price of the Tempstrips start at £9.00 per pack of 10 and the Thermax labels start at £4.40 per pack of 10.

Electronic Temperature Instruments Ltd.,
PO Box 81,
Worthing,
West Sussex BN13 3PW.
Tel: 0903 202151.

Black Star Nova



Black Star Ltd now have available the Nova 2400 u.h.f. counter timer. It's capable of frequency measurement up to 2.4GHz and there's the added bonus of period measurement down to 200ns and pulse/event count up to 20MHz. For high stability applications, temperature compensated crystal options are available.

The Nova 2400 is mains or battery operated with an $8\frac{1}{2}$-digit liquid crystal display, allowing a resolution of 10Hz at the maximum 2.4GHz measurement. It has three front panel inputs which cater for 10Hz to 20MHz (input A), 15MHz to 200MHz (input B) and 150MHz to 2.4GHz (input C). Four push-button switches select gate intervals of 0.01, 0.1, 1 and 10 seconds (0.0128, 0.128, 1.28 and 12.8s on the 2.4GHz range), to give measurement resolutions down to 0.1Hz on input A, 1Hz on input B and 10Hz on input C.

Input A is high impedance (1MΩ) with a.g.c. to allow fast, simple measurement of virtually any waveform. Inputs B and C are of standard 50Ω impedance with a BNC coaxial connector. All inputs are high sensitivity allowing measurements down to approximately 10mV r.m.s. sinewave, with overload capability to 250V r.m.s. at 50Hz.

The Nova 2400 costs £299 plus VAT and further details are available from:

Black Star Ltd.,
4 Harding Way,
Somersham Road,
St. Ives,
Huntingdon,
Cambs PE17 4WR.
Tel: 0480 62440.

Audio Signal Generator

The G3 signal generator from Masterswitch Ltd., is a low distortion battery powered instrument that has sinusoidal, square and triangular output and yet is not a function generator.

The sinewave is pure with a maximum distortion of less than 0.04% over its range of 20Hz to 20kHz. The company say it's ideal for testing and checking distortion levels on hi-fi equipment and it's also a very useful general purpose audio signal generator.

It has switched and continuously variable attenuators with a maximum output of 6 volts peak to peak from a 50Ω source. It's very compact and weighs only 400g with batteries.

Masterswitch Ltd.,
8 Dorset Road,
Tottenham,
London N15 5AJ.
Tel: 01-802 1423.

EUCW Straight Key Day

The Scandinavian CW Activity Group have re-designated their midsummer straight key day as "EUCW Straight Key Day". This event will be held on Saturday June 24 and will be open to all amateur c.w. operators who enjoy working on the hand key, whether regularly or just occasionally. Participants receiving at least two votes for "best fist" will receive a "Straight Key Award" free of charge.

If you would like more details of the event, send an s.a.e. to:

G4FAI, 1Tash Place,
London N11 1PA.

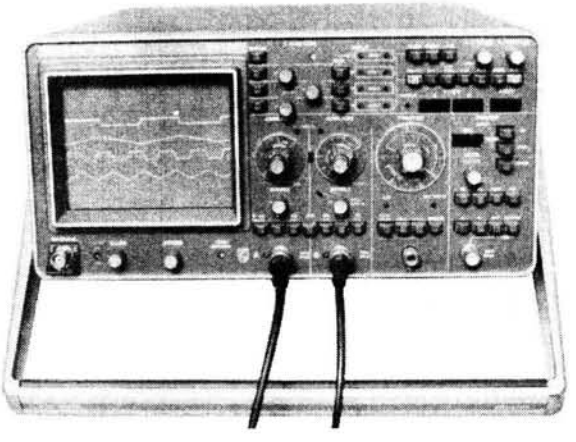
125MHz DSO

The Philips PM3311 125MHz digital storage oscilloscope can now be obtained from Carston Electronics, the used equipment company, fully tested, recalibrated and guaranteed.

The dual-channel 'scope has a 125MHz sampling rate and sensitivity of 10mV. There are four memories of 256 x 256 to store the digitised waveforms. Its a-d converter has a sample and hold circuit that ensures a high vertical resolution at high time settings—6 bits at 5ns/div.

Other features of the instrument are the ability to hold both channels' data in one memory so that up to eight recordings can be displayed at once. Multiple shot mode, X-Y plotter output and "roll" modes enhance its versatility further and an optional IEC/IEEE interface can be added for full test system integration.

Carston Electronics Ltd.,
2–6 Queens Road,
Teddington,
Middlesex TW11 0LR.
Tel: 01-943 4477.



Computer Programs

Harlech Electronics have recently completed two computer programs which readers may be interested in. The first is a p.c.b. drafting program for the Amstrad PCW 8256 which is capable of drawing either a p.c.b. track layout or schematic diagram. It costs £29.95.

The second program is an electronic calculator for the Spectrum and is suitable for the RAE student or electronics enthusiast. It simulates inductors, capacitors and resistors in series and parallel, works out frequency to wavelength conversions, calculates coil turns vs. inductance, transformers, tuned circuits and is a c.w. trainer, too. This program costs £6.50.

Harlech Electronics,
Noddfa,
Lower Road,
Harlech,
Gwynedd LL46 2UB.

WRITE ON ... *the page where you have your say*

Expedition

May I say how much I enjoyed the article "Expedition to OV00" which appeared in the January issue of *PW*.

A few years ago I would have passed over an article such as this with no more than a perfunctory glance, but having recently joined the ranks of the WAB I found it totally absorbing. In common with many others I had been aware of WAB activity on various frequencies, and like most listeners intrigued as to the meaning of the curious book numbers being exchanged. Finally, a couple of months ago, I decided to call into a small net operating on 80m and I was hooked.

To my mind the WAB embodies everything that is good about amateur radio. It offers competition at many levels, it promotes friendship both at home and overseas, it helps other less fortunate fellow enthusiasts by donating surplus monies benefiting the Radio Amateur Invalid and Blind Club among other worthy causes, and it certainly improves one's knowledge of the British Isles.

So, if you are feeling rather jaded with the inevitable "5/9 QSL via the bureau old man" syndrome, why not introduce yourself when you next hear a net operating. You will receive a warm welcome but beware, it could become addictive!

Roy Aitken G4VCT
Morecambe

Rallies

After reading the letter from the Hon Sec of Telford in the December 1988 issue of *PW*, complaining that few traders attended his rally, and then in the leader by Geoff Arnold saying that the number of rallies should be reduced—I feel compelled to write to you.

First, traders do not attend rallies unless they are financially viable either in the long or short term. I realise that it must be hard for them working every weekend but I have little sympathy as the choice be it for love or money is theirs.

Secondly, Geoff Arnold implies that the number of rallies should be reduced so that traders may attend them all. Market forces apply in amateur radio as well! If there are a lot of rallies then the trader must determine for himself which ones to attend. Those organising the events must present them in such a manner—good facilities and proposed turnout, etc., as to attract as many traders as possible.

What we must not in my view do, as the leader suggested, is to restrict the number of rallies because traders cannot attend. There is more to a rally than a commercial stall. I can never afford anything anyway!

S. J. Oxlade G4YLA,
Warminster, Wilts.

I feel that Mr Oxlade has rather got hold of the wrong end of the stick here. Traders are well used to making commercial decisions about their businesses and will continue to do so. What the rally organisers must realise, however, is that there is not a bottomless pit of dealers, staff and stock which can be spread ever more thinly over the steadily increasing number of rallies.—Ed.

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 45 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.

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The Simple Contact

Many of us regard switches, relays and connectors as being simple items, rarely considering their correct selection and use in industry or in home-built projects, says Michael John York G1BKI.

Most manufacturers of switches and relays give only the "pure resistive load" ratings for their contacts. This is commonly known as the "AC1" rating (see Table 1). Using this rating in circuits controlling filament lamps, transformers, motors, etc., will cause premature contact failure, and can sometimes melt the entire relay or switch casing. A simple solution is to use a much bigger contact, but this is not really the correct choice.

Dividing the AC1 rating by 8 or 10 times will give you approximately the rating that can be used on lamps, transformers, motors, etc. The reason behind the derating is that any load other than a pure resistive one will have an "inrush" or switch-on current far greater than its running current. For example:

Filament lamps at switch-on have a very low resistance, and will pass anything from 8 to 20 times their running current until they reach operating temperature.

Transformers have an inrush current which can be of 10 times operating current, lasting for at least one half-cycle of the supply (10 milliseconds in the case of a 50Hz mains supply).

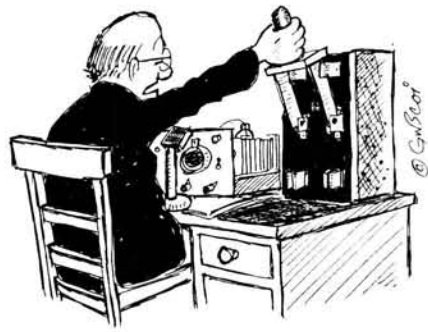
Electric motors have a starting current 10 times their running current.

Beware of Tarnish

All contacts need a minimum current passing to maintain a low contact resistance. A 10 amp contact used on 5 volts d.c. at 5mA will eventually go open circuit or intermittent. This is because the contact material, which is generally silver, will tarnish and go dull in colour. However, the contact will be usable again if a higher current is passed through the offending contacts, physically blasting away the tarnish, though the problem will repeat itself unless a permanent solution is found. The solution is to choose the correct contact material, or type of action of the contacts.

Gold contact material does not tarnish, and is excellent for use in circuits carrying small signal currents. It is of no use at high currents as it is a softer material and will soon burn away.

A compromise solution is to use a silver contact which when operated wipes the contact surface clean; hence called a wiping action.



Failure Symptoms

The ideal contact is one where 100 per cent of the metal contact face areas are touching. This is impossible in practice due to manufacturing tolerances and the materials used. Under a microscope, the contact surfaces would be seen to have large craters resembling the moon. Manufacturers take this into account and allow for the use of about 60 per cent of the area after several "bedding in" operations.

This can lead to problems in that any sideways movement or thermal expansion can cause wear. Such movement is called "fretting". An example of this is a relay whose d.c. coil is powered from a.c. via an unsmoothed rectifier circuit. This produces vibration and literally files the material away, hence failure. The other problem is switching the load too many times in a short time period, which causes heating as well as vibration, and hence contact wear.

Relay contact return springs are normally chosen so that they have enough force to maintain low contact resistance on the normally-closed contact, yet are weak enough to allow the solenoid action to change the contacts over. This arrangement can cause problems with age, as the return spring can break or become weak, so failing to maintain a normally-closed contact.

The strength of the solenoid's pull is dependent on the applied voltage; more volts more pressure, less volts less pressure. If for example you operate a d.c. relay from an a.c. supply via a rectifier but without any smoothing, you set up a condition where a weak solenoid magnetic field and vibration at ripple frequency lead to mechanical wear and high contact resistance. The relay may dramatically destroy itself in a short period of time.

TABLE 1
IEC 158 (BS 4794)

AC1	Non-inductive heaters, resistive loads
AC2	Filament lamps, slip-ring motors, vacuum cleaners, hair dryers, small transformers, etc.
AC3	Squirrel-cage motors: starting, plugging; large transformers, halogen lamps, certain types of switched-mode power supplies, etc.
DC1	Resistive loads, heaters, etc.
DC2	Filament loads, shunt motors, etc.
DC3	Shunt motors: starting, plugging, inching; halogen lamps, etc.

Switches

The mechanical and electrical life of a switch can be in the order of fifty thousand operations at full current, as long as you avoid water, dust, physical abuse, superman type operators and excessive heat.

Solvent cleaners without lubricants should be avoided, as these can clean away oils and greases which are there to prolong the life of the moving parts.

The soldering of switches should be done at lower temperatures to avoid melting the case and misaligning the contacts. It is good practice to find out the recommended soldering times and temperatures from the manufacturers.

Connectors

Most reasonably priced connectors are usually gold-plated, because gold does not suffer from tarnish as silver and tin do. However, there are still problems with "fretting" as the male pin is smaller in size than the female socket, and hence has a different amount of thermal expansion.

The gold material used can be poor in quality and porous. Moisture and metal salts can creep under the gold and will cause it to lift off the base metal and blister. This effect can be seen under a magnifying glass as black spots, which are basically the corroded

or oxidised base metal showing through the blisters.

This symptom could be wrongly diagnosed as contact wear. Pre-coating the gold with a good contact cleaner lubricant will virtually eliminate the problem.

Free silicones, as found in floor and furniture polishes, can creep along equipment cases and printed circuit boards and onto relay contacts. Here, the effects of vibration and arcing will transform them into hard silicone crystals, which will file the contact materials away, causing total failure of all the contacts.

Silicones on electronic components will prevent labels and inks adhering to the surface, as well as preventing surfaces being glued together. Never use silicone oil on electrical contacts, despite its excellent water repellent qualities.

Finally

Spark suppression at switch and relay contacts has not been mentioned in this article, as it is generally well covered in electrical and electronic textbooks.

Contacts are extremely complicated in their construction, and this article has only briefly scanned the subject. Further reading can be found in good technical books. Examples of relay technology can be found in the *Electronic Engineers Reference Book (5th Edition)* ISBN 408 00589 0, edited by F. Mazda. Though this book is probably too expensive for individual purchase, it would be worth enquiring at your local lending library. **PW**

For further reading on lamp inrush currents, see "All About Lamps" in this issue

Feature

Grounding for the Shack

John Brown G4UBB defends conventional earthing arrangements against recent suggestions of disconnecting earth wires from equipment mains plugs.

RECENTLY articles have appeared whose authors favour disconnecting the mains earth lead from radio equipment supply plugs, (a) in order to reduce mains borne interference and (b) as part of local earthing arrangements to deal with the possibility of a broken neutral conductor.

However, some people may feel that a simple approach in keeping with ordinary domestic installation practice would be more appropriate to their own non-specialised knowledge as radio amateurs or short wave listeners. Also the gains expected from relatively sophisticated separate earthing systems may be difficult to achieve, particularly when trying to follow unfamiliar practices.

Among radio enthusiasts there seems to be substantial agreement that disconnection of mains earthing can be helpful in preventing mains borne interference entering radio equipment. However, I believe that the gains made in reception quality are not offset by the added complication of alternative safety measures. It seems to me preferable to accept the best performance offered by conventional mains filters while retaining the mains earth connection.

Indeed Amcomm of London have warned that failure to connect the earth conductor of the 3 core equipment cable to mains earth, as instructed by the equipment manufacturers, could invalidate both the manufacturer's liability and the equipment warranty.

Some recently published articles have identifed the potential danger arising from a combined break in both the neutral and earth conductors on a protective multiple earth (p.m.e.) system, using both mains and radio earths.

However, whilst recognising the potential dangers it is the view of the Electricity Council and also myself, that the Electricity Board's p.m.e. earthing terminal provides an extremely reliable earth for 50Hz system use.

Care

No system of earthing can be guaranteed to provide absolute safety but I offer the following as an acceptable alternative to suit radio enthusiasts who wish to stay with conventional earthing via the 13A 3-pin plug, usually (but not always) combined with connection to local r.f. earthing, radial and/or counterpoise systems.

"ALWAYS EARTH ON TO THE CENTRAL HEATING HERE"

To quote the Institution of Electrical Engineers' *IEE News*, June 1987 p.8; *"Proper care* in the use of electricity is the only true safeguard . . ."

The acronym *care* summarises the following code;

Connect all 3-core mains cables to 3-pin plugs as recommended by the equipment manufacturers.

Arrange 13A socket outlets in the usual way according to the IEE Wiring Regulations

Residual current protected sockets may be used

Equipment earthing terminals may be connected to local grounding systems and/or counterpoise installations. For mains fed equipment this is in addition to earthing via the 3-pin plug.

References

The following articles relevant to the discussion of safety earthing and towards avoiding mains borne interference from entering radio receivers, have appeared in *Radio Communication:* "Safety in the Shack" by Peter Chadwick G3RZP, February 1987.

"Protective Multiple Earthing Hazards" by Pat Hawker G3VA and K. A. Jones G8CZM, April 1987.

"The Killing Ground" by Peter Chadwick G3RZP, June 1987.

"PME Revisited", March 1987.

"The r.c.c.b. — an IEE Safety Warning", p.751 October 1987.

Also see *Practical Wireless,* "Electrical Safety—the Shocking Truth", by Roger Alban GW3SPA, parts 1–3 August, September, November 1986.

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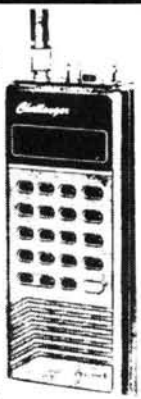

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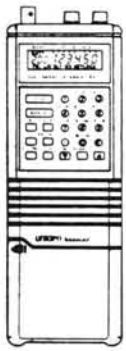

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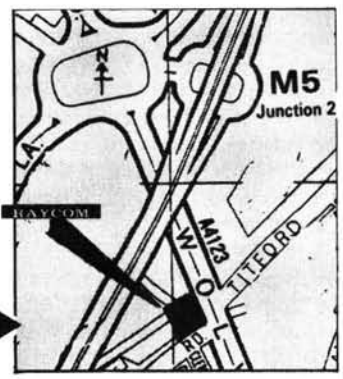

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Packet Radio Update Part 1

Since the last series written by Roger J. Cooke G3LDI in August 1987, considerable progress has been made in the world of packet radio. Now, he updates us with what's going on there.

Growth in activity has been exponential and it is estimated that there are well over 4000 amateurs active in the UK alone. Indeed it is quite possible now to obtain a DXCC on packet with well over 140 countries active on the h.f. bands. In fact, h.f. has expanded to such an extent that packet has spread to 14.117MHz — much to the consternation of some who consider it an undesirable state of affairs; more on that later.

With the upward trend of the current sunspot cycle, activity has moved to 21MHz with me residing on 21.107 most of the time with the BBS. However, at this moment we are in the doldrums and I will be moving back to 14.105MHz shortly.

Just to whet your appetite if you are keen on chasing DX, the countries that are currently active are given in Table 1.1. This figure is increasing daily and it will be interesting to see who will be the first to claim packet DXCC. Locally in Norwich, Ted G4RCI leads the field with 85 worked. however, as usual, the difficult part is obtaining the QSL card! I am still stuck on 67 worked, mainly due to the fact that the 14MHz beam met with an accident and also the BBS has kept me off the DX scene somewhat. This, coupled with the fact that I have changed over to the WA7MBL software on a PC clone from the W0RLI CP/M version has kept me quite busy!

HF Packet

Despite all this, h.f. packet has remained a bone of contention for quite some time and comments such as, "I thought packet was only for v.h.f." and, "packet should stay in the RTTY segment", or the worst comment of all, "packet doesn't work on h.f." are heard all too often. The same attitudes and prejudices abounded in the late fifties when RTTY first came on the bands. I was one of the first G stations on RTTY and well remember the struggle we had to establish a niche for our unwanted jingle-bells. There was certainly no bandplan to cover operation on RTTY and James Hepburn VE7KX put his RTTY where he thought he would be out of the way of most c.w. and all s.s.b. operators, namely 14.095MHz. This established the now well-known "RTTY segment". Well, history repeats itself, now it's packets' turn.

However, the pundits who reckon we ought to stay in the RTTY segment have obviously not used either mode. The two modes are NOT compatible. The very nature of the continuous carrier, 100 per cent duty-cycle of RTTY will ensure that the packet station will not stand a snowball-in-hells chance of being heard.

Robert, son of G3LDI, and Malcolm G3PDH at GB3NP

We therefore NEED an exclusive segment, say 20kHz, to use the mode properly. I am of the opinion that packet and AMTOR will supersede RTTY as machines become obsolete, irreparable, etc., but it will take time and until then the two modes cannot co-exist.

A paper has been prepared by the RSGB HF Committee and was presented at the IARU Region 1 HF Working Group meeting in September 1988. Unfortunately, at that meeting it was decided to recommend that packet co-exist with RTTY in the RTTY segment, a totally unsatisfactory situation. A bulletin was sent out earlier (dated 6 June 1988) via the network inviting comments of a constructive nature so that an overall consensus could be obtained. I would urge you to read this paper which has a number of salient points regarding h.f. working and then send your comments to add weight to the argument regarding the required EXCLUSIVE frequencies. If you have not seen the bulletin, an s.a.s.e. will produce a copy — QTH at the end of the article.

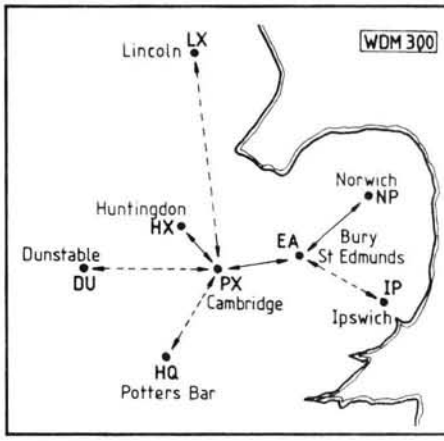
Bandplans are made by gentlemen, most packet operators hopefully are gentlemen, the recommendations of both the ARRL and RSGB HF committees are that we stay within the RTTY segment. This has been tried and found to be impossible so it is imperative that we have a segment solely for packet. Then we can sort ourselves out within that segment with spot frequencies for BBS operation and others (a larger proportion in my opinion) for regular contacts. The average packet operator is not an ostrich, but neither does he wish to be ostracised. After all, 20kHz from the s.s.b. portion on 21 and 14MHz leaves the s.s.b. operator a 200kHz average amount on each band which is quite a large percentage. So, PLEASE write to the HF Committee Chairman, Martin Atherton G3ZAY, 41 Enniskillen Road, Cambridge CB4 1SQ and add weight to the argument. Then perhaps we may get just the allocations we require.

NetRom

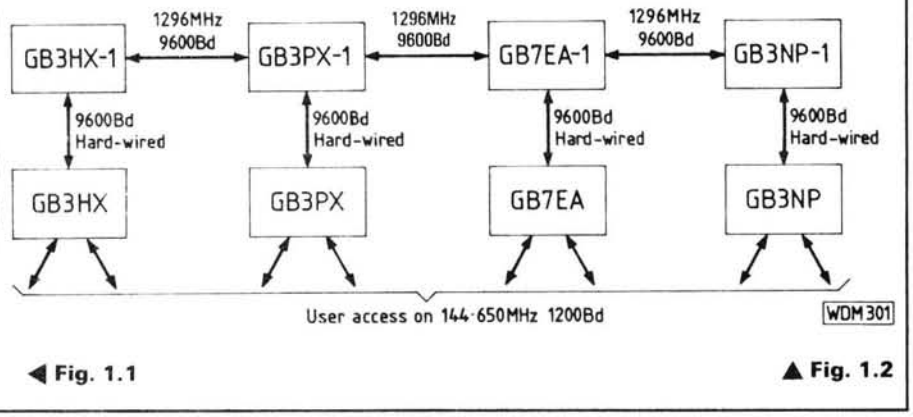
The introduction of NetRom has certainly made the forwarding of mail a great deal easier. However, with NetRom came some aggravation with complaints that control codes were fouling things up, causing screens to clear, etc. This, coupled with the increase in traffic, the increase in user-

TABLE 1.1

A4	A6	A9	AP	BY	CE	CN8	CP	CT1	DL	DU
EA1	EA6	EA8	EI	F	FK	FM	FO	FR4	G	GI
GJ	GM	GU	GW	HA	HB	HB0	HC	HH	HI	HK
HL	HP	HR	HS	HT	I	IS0	J8	JA	KC4	KG4
KH0	KH2	KH6	KH8	KL7	KP4	LA	LU	LX	LZ	OA
OD	OE	OH	OH0	ON	OX	OY	OZ	P2	PA	PJ2
PJ7	PY	PZ	SM	SP	ST	SU	SV	SV9	T7	T30
TF	TG	TI	TK	TR	TU2	UA3	UT5	V8	VE	VK
VP2M	VP9	VS6	VU	W	XE	XX9	YB	YJ	YU	YV
Z2	ZD7	ZF	ZK1	ZL	ZS	ZS3	3A	3D6	4U1ITU	
4X	5H3	5N	5W	5Z	6W	7P	9H	9K2	9M	9N
9Q	9V									



◀ Fig. 1.1



▲ Fig. 1.2

access to BBSs and also real-time contacts on 144.650 instead of 144.675, prompted the forming of Eastnet. James Miller G3RUH, together with Philip Howarth G3YAC were both instrumental in organising many meetings with representatives from the GB3NP, GB3PX, GB3HX and GB3LX groups, the final outcome of which was the decision to move the inter-node linking to 1296MHz — to be implemented in July — assuming licensing by then. We are still waiting (as of December '88), but have carried out site tests and proved the path. GB3NP is situated at the top of a grain silo, about 27m above ground. We had to hoist the gear up by rope on a very cold March Sunday. The photograph shows Malcolm G3PDH and Robert, son of G3LDI, at the antenna of GB3NP prior to hoisting all the equipment.

The antennas will be helicals, designed by James G3RUH. He has also designed a very nice 9600 baud modem for use at each site, which incidentally is being marketed worldwide. However, the cost of such a system is fairly daunting, especially when your group has few members. So, if you have not paid your repeater subs yet, think twice about how it got there. It's not an AOG device (Act of God)—indeed it has been estimated that the core of the Eastnet project will cost approximately £2000.

In Norwich we have raised subs by means of junk sales, more members, a barbecue (hopefully an annual event), etc. GB3EA recently were forced into a site move which necessitated a relicence. This has just come through as GB7EA, but they are now faced with a £120 site rent with just five members. If you use GB7EA on a regular basis . . . (enough said?).

The diagrams in Figs. 1.1 and 1.2 show the basic arrangement of Eastnet and also the proposed extensions to it. Hopefully all inter-node traffic will eventually rest on the 1296MHz band, thus increasing the traffic flow (English for the American "throughput") and the efficiency of the overall system. It has already been mooted that perhaps the 9600 baud may not be high enough depending on end-user use. The slower end-user speed of 1200 baud could cause congestion, and this may have to increase also. However, we have made very good progress in the few years that packet has been with us.

TABLE 1.2

Country	No. of NetRoms
Argentina	1
Australia	6
Austria	5
Belgium	14
Chile	2
Denmark	4
England	37
Indonesia	1
Italy	4
Japan	185
Netherlands	1
Norway	20
Spain	4
Sweden	10
Switzerland	7
West Germany	21
Yugoslavia	3
USA & Canada	750

Whilst on the subject of NetRom, some rather interesting statistics appeared in *Gateway*, the ARRL Packet Newsletter. The number of NetRoms sold by the end of 1987 was well over 1000. The average rate of sales is over 30 per week and growing. NetRom is now in use in over 20 countries and the most interesting part is the distribution per country as given in Table 1.2. Note how many are already operational in Japan.

Finally, in this issue, a mention of TheNet. This is a PD software package, available from NORDLINK—the Northern Germany Packet Radio Development Group. It has been written by DF2AU and DC4OX and it will do all that NetRom will do and more. It has seen distribution to sixteen countries as at May 1988. More details about this in Part 2, but if you would like a copy of the software, Dirk G1TLH is handling the distribution for the UK and a small donation to cover postage, etc. (which will go to the Eastnet fund) will obtain your copy.

Addresses

G3LDI: The Old Nursery, The Drift, Swardeston Common, Norwich, Norfolk NR14 8LQ.

G1TLH: 24 Cemetery Road, East Dereham, Norfolk NR19 2ET.

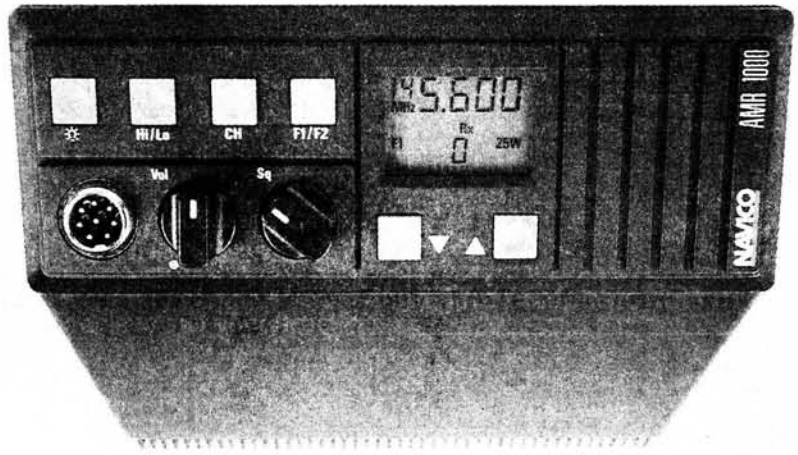
ERRORS & UPDATES

PW "Badger" October 1988

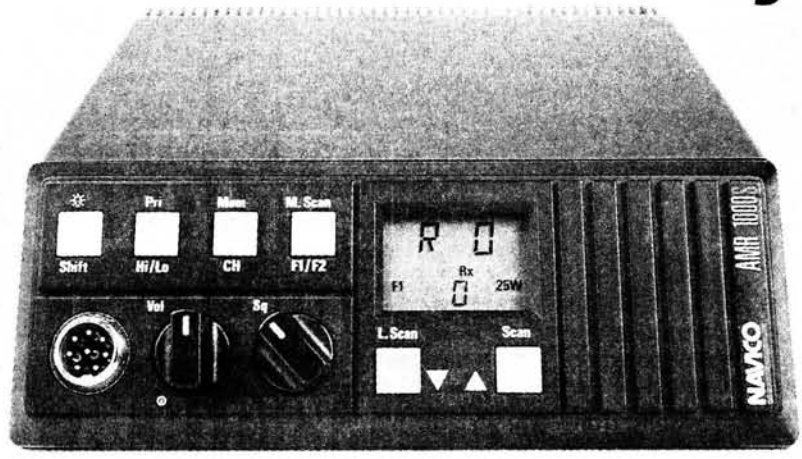
De-coupling capacitor C8 is connected from the +12V supply rail to ground. Unfortunately, due to an error in the p.c.b. artwork, the wrong hole was counterbored in the ground plane, thus connecting the +12V side of C8 to ground. To overcome this problem, counterbore the second ground plane hole of C8 with either a Vero spot-face cutter or suitably sized drill bit.

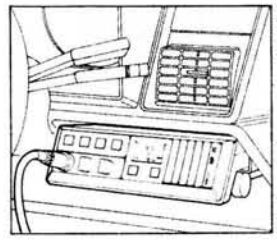
An RF Operated Relay, February 1989

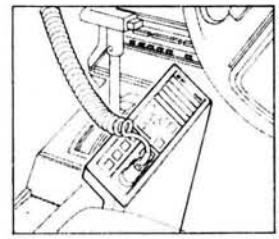
Apologies to the author, Paul Benton G8SVF, for the error in his callsign on this article.

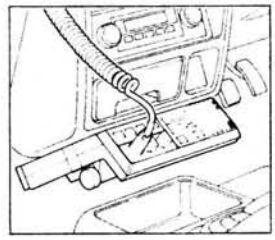


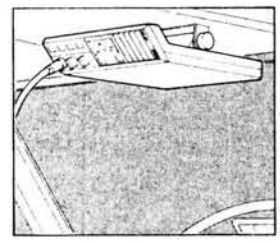
The new AMR1000/S
It checks out from every angle




Under dash mounted (side)


Central console mounted


Under dash (central)


Roof mounted

Whichever way you look at it, the Navico AMR1000/S sets new standards in 2m mobile transceivers.

The angled, reversible control panel, together with a range of inexpensive optional mounting brackets enables installation in any vehicle, whether under or on top of the dash, either side of a central console or even from the roof.

This means the display will always face you giving total access to the controls which are spaced to allow simple, safe, mobile operation. The front mounted loudspeaker will also face you, projecting the sound toward you and not at your feet or into the dashboard.

Combine this with the most sensitive and selective receiver, an audio response tailored for today's busy band and the unique, fully automatic repeater/simplex operating facilities and you have a truly remarkable mobile radio.

There is also a choice of models to suit your exact needs. In the words of Chris Lorek of HRT about the Navico AMR1000/S "Not only does it out-perform its competition on technical grounds but it offers many very useful operating features not found on other rigs, and sells at what appears to be a very competitive price".

Check it out for yourself, prices start at just £247.25 (incl. VAT). For more details and to arrange a personal demonstration clip the coupon today.

PRIORITY INFORMATION REQUEST
For full details send to:
Navico, Star Lane, Margate, Kent CT9 4NP,
United Kingdom. Telephone: 0843 290007.

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PW/3/89

The professionals in amateur radio

NAVICO®

PW REVIEW

The latest mobile transceiver to appear from Icom is the dual-band IC-3210, offering full duplex operation on both the 144 and 430MHz bands. It is also fitted with a built-in r.f. diplexer to allow one of the many dual-band mobile or base station antennas to be used without the necessity of an external combiner. PW *has been fortunate in obtaining an exclusive review sample of this unit from Icom (UK) Ltd. Here, Chris Lorek G4HCL reports on his on-air and lab tests.*

Features

The set is fractionally smaller than its predecessor the IC-3200, having the same fascia but with 50mm less depth. The resultant small size allows it to be fitted with ease into the smallest of dashboards. A large backlit l.c.d. panel with coloured filters provides a clear readout of the operating frequency, memory channel, signal strength and the like, and for night-time use the level of illumination may be varied in four pre-set steps to avoid distraction from driving. The front panel contains a minimum number of controls and switches in a further attempt to make operation when on the move reasonably simple.

A transmit power of 25W is provided on each band, with a switchable low power of 5W in each case for local communication or for when you need to reduce battery drain. The set comes with a mobile fist microphone complete with UP/DOWN buttons and an internally-fitted 1750Hz toneburst for repeater access. A mobile mounting bracket, fixing hardware, and a fused d.c. power lead of generous length are also supplied.

The set covers 144-146MHz (2m) and 430-440MHz (70cm), using programmed steps of 12.5kHz or 25kHz independently selectable on each band. It is possible, if required, to extend the frequency coverage on receive on both bands for monitoring purposes. Twenty memory channels are provided, each storing two frequencies. These may be two frequencies on a single band such as a repeater channel or indeed two simplex frequencies, or a cross-band duplex frequency. In the latter case, simultaneous transmit and receive is possible, in a manner similar to a duplex-type telephone conversation. Note that it is **not** possible to have complete twin-band operation, i.e. it isn't possible to receive on two bands at the same time as you would be able to do with separate rigs.

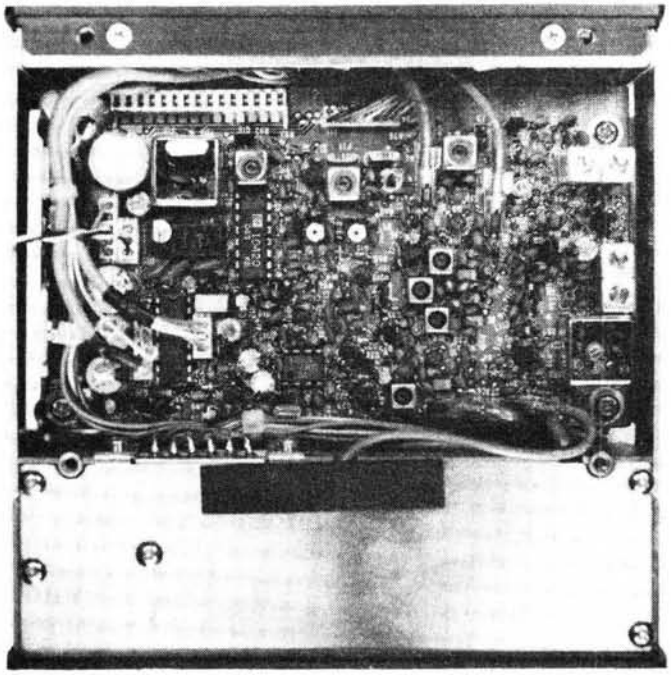
Scanning

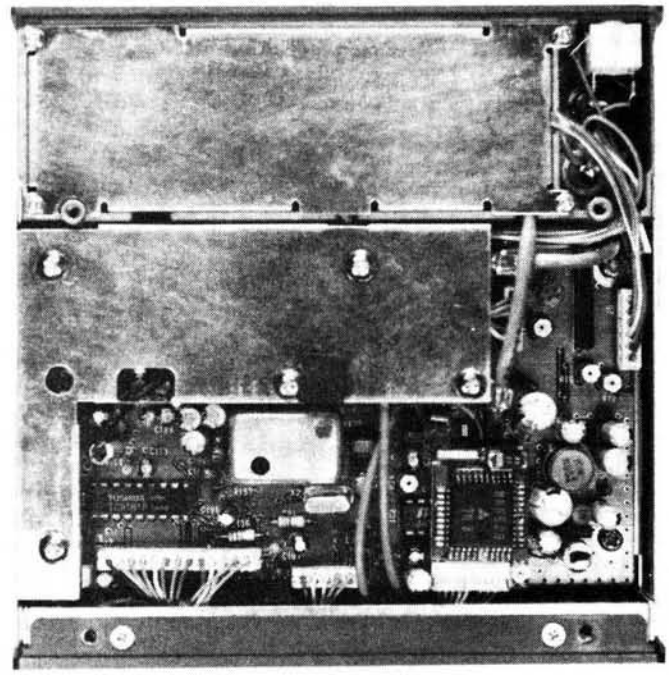
Three modes of scanning are provided, a programmed band scan, a memory scan, and a selected band memory scan. In the programmed band scan, any two frequencies on a given band may be preset as scan edge limits, with the frequency range in between being searched in the user-selected channel steps. The memory scan searches through all the selected memory channels, any number of these may be locked out of the scan mode if required. The selected band memory scan goes one step further and only searches those channels programmed in the selected 2m or 70cm band. In each case the search is initiated by keeping one of the microphone-mounted UP/DOWN buttons pressed for at least half a second, and halts as soon as the receiver squelch lifts, signifying a received signal, continuing after a pause of 15 seconds regardless of squelch state. If the received signal drops before this time period, the set pauses two seconds before resuming to prevent missing a simplex reply.

A two-channel "priority watch" is also available, where the set briefly checks a pre-programmed frequency every 5 seconds, halting again for up to 15 seconds if activity is present. This mode is enabled by a press of the front panel PRIO button.

Controls

As well as by using the microphone mounted UP/DOWN buttons, the operating frequency may be varied by using the large panel mounted click-step tuning knob, and by depressing the TS button 1MHz steps are provided to allow you to get from one part of





Icom IC-3210 Dual-band Transceiver

the band to the other quickly. The VFO/M button beneath the tuning knob switches between digital v.f.o. and memory channel operation, and an adjacent CALL button gives access to a pre-programmed call channel on both 2m and 70cm bands, pressing this button again reverts the set back to normal v.f.o. or memory operation. Other smaller buttons above the microphone connector are used for memory and duplex programming, as well as switching an optional sub-audio tone unit in and out of circuit.

The rotary volume control doubles as a power on/off switch, and the adjacent rotary squelch control when momentarily depressed opens the receiver squelch as well as automatically switching the receiver to the programmed transmit frequency, e.g. for reverse-repeater checking.

Connections

The usual 8-pin Icom microphone carries lines for p.t.t., TX audio, RX audio output, UP/DOWN frequency control, a Tone Squelch Busy line, and an 8V d.c. output supply, allowing the connection of a number of external units such as a packet radio TNC without the need for several leads. On the rear of the transceiver case a 3.5mm jack is provided for an external speaker, together with flying leads for d.c. supply and the common 2m/70cm antenna, the latter being terminated in an SO239 socket.

Accessories

A number of optional accessories are available for the transceiver, such as external microphones for base and hands-free mobile use, a variety of external speakers, and an a.c. power supply for base station use. An internal fitment is the optional UT-40 tone squelch unit, adding sub-audio tone generation and receiver squelch switching facilities, for use on simplex for quiet monitoring of busy frequencies, or on duplex with the increasing number of UK repeaters having sub-tone control and regeneration facilities.

On The Air

The set was tested both when mobile, using a gutter-mounted dual-band whip, and from home on both voice and packet coupled to a rooftop dual-band collinear.

Programming the memories with my required local repeater and simplex chat channels was very simple due to the logical programming method. I found I rarely had to refer to the supplied instruction manual. Reading through this however gives the newcomer an excellent step-by-step guide to operating the set, with worked examples thrown in for good measure.

I found it useful to be able to program 12.5kHz step sizes on 2m with 25kHz steps to 70cm, hence allowing me to miss the several 12.5kHz offset carriers present on 70cm from the primary band users. In many areas of the country, amateurs frequently use 12.5kHz steps on 2m though, hence this facility was very useful. After programming the two CALL channels with S20 and SU20, I commenced installing the set in my Ford Escort.

Due to the set's compact size, I found it fitted quite nicely on the top of the dashboard, hence minimising the eye-travel distance required between the display and the road ahead. I also found the set would easily fit in several places beneath the dashboard fascia if required, due to its short case depth, but here the internal speaker pointed towards the floor carpet which tended to reduce the readability somewhat.

Using the set whilst on the move was very simple, due the very clear display

and uncluttered front panel controls. I used the UP/DOWN buttons in combination with the programmed memory channels almost exclusively. When things became quiet, I found a quick band scan to search for activity or a QSY to my programmed calling channel to put a CQ out could easily be initiated due to the sensible positioning of the relevant buttons, just beneath the large main tuning dial.

I found repeater access was made easy due to the microphone-mounted toneburst button, rather than having to fumble around finding the appropriate fascia button as some earlier mobile sets required. For reverse repeater checking, prior to attempting a simplex QSY, a quick press of the squelch knob gave me an instant verification, this again being an operation that could be carried out by touch alone and hence not requiring me to take my eyes off the road ahead.

Reports of my transmitted audio were generally very good if occasionally marred by the presence of background noises, this possibly being due to the sensitive nature of the supplied fist microphone. Of note for potential users of external "gooseneck" or neckband microphones is that the 1750Hz toneburst circuitry itself is incorporated into the supplied Icom fist mic; if you remove this then you lose the facility. On receive I found the available volume level perfectly adequate, although rather on the "toppy" side as I have become used to from Icom mobile gear. Plugging in my external mobile speaker made little difference to the frequency response or the audio level, showing that the small internal speaker was doing its job quite well.

I found the receiver sensitivity on both 2m and 70cm to perfectly match the available transmit power, with several distant repeaters being heard and worked through. The receiver bargraph S-meter did vary quite a bit with small changes in the receive signal strength. With normal mobile flutter it was often either at full scale or not reading at all, this however is a limitation with many f.m.-only sets.

When in use at home, the set gave a good performance on both bands in rejection of 12.5kHz spaced channels. I found also on 2m that it was quite immune to transmissions from my adjacent PMR hand-portable on 172MHz, indicating the set should be capable of holding its own in many highly-congested r.f. locations such as city centres with taxis and despatch PMR transceivers operating all around. During long ragchew-type QSOs on high power, I did see the transmitter power reduce somewhat on both bands as the rear heatsink became hot, dropping from 26W to around 18W after several minutes of continuous transmission.

I performed a quick check by connecting the set via the mic plug to one of my packet radio TNCs, as many readers would also be interested in the use of the transceiver for this mode. I found in general the set-up performed quite well, but occasionally it would miss packets when communicating with a local Network Node station having a DWait of 0 and a very short TXDelay. This was due to the slight delay in the IC-3210 synthesiser switching from transmit to receive, and failing to receive a correct ACKnowledgement. This however to be fair is a common problem and arguably due to the remote TNC's settings, but it must be borne in mind.

★LABORATORY RESULTS

RECEIVER

Sensitivity:
(Input level p.d. required to give 12dB SINAD)

144MHz: 0.136µV	430MHz: 0.147µV
145MHz: 0.135µV	435MHz: 0.132µV
146MHz: 0.138µV	440MHz: 0.145µV

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

	145MHz	435MHz
+12.5kHz:	44.0dB	47.5dB
−12.5kHz:	41.5dB	34.5dB
+25kHz:	79.5dB	79.0dB
−25kHz:	78.5dB	76.0dB

Blocking:
(Increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal)

	145MHz	435MHz
+100kHz:	90.5dB	91.5dB
+1MHz:	101dB	102dB
+10MHz:	107dB	110dB

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

	145MHz	435MHz
25/50kHz:	75.5dB	74.5dB
50/100kHz:	76.0dB	74.5dB

Maximum Audio Output:
(Measured at 1kHz on the onset of clipping)
3Ω load: 2.55W r.m.s.
8Ω load: 1.62W r.m.s.
15Ω load: 0.98W r.m.s.

Imagine Rejection
(Increase in level of signal at first i.f. image frequency over level of on-channel signal to give identical 12dB SINAD signals)
145MHz: >110dB *435MHz: 105dB (−61.750MHz)*

S-Meter Linearity:

Indication	145MHz Sig.Level (p.d.)	145MHz Rel.Level	435MHz Sig.Level (p.d.)	435MHz Rel.Level
S1	0.51µV	−5.3dB	0.73µV	−4.6dB
S3	0.55µV	−4.7dB	0.82µV	−3.6dB
S5	0.68µV	−2.8dB	0.91µV	−2.7dB
S7	0.76µV	−1.8dB	1.02µV	−1.7dB
S9	0.94µV	0dB ref	1.24µV	0dB ref
S9+	1.18µV	+2.0dB	1.85µV	+3.5dB
S9++	1.93µV	+6.2dB	3.05µV	+7.8dB

TRANSMITTER

TX Power and Current Consumption:

Freq MHz	Power	10.8V Supply	13.8V Supply	15.6V Supply
144	High	19.2W/5.30A	26.4W/5.65A	33.1W/5.70A
	Low	3.95W/2.40A	3.95W/2.45A	3.95W/2.45A
145	High	19.2W/5.35A	26.5W/5.65A	33.4W/5.70A
	Low	3.95W/2.39A	3.95W/2.45A	3.95W/2.45A
146	High	19.2W/5.40A	26.3W/5.70A	32.9W/5.70A
	Low	3.90W/2.39A	3.90W/2.45A	3.90W/2.45A
430	High	10.5W/4.50A	26.6W/6.20A	32.5W/6.75A
	Low	3.60W/2.20A	4.40W/2.40A	4.80W/2.50A
435	High	10.6W/4.65A	26.3W/6.35A	32.0W/6.65A
	Low	3.40W/2.15A	4.40W/2.30A	4.85W/2.40A
440	High	10.9W/5.05A	25.9W/6.30A	30.5W/6.45A
	Low	2.95W/2.05A	3.70W/2.20A	4.20W/2.30A

Harmonics:

	145MHz	435MHz
2nd Harmonic:	−72dBc	−83dBc
3rd Harmonic:	−94dBc	−82dBc
4th Harmonic:	−82dBc	−97dBc
5th Harmonic:	−98dBc	<−100dBc
6th Harmonic:	<−100dBc	<−100dBc
7th Harmonic:	<−100dBc	<−100dBc

Spurii: *(Transmitting on 435MHz)*
217.5MHz: −71dBc (½ carrier), 652.5MHz: −77dBc (1½ carrier)

Peak Deviation: 2m: 4.72kHz 70cm: 4.68kHz

Toneburst Deviation: 2m: 4.45kHz 70cm: 4.34kHz

★ MAKER'S SPECIFICATIONS

GENERAL	
Frequency range:	144–146MHz 430–440MHz
Emission mode:	F3E (f.m.)
Antenna impedance:	50Ω unbalanced
Memory channels:	20 (double-spaced) plus two call channels
Supply requirements:	13.5V d.c. ±15%
Transmit:	7.6A (high power) 3.6A (low power)
Receive:	550mA (standby) 900mA (max. audio)
Dimensions:	140W x 50H x 180Dmm (excluding projections)
Weight:	1.2kg (2.6lb) approx.
RECEIVER	
Circuit type:	Double superhet IF1 30.875MHz IF2 455kHz
Sensitivity:	0.18μV for 12dB SINAD
Audio output:	>2.4W (8Ω, 10% t.h.d.)
TRANSMITTER	
RF output power:	25W (high) 5W (low)
Maximum deviation:	±5kHz
Spurious emissions:	>60dB below carrier
Mic impedance:	600Ω

Laboratory Tests

The accompanying technical results show the set performed very well in most respects, of note being the good adjacent channel and general strong-signal rejection. This shows the set to have the ability to operate reasonably well with 12.5kHz channel spacing if this is formally adopted in the future. The S-meter dynamic range was rather limited, as found on-air.

On transmit the harmonics were very well suppressed, I did note two spurious outputs though, albeit at a low level, when testing on 70cm. These occurred at ½ and 1½ times the carrier frequency, the higher of these falling within the UK TV channel 43. The transmit deviation was correctly set at just below 5kHz on both bands. Ample r.f. power output was provided on both bands, though this did start to reduce slightly as the set became hot when testing on high power.

Conclusions

At a current selling price of £499, the Icom IC-3210 is very good value for money, costing little more than a typical single-band f.m. transceiver with similar features, and certainly a great deal less than separate transceivers for each band. It does not give the flexibility that separate transceivers or some dual-band sets give (such as being able to listen out on 70cm whilst having a QSO on 2m), but offers the advantage of a single compact rig that is small enough to fit in many of today's cars with their limited dashboard space.

The set is easy to operate, this fact being very important when operating on the move. Its large display and uncluttered controls helped greatly in this respect. Note that the use of an external mobile microphone will also require an external 1750Hz tone generator to be provided for repeater access. The technical performance was quite reasonable for a 25W equipment, and the capability of extending the receiver frequency coverage may also be of advantage to the scanner enthusiasts amongst us, indeed the USA model of this set offers 138-174MHz reception as standard giving an indication of its potential.

Thanks go to Icom (UK) Ltd for the loan of the review set. **PW**

The G2BCX

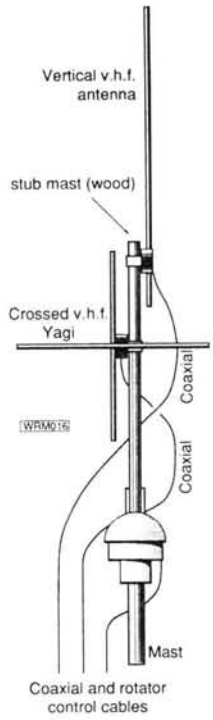
Antenna Clinic

Session 3

In the course of a year, antenna specialist F. C. Judd G2BCX receives many queries from radio enthusiasts, both about his own designs and about antennas in general. These come not only from various parts of the British Isles, but also from as far afield as Australia, New Zealand, Indonesia, Sri Lanka and several European countries.

Often, several people will ask a very similar question, highlighting a point that may be widely misunderstood. This series aims to explain some of these.

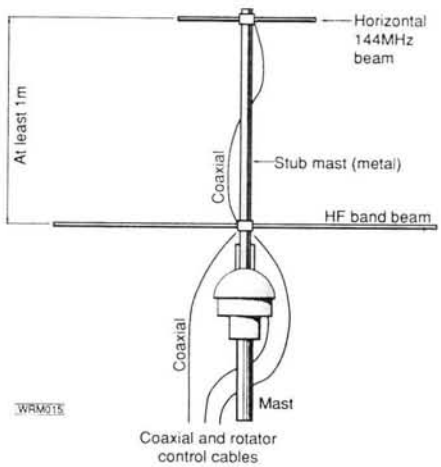
Q "I have a crossed Yagi beam on the rotator stub mast and above this a 'Slim Jim', as shown in the drawing. With the Yagi operating in horizontal mode, the v.s.w.r. is about 1:1, but in vertical mode this rises to around 1.6:1. The coaxial cable from the 'Slim Jim' comes down between the Yagi directors and the stub mast is metal."



A With the crossed Yagi operated in vertical mode, the coaxial cable from the antenna above is running parallel with the vertical directors of the Yagi. The metal stub mast is also in close parallel proximity to the Yagi directors. Both the cable and the stub mast are almost certainly causing detuning of the Yagi directors, resulting in higher v.s.w.r., and may also be causing radiation pattern distortion and loss of forward gain.

If possible, the stub mast should be of wood (of the same diameter as the metal mast) and the coaxial cable from the "Slim Jim" taken outward in a curve and returned to a point lower than the vertical directors of the dual yagi before it continues its run down the main mast to the transmitter as shown in the drawing.

Incidentally, a 144MHz beam in **vertical** mode above a horizontal h.f. beam is not likely to have any effect on the h.f. beam, but the radiation pattern of the v.h.f. beam could be distorted by the presence of the h.f. beam beneath it. Separation should be at least 0.5m.



Q "I have constructed the '2BCX 16-element 144MHz beam antenna which is to be mounted at the top of the stub mast on a rotator. Below this, on the same stub, is a Tribander TH3 for 14, 21 and 28MHz. The feed cable from the v.h.f. beam will have to come down between the directors of the Tribander (see drawing). Will this have any effect? Also, how high should the 144MHz antenna be above the h.f. beam?"

A Since the feed cable run is at right angles to the director elements of the lower antenna, it is most unlikely to have any effect on either antenna. Provided the v.h.f. antenna is horizontal (as also the h.f. beam) the spacing between them should be at least a half-wavelength ($\lambda/2$) at 144MHz, in other words about 1m, but preferably more if possible. Closer proximity could affect the tuning of the v.h.f. antenna, with the resulting higher than acceptable v.s.w.r. and distortion of the radiation pattern.

Q "I have been successful in building and operating your design for a "Slim Jim" (from *Out of Thin Air*). However, I can find no reference to the power to be expected from the use of this antenna. For instance, any dB gain or e.r.p I am using on FT-290R with about 2.5 watts to the antenna."

A The "Slim Jim" does have a very small gain. 0.8dBd, but this is hardly worth considering so "gain" as such is regarded as unity. In other words the same as for any single element or folded half-wave dipole. If cable losses and any other inherent losses are ignored, the e.r.p. for 2.5W fed to the antenna will be 2.5W. Antennas cannot generate power of their own accord.

Directivity gain and e.r.p. were dealt with extensively in *PW* February 1988*.

*Copies of these issues available from PW Post Sales, price £1.40 each including post and packing.

Q "I have built the '2BCX 16-element 144MHz (2m) beam antenna and it works very well, indeed I am quite impressed with its performance. However, I am thinking of ways of improving the system generally, without resorting to buying a 'linear'. What I would like to know is, can I increase the number of directors in order to obtain some more gain?"

A The answer to this question is virtually the same as for the question about the 2m Ring Beam, published in Session 1. The addition of even two or three directors would entail considerable modification to the antenna. The resulting extra directivity gain would probably not amount to more than a dB or so.

More of your questions answered next month

NiCad Battery Protector

After reading Ian Barnes' letter in the September issue of PW *the author, Ian Hickman decided to dig out this ingenious circuit he designed a few years ago. It's basically a voltage regulator with some cleverly designed current limit features. The circuit, when placed ahead of an existing NiCad pack, will make the battery short-circuit proof.*

I have never forgotten seeing a wire jumper lead accidentally shorted across a terminal board providing multiple taps from a Post Office type 50V bank of lead acid cells. The wire was raised to a bright red heat, melting off the rubber insulation and then the cells started to boil, giving off clouds of sulphuric acid vapour. Fortunately at this point someone managed to lever off one end of the wire.

The fact is that many types of secondary cell have a very low internal resistance so that when short-circuited, the current is very high. This results in the energy stored in the battery being released in a very short time, so that enormous power is dissipated, much of it within the battery as heat. With so much heat generated in such a short time, very high temperatures can be reached, constituting a real fire hazard. Readers might therefore be interested in the circuit, described here. It will protect secondary cells and associated equipment from damage due to short circuits. It is based upon an article which appeared originally in the "Design Focus" section of *New Electronics* in September 1987 and now appears here with some improvements.

Operation

The circuit for the regulator is shown in Fig. 1. It is basically a battery driven voltage stabiliser with constant current overload protection, but there is a little more to it than that, as will become apparent. Diodes D1 and D2 and resistor R3 produce a voltage at the emitter of Tr1 which is 6.8V negative with respect to the +12V output terminal. This is compared by the error amplifier Tr1 with the voltage derived from the wiper of R5, which is used to set up the output voltage. If the +12V output falls, then Tr1 turns on harder, since (due to the constant volt-drop across diodes D1 and D2) its emitter goes negative more rapidly than its base. Thus Tr1 turns on Tr3 which likewise turns on the main pass transistor, Tr4. This restores the output, the negative feedback loop formed by these three transistors maintaining the desired voltage. In the event of a short-circuit at the output, the current supplied is limited to just over 500mA by the action of the constant-current protection loop, comprising Tr2, Tr3 and Tr4. Transistor Tr2 monitors the volt-drop across the 1Ω resistor R1. If this exceeds about 550mV then Tr2 starts to conduct, robbing Tr3 of base current. The base current available to Tr3 is strictly limited, being set by the approximate 5V drop across R3. In normal operation, most of the current through R3 is used to supply the diodes D1 and D2, but if the output voltage falls appreciably the current transfers to Tr1 collector, in an effort to maintain the output voltage. Under short-circuited output conditions, as noted earlier, Tr1 collector current is shunted away from Tr3/4 so as to limit the output current. Clearly the circuit could not be allowed to provide over 500mA into a short-circuit indefinitely, for the dissipation in Tr4 would then be 7W or so, assuming about 14V is available from the battery. A time-out on the short-circuit current is provided by a *CR* time-constant.

Time-out

When the output of the circuit is shorted, C1 initially holds the base of Tr1 at its normal operating voltage, about 6V, but this voltage dies away as C1 is discharged via R6 and R4, which are effectively in parallel (since the output is shorted to 0V). The time-constant is about 20 milliseconds so Tr4 only has to support 7W of collector dissipation for a very brief period. Diode D2 prevents C1 from being discharged also via the base-emitter diode of Tr1 and D1 when the output is shorted, for of course a Zener diode works perfectly well as a normal diode when its cathode is taken negative with respect to its anode. Once C1 has discharged, Tr1 can pass no collector current, this is also the case with Tr3 and Tr4. The output current into the short-circuit falls virtually to zero —but not quite, there remain a few microamps flowing through R2. When the short-circuit is removed, R2 raises the voltage at the +12V output terminal, and hence at the base of Tr1, just sufficiently to cause the constant voltage regulator loop to start up again and restore the 12V output.

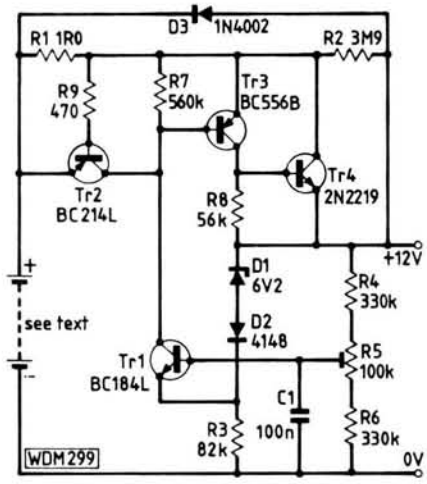


Fig. 1: Circuit diagram of stabiliser

Extra Capacitor Needed

When a large uncharged capacitor is connected across the output terminals it effectively short-circuits them, and the capacitor will be charged up, initially in current limit, until its terminal voltage reaches 12V, when the charging current will cease entirely. Provided that the capacitor connected to the output is not so enormous that C1 discharges completely before the output voltage has a chance to rise to a couple of volts or so, then the output voltage will recover after an initial dip. The circuit of Fig. 1 will turn on into a capacitor in excess of 2200μF. It is a good idea to have a large smoothing capacitor across the equipment to be supplied by the battery-cum-stabiliser, to maintain a low output impedance at higher frequencies; however it should be mounted close to the load and not included in the circuit shown in Fig. 1. The output resistance of the circuit is an ohm or less, just depending upon the gain of the transistors and the slope resistance of the Zener diode (D1).

Protection Without Headroom

The bank of NiCad cells forming the battery must of course supply somewhat in excess of 12V for the circuit to operate satisfactorily. If there is inadequate voltage headroom for the circuit to operate as intended it will still provide the maximum output voltage

SHOPPING LIST

Resistors

0.6W 1% Metal film[1]

1Ω	1	R1
470Ω	1	R9
56kΩ	1	R8
82kΩ	1	R3
330kΩ	2	R4,6
560kΩ	1	R7
3.9MΩ	1	R2

Vertical sub-miniature skeleton carbon preset

100kΩ	1	R5

Capacitor

Epoxy cased plate ceramic

100nF	1	C1

Semiconductors

Diodes

BZY88C 6.2V	1	D1
1N4002	1	D3
1N4148	1	D2

Transistors

BC184L	1	Tr1
BC214L	1	Tr2
BC556B	1	Tr3
2N2219A	1	Tr4

Miscellaneous

0.1in Veroboard (13 holes × 9 strips); Veropins; connecting wire.

(1) Maplin Electronics plc
PO Box 3
Essex SS6 8LR
Tel: 0702 552911

possible, but most importantly will still provide protection against short-circuits. For many purposes, eleven Ni-Cad cells would suffice whilst twelve provide a wider margin, advisable if operation at low temperatures or with loads of up to a few hundred milliamps is envisaged. If you use a bank of NiCad cells to power portable equipment and have a second set, so that you can effect a quick change during mobile operation, then this circuit is ideally situated **within the battery pack.** This will then completely protect the bank of cells from accidental short-circuit.

As shown, the circuit is suitable for loads drawing up to about 250mA. For higher loads, say 500mA to 1A, all the resistors should be scaled, pro-rata, down in value and a transistor with a higher dissipation fitted in position Tr4. The use of a device with a TO220 style case together with a heatsink is recommended, if the battery is to be used in a warm environment.

Note that the circuit provides protection specifically against short circuits. If a 10Ω resistor were connected across the output terminals, the current would limit at around 600mA, leaving about 8V dropped across Tr4. Its dissipation would therefore be 4.8W, way in excess of its 25°C collector dissipation rating of 800mW. So if your spare battery pack is in the wife's shopping bag it will be safe from aluminium foil, but don't let her carry spare resistors in her bag!

Charging

The diode D3 provides the current path for recharging, by-passing the regulator circuit. Do not use and charge the battery at the same time, since the battery pack terminal voltage will be in excess of the nominal battery voltage during this action. The current available from most NiCad chargers is generally insufficient to power equipment and charge the battery at the same time. With regards to charging NiCads a useful tip is to give the battery pack an occasional long charge at a low rate, totalling well in excess of the nominal battery ampere-hour rating. This will balance the cells, i.e. ensure that they are all fully charged. There is a tolerance on the capacity of single cells, so that when a NiCad battery is "exhausted" it will continue to supply current at a reduced terminal voltage. The current from the remaining cells which are not exhausted flows through the weakest cell, tending to reverse charge it. This is an unhealthy situation, as with repeated recharging, the weakest cell in the series circuit will finish up with a lower and lower proportion of its full capacity charge. Hence the need for a "balancing charge" and also of a voltmeter fitted to the host equipment to give warning of reduced terminal voltage, thus showing when the NiCad pack needs charging or recharging.

Construction

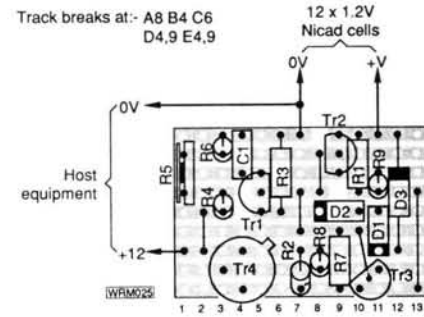


Fig. 2: Veroboard component placement diagram

In order to fit the protection circuit within the confines of an existing battery pack the physical size of the device needs to be kept small. To meet this criterion the author decided it best to build the circuit on a small piece of Veroboard, mounting a good many of the passive components vertically. The final component layout is shown in Fig. 2. Due to the compact nature of the layout it may be prudent to sit down and analyse the design, to make sure in your own mind as to the exact location and orientation of each component. It should be noted that in order to follow the layout, transistors having an "L" suffix to their type number must be used for Tr1 and Tr2. ***PW***

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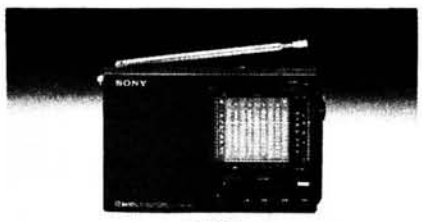

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Have Hallicrafters S-120 communications receiver 550kHz–30MHz, plus Panasky/Nissin m.w. plus 5 others bandspread receiver. Would exchange for 144MHz receiver, 144MHz converter i.f. any 2 to 30MHz or CB transceiver. P. Robins G8BSK. 290 Priory Road, St Denys, Southampton SO2 1LS. *F182*

SNIPPETS

As the name suggests a "Snippet" is any small piece of information snipped from the rich fabric which makes up our hobby. If you've a useful idea, hint, tip or wrinkle, that you feel is worth sharing with your fellow amateurs, then send it to our Editorial address. Each lucky person to get his "Snippet" in print will receive a £5 *PW* voucher. The "Snippet" must be original information, and not duplicated to other magazines. We reserve the right to edit or shorten any "Snippet". "Snippets" may also be placed in our Prestel Mailbox 202671191. The ideas that appear in "Snippets" have not been tried by, nor are they necessarily endorsed by *Practical Wireless*.

The problem of removing tarnish and oxide from p.c.b.s seems well catered for these days with modern solvents. However, there is one method that doesn't resort to the use of chemical agents; abrasive glass fibre brushes. Unfortunately, you hardly ever see these items for sale, but while looking through a catalogue of drawing office equipment I noticed a "Staedler Mars FIBRASOR". This turns out to be a glass fibre brush looking like a clutch pencil. I think its original use was for removing Indian ink from tracings but it works a treat on cleaning p.c.b. tracks. The fact that this item is sold in most stationers and art shops makes it relatively easy to obtain. **G.L.** *E992*

Ever wished you had a disposable funnel for transferring nasty chemicals like ferric chloride (p.c.b. etchant) or silver nitrate solution (photographic developer) from one container to another? As every responsible person should be aware, you should not store anything other than water in discarded soft drinks bottles. So what has this got to do with funnels? Well just think about all those clear plastics soft drinks bottles you must throw away in a year. All you have to do is empty and wash the bottle, measure about $\frac{1}{3}$ of the bottle's length down from the neck, at this point cut round the body of the bottle with a hacksaw. Then take the cap off and there you have a funnel. Do please remember that certain solvents and hot liquids dissolve plastics. **R.A.** *IH001*

All About Lamps

Part 1

In these days of light-emitting diodes and similar solid-state technology, filament or neon lamps are looked upon by some as pretty "old-hat". They are still widely used, however, and an understanding of their characteristics is worthwhile for any radio enthusiast. In this article, J. D. Harris sheds some light on the subject.

Thomas Edison had a problem. The carbon filament gave out quite a good light, provided the glass-maker had managed to get a reasonable vacuum in the bulb. However, after a few hours the inside of the bulb began to become black. Edison realised that it was the material from the filament that was being deposited on the bulb, but how to stop it? As an experiment he placed a metal plate inside the bulb. That did not have much effect. In an idle moment he connected the plate to a positive supply and was more than surprised to see that a current resulted.

That was in 1882 and over the following years whilst the electric lamp became a commercial entity the Edison effect was ignored. In 1904 Ambrose Fleming, having been working on the same problem, patented his "oscillation valve". Of course it did not oscillate but it proved a rather good detector for the "radio" waves that the noble Italian Signor Marconi was experimenting with at the time. But that is another story . . .

The modern filament lamp is still made on the same basic principles using an incandescent filament in a bulb with a good vacuum. With vastly increased knowledge of metallurgy and vacuum techniques, long-life lamps are of course available, but the "blackening" problem still exists!

Like the majority of electronic components available today, there is a bewildering variety of miniature filament and neon lamps on the market and incorporated in electrical and electronic equipment. There is less standardisation in these components than many others.

Whilst in applications as indicators, filament and neon lamps serve the same purpose—to show the state of the equipment or circuit in which they are placed—the basic operation of the two types is very different. Both types can be used as circuit components rather than as indicators, but in general these types are manufactured to a much tighter tolerance and the more usual types may not give satisfactory results when used as substitutes.

Miniature Filament Lamps

The "active" part of a miniature filament lamp is the filament. This is made from tungsten and is heated to incandescence by the passing of current. Tungsten is used because of its very high melting point (3655K), low evaporation at high temperatures and good mechanical strength.

Three basic types of lamps are manufactured, volume production being obtained by the use of highly automated equipment.

Butt-sealed

In the butt-sealed construction the filament/bead assembly is offered to a glass bulb. A glass tube known as the exhaust tube is then placed in contact with the bulb/filament assembly, and the two parts are then subjected to sufficient heat to fuse them together. At the same time, air is withdrawn from the assembly to ensure that a high vacuum exists within the bulb/filament area. As can be seen from Fig. 1.1 the completed lamp can then be used as a wire-ended lamp or fitted with a base to allow it to be used in one of the wide variety of lampholders available.

The leads that provide connection to the filament need to be made from special wire where they pass through the glass, to ensure that an effective seal is maintained over the life of the lamp. This material is known as Dumet, and is a copper sheath surrounding a nickel-iron core. If wire ended lamps have been stored for long periods without adequate protection these leads can become oxidised and often impossible to solder. Cleaning the leads with a 10 per cent hydrochloric acid solution and then washing and retinning will allow soldering with ease.

Bead-sealed

In the bead-sealed method of manufacture the glass bead itself is fused

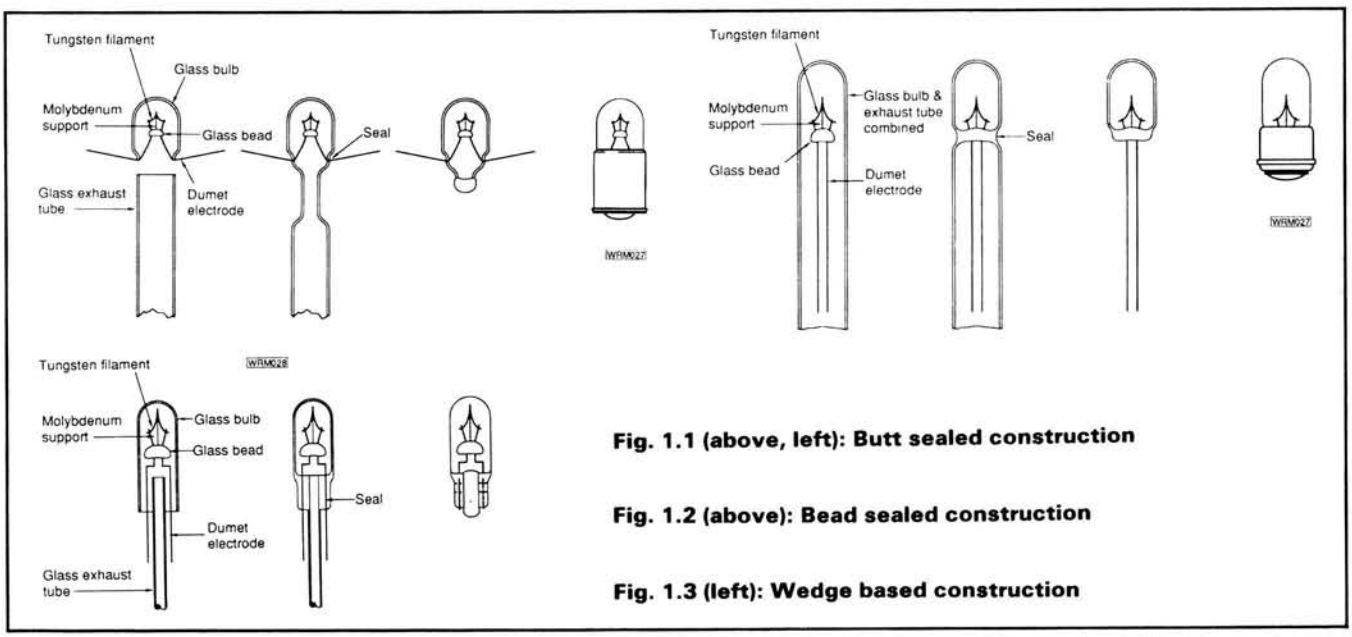


Fig. 1.1 (above, left): Butt sealed construction

Fig. 1.2 (above): Bead sealed construction

Fig. 1.3 (left): Wedge based construction

into the integral bulb/exhaust tube (Fig. 1.2). This results in a finished item with greater mechanical stability. Where lamps are used for direct mounting onto printed circuit boards, this type of construction is to be preferred.

The leads exit directly from the lamp obviating the need for a right-angled bend that would be required if butt-sealed types are used. On butt-sealed lamps the sealing tip can easily become broken during assembly. A number of equipment manufacturers have fallen into the trap of using the cheaper butt-sealed type and eventually having to use special pads to distance the sealing tip from the p.c.b.

Wedge Base

A further type of construction is the wedge-base lamp. In this type the leads are of a larger diameter than those used on the others, and are formed round the end of the glass base giving a "pluggable" lamp without the need for a base (Fig. 1.3). This reduces the price of the lamp and many inexpensive lampholders are available. Wedge-base lamps are widely used in the automobile industry.

Sizes

Although there are international specifications covering miniature filament lamps (US Mil Standards, IEC Publication 61, etc.) there is no fully agreed standard way of describing the size of a lamp. The most popular is a non-metric system that was originated over 30 years ago in the USA. In this system the bulb diameter is defined in units of $\frac{1}{8}$in (approx 3.18mm), so that, for example, T$1\frac{3}{4}$ is $1\frac{3}{4} \times \frac{1}{8}$in (approx 5.85mm). The letter "T" identifies the lamp as having a tubular (straight-sided) bulb. The letter "G" would describe a globular (spherical) bulb. As always, mixing units can lead to confusion, and for instance wedge base lamps are numbered T4.6, T10, etc. These numbers refer to the diameter in millimetres and not the original (T-$\frac{1}{8}$in) designation.

Other means of identifying lamp base and sizes are used in the UK (based on names and their abbreviations) and in Europe (based on diameters in millimetres). Bases fitted to miniature filament lamps to allow them to be used with suitable lampholders are, to say the least, multifarious. However, it is often possible to identify various lamps from the part numbers and Table 1.1 shows various types of bases in general use in radio and related equipment. When seeking replacements, care should be taken to give exact dimensions if doubt exists. For instance some bi-pin lamps are available with the same basic construction but with up to five different lead spacings.

Lamps with screw-form bases have a single contact, whilst bayonet-form bases may have either single or double contacts. On single-contact lamps the other connection is made via the metal cap. Variations in manufacturers' types do exist but generally lamps of this type are interchangeable.

The construction and shape of the filament is dictated by the voltage and current at which the lamp is designed to operate. The higher the voltage the longer the filament. The practical voltage limit in lamps with 5.1mm diameter bulbs and less is 28V. Filaments for higher voltages are generally of the coiled-coil construction. As it is impossible to accommodate even a coiled-coil filament in a straight line with these types of lamps, it is supported in two places with rigid insulated wires known as filament supports.

Lamp ratings are expressed in voltage and current or voltage and wattage and light output. The first two are generally derived from tests carried out at 50Hz and are taken with the filament operating at its nominal value.

The measurement of light output is not so simple as first appears. Most European makers specify light output in lumen (lm) whilst American and British catalogues specify m.s.c.p (mean spherical candle power). The Internationally agreed SI unit is the candela (cd). A point source of one candela would emit one lumen of luminous flux into each solid angle round it, which is a total of 4 lumen.

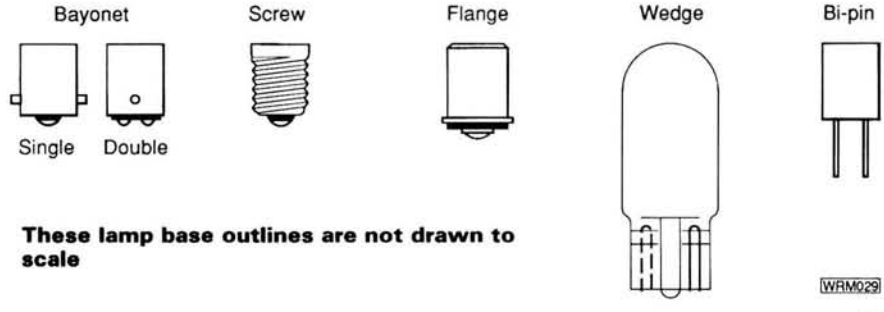
Normal production tolerances for light output are 25 per cent. Light output tolerances can be made tighter by selection by the manufacturer although 10 per cent is the practical limit. Lamps with selected light output are designated with a suffix . . . AS10 or . . . AS15. This means aged and selected for light output of 10 or 15 per cent. Lamps are aged by the manufacturer operating them at their nominal voltage for varying periods depending on the specification requirements.

TABLE 1.1
LAMP CODES

Cap Form	Cap Diameter	European Code*	UK Code
Bayonet	7mm	BA7s	-
	9mm	B9s or BA9s	MBC (Miniature Bayonet Cap) or MCC (Miniature Centre Contact)
	14mm	B14s or BA14s	SCC (Small Centre Contact)
	14mm	B14d or BA14d	SBC (Small Bayonet Cap)
	22mm	B22d	BC (Bayonet Cap)
Screw	5mm	E5	LES (Lilliput Edison Screw)
	10mm	E10	MES (Miniature Edison Screw)
	12mm	E12	CES (Candelabra Edison Screw)
	14mm	E14	SES (Small Edison Screw)
	22mm	E22	ES (Edison Screw)
	40mm	E40	GES (Goliath Edison Screw)
Flange	4mm	SX3s	Sub-midget Flange
	6mm	SX6s	Midget Flange
Wedge	10mm	W2.1 x 9.5d	Wedge Base
Bi-pin	Various diameters and pin spacings		

Glass Shape	Glass Diameter	USA Code (based on mulitples of $\frac{1}{8}$in)
Tubular	2.5mm	T–$\frac{3}{4}$
	3mm	T–1
	4mm	T–$1\frac{1}{4}$
	5mm	T–$1\frac{1}{2}$
	6mm	T–$1\frac{3}{4}$
	6.6/7mm	T–2
	10mm	T–$3\frac{1}{4}$
Globular	11mm	G–$3\frac{1}{2}$
	15mm	G–$4\frac{1}{2}$
	18mm	G–6

*NOTES:
1. "A indicates a bayonet cap with shortened pins, originally designed for use in slide-action focusing lamp-holders in car light fittings.
2. "d" indicates a double contact base.
3. "s" indicates a single contact case.



These lamp base outlines are not drawn to scale

WRM029

During the first few hours of aging obvious faults will be detected. The aging process tends to stabilise the filament enabling an easier assessment of selected lamps to be made.

The radiation from a tungsten filament covers a wide range from infrared to ultraviolet and as such filament lamps can be used with filters having a wide colour range. The luminous efficiency is not high as the majority of the power developed is wasted in the generation of heat. The efficiency is controlled by the operating temperature of the filament. As the filament temperature also dictates the rate of evaporation of the tungsten, this greatly affects the life of any particular lamp. Thus for a fixed wattage rating a filament can give a high light output and short life or a lower light output and longer life.

Lamp Life

The life of lamps that is normally quoted by manufacturers represents figures derived from carefully controlled test conditions and often bear little relation to the actual operating use. Life tests are carried out using stabilised a.c. voltages at 50Hz, the lamps being operated in a controlled temperature of 30°C and of course not subjected to shock or vibration.

The commonest cause of premature lamp failure is mechanical shock and vibration. These external factors can cause the filament to break or "shorted turns" to occur, causing rapid increase of current and the lamp will burn out after a short time. In some illuminated push-buttons the incorporated lamps can be subjected to very high G forces, even if only for short periods of time, sufficient to cause filament breakage. Lamps should be operated in ambient temperatures of less than 100°C. If the ambient temperature exceeds 95°C the temperature of the bulb inside the lamp will exceed 100°C. This can cause outgassing of water vapour. Although only very small quantities of water vapour will exist dissociation of the vapour occurs near the hot filament and oxides of tungsten and free hydrogen are formed. In time this will increase the loss of tungsten from the filament and lead to premature "blackening". Lamps placed in situations without adequate heat-sinking or ventilation can soon show this effect. Dial lamps used in car radios are a good example where this type of fault can occur and replacement can be a time consuming and frustrating task. Where 12V lamps are fitted to original equipment it is worthwhile fitting 14V types when replacement is needed. Usually the light output will be sufficient and the life of the lamp much longer.

It is a little known fact that lamps operated from a d.c. supply have a life reduction of 50 per cent over the same lamp/current used from an a.c. supply. This reduction in life however does depend to a great extent on the wattage of the lamp and the type of filament used. Some manufacturer's catalogues now show the life when using either a.c. or d.c. supplies. The cause of shorter life on d.c. is electromigration of tungsten in a unidirectional electric field. Eventually "notching" occurs, causing localised thinning of the filament, this leads to "hot spots" and burn-out of the lamp. This effect is more noticeable on filaments with smaller diameters and at lower operating temperatures. Lamps operated on d.c. supplies at currents of less than 80mA can be more susceptible to this failure mode. If possible lamps used on d.c. should have nominal current ratings of greater than 100mA. For example, a typical indicator lamp having a rating of 12V at 50mA has an a.c. life of 5000 hours but only 2000 hours at d.c.

If lamps are operated in situations of repeated switching this can cause early failure because of thermal shocks or surge currents. During the life of the lamp the filament will become more brittle and failure due to thermal shock more likely. Surge currents can cause filament "hot spots" to heat up above the melting point of tungsten. When lamps are used in this type of situation, a small permanent standing current (low enough to keep the filament below incandescence) will minimise this effect.

Lamps operated from a constant current source, via high value series resistors or in series can also lead to life reductions of as much as 50 per cent. Over the life of the lamp, the filament resistance will increase and therefore the voltage across the lamp will increase. This effect is of course progressive, hence the reduction of life under these conditions. The problem can generally be overcome by ensuring that the voltage across the lamp is less (at the outset) than the rated voltage.

The resistance of the filament and hence the current through it should also be taken into account when designing circuits to drive filament lamps. This cold/hot resistance change occurs over a relatively long period of time in terms of semiconductor switching. For instance a filament having a nominal operating current of 100mA will at the instant of switch-on have a current of 1000 per cent of the nominal value and even after 10 milliseconds this current will still be 300 per cent of nominal (see Fig. 1.4).

This change in resistance can be used to advantage as a current control device. One of the most common applications of filament lamps as a circuit component as opposed to an indicator, is in telephone handsets. This particular application consists of two 5V lamps with closely defined resistance/current characteristics connected in series with a circuit that acts as an automatic volume control to compensate for variations in BT line levels. Lamps used in this type of application are known as barretters. Larger types of barretters are also found in telephone exchange equipment and were used as a series dropping resistor in certain makes of a.c./d.c. valved radios.

Lamps can be operated outside their nominal ratings by using the chart shown in Fig. 1.5, although changes beyond 10-20 per cent from nominal should be treated with caution.

1. To increase the light output of a lamp by 40 per cent, it can be seen that:
(a) The voltage has to be increased by 10 per cent
(b) The current will increase by 5.2 per cent
(c) The life will decrease by 68 per cent

2. If a lamp is operated at 85 per cent of its rated voltage:
(a) The current decreases by 8 per cent
(b) The light output decreases by 45 per cent
(c) The life increases by 700 per cent

It can be readily seen that relatively small decreases in applied voltage can greatly increase lamp life. The curve shown in Fig. 1.6 is calculated on the

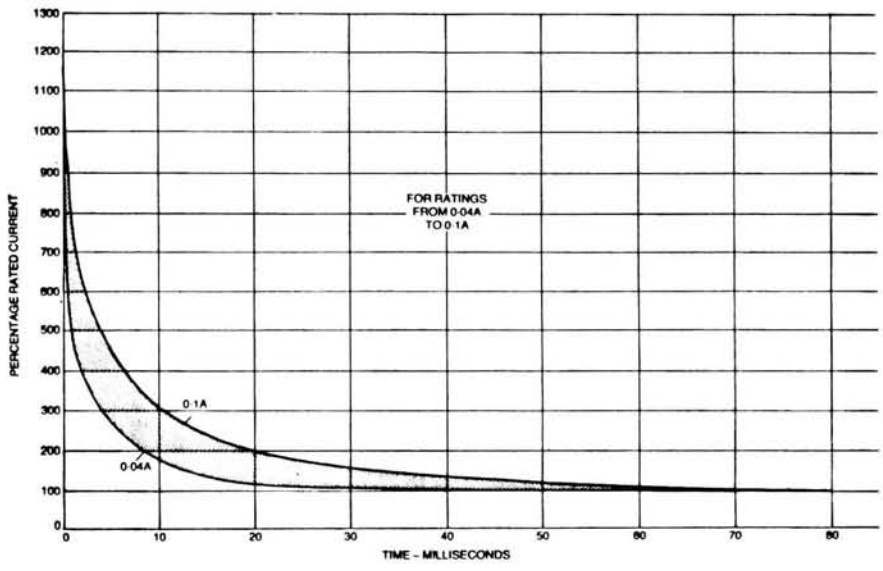


Fig. 1.4: Typical "switch-on" current characteristics for small tungsten filament lamps

assumption that the life is inversely proportional to the 13th power of the applied voltage.

Tungsten Halogen Lamps

Efforts to increase lamp life and efficiency have resulted in the introduction of the tungsten halogen lamp (first called "quartz-iodine" lamps). The slow evaporation of tungsten from the filament in a conventional lamp causes particles of tungsten to condense on the relatively cool inner surface of the bulb. This leads to the well known "blackening" and reduction of light output over the life of the lamp. If a halogen is added to the gas filling of a tungsten lamp this will combine with tungsten to form tungsten halide. Providing that the lamp is manufactured and operated in such a way that the inside wall temperature of the bulb is kept above 250°C the tungsten halide is prevented from condensing and is returned back into the vicinity of the filament. The high temperature of the filament breaks down the tungsten halide into tungsten and halogen; the metallic tungsten is deposited on the filament and halogen is released to cause the cycle to be repeated. If the tungsten could be re-deposited on the exact place it originally evaporated from, the lamp would last indefinitely.

Tungsten halogen lamps do not blacken during life and thus continue to emit their full light output. Generally they have a life some two or three times that of the conventional filament lamp and an efficiency of more than double. Tungsten halogen lamps are available from 10 to 3000 watts or more.

Because of the need to keep the wall temperature of the bulb above 250°C to maintain the halogen cycle, tungsten halogen lamps should be run at or near their rated voltage. The scope for dimming them by applying a reduced voltage is therefore limited.

These lamps are found in a very wide variety of applications such as car headlamps, projectors, floodlighting, display lighting and photocopiers. In photocopying and similar applications the fact that tungsten halogen lamps retain their colour/temperature characteristics over life is of particular use.

Due to the high temperatures involved care should be taken when using tungsten halogen lamps. The correct holders or fittings must always be used. It is obvious that the glass envelope must not be touched when the lamp is on due to the high temperatures involved. However it is also important that the glass envelope is not touched when the lamp is cold. Sweat and grease from the skin will be left on the bulb causing a hot spot to develop and the bulb to crack. Many tungsten halogen lamps are manufactured with integral reflectors, thus making the handling very easy. Often, these reflectors have dichroic properties, directing the light forward in a beam, while allowing most of the heat to escape through the reflector to the rear.

The second part of this article will deal with neon lamps and electroluminescent panels.

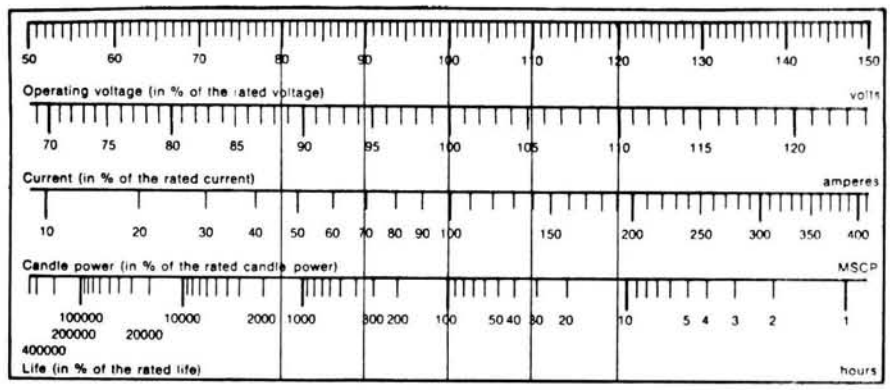


Fig. 1.5: Current, light output and life, related to operating voltage

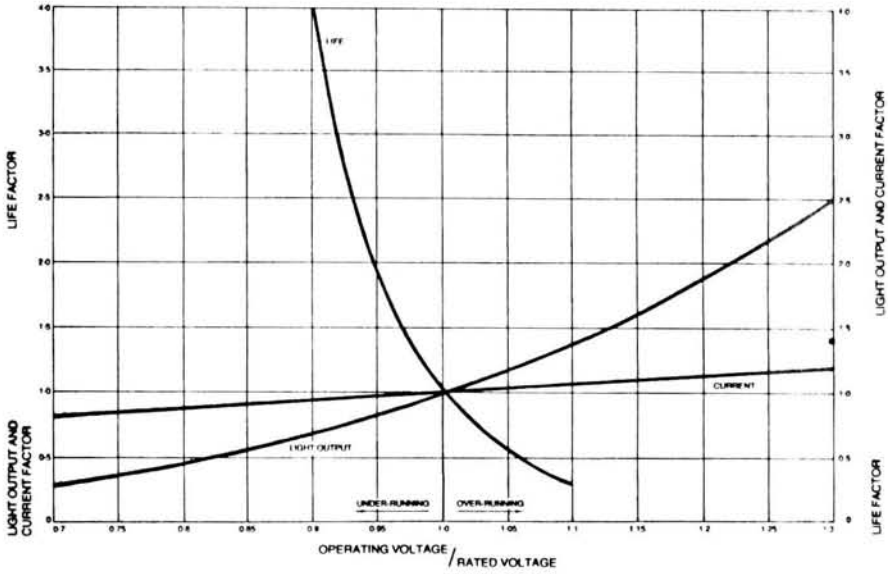


Fig. 1.6: Performance curves for miniature filament lamps. Variations of more than ±10% from nominal are not normally used in practice

Reading & Understanding Circuit Diagrams

(with a bit of theory thrown in)

In Part 12, R.F. Fautley G3ASG looks at Class B, AB and C operation of r.f. power amplifiers.

Class B

After Part 11, you should have some idea what a V_G/I_A valve curve looks like (and means). So, the curve in Fig. 12.1 will probably explain itself. Class B operation does not provide an anode current waveform the same shape as the voltage waveform at the grid. In fact, it operates rather like a half-wave rectifier, producing anode current for the positive half-cycles of the grid voltage waveform and none at all for the negative half. This is because the grid bias voltage is set to just about anode current "cut-off"—the value for an anode current of just about zero. So the anode current waveform is very distorted and its harmonics could cause a lot of interference.

Help is at hand though, in the form of the anode tuned circuit, L3 and C3, (see Fig. 11.1). For during the half-cycle when no anode current is flowing, a great piece of magic is performed by the tuned circuit. It actually **adds** the other half-cycle to provide a complete r.f. sinewave!

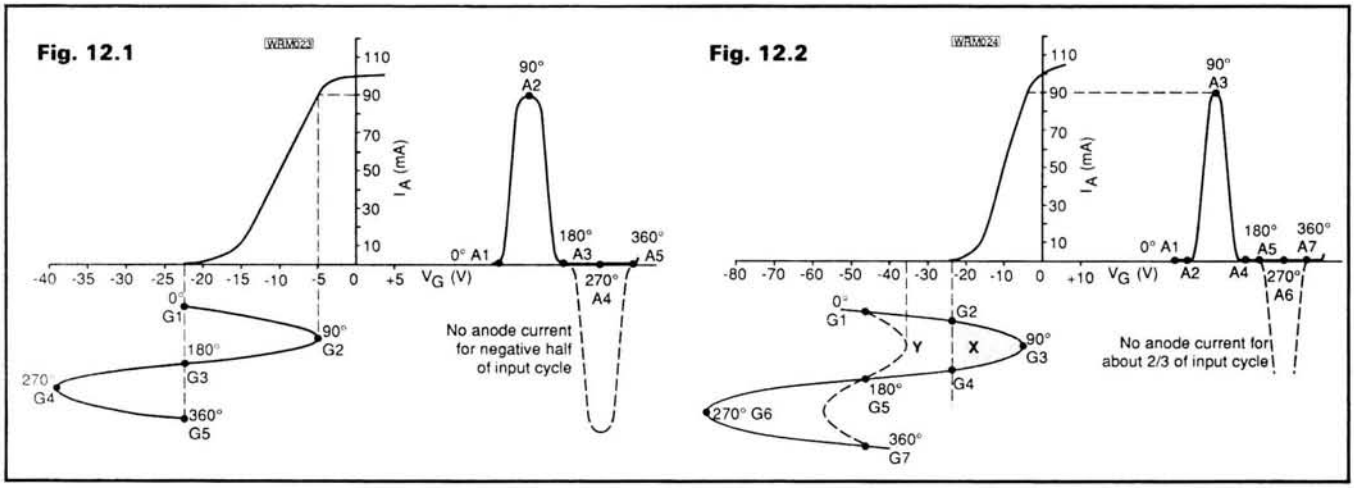
Another diversion is required here to understand what happens. If a simple *LC* circuit could be made that had no losses at all (that is both inductor and capacitor were **perfect** components comprising reactance only and absolutely no resistance)—once it was electrically stimulated it would oscillate theoretically for quite a time. That is, after being "struck" it would "ring", rather like a bell. The frequency, or pitch, of a bell's note is controlled by the bell's physical dimensions, which are **its** tuned circuit.

If a small amount of resistance is added to the tuned circuit, then the oscillation amplitude would be reduced by a fraction every cycle until eventually it would cease. Now, all practical tuned circuits **do** have resistance so they don't oscillate very much, if at all. However, each half-cycle of anode current which flows through the tuned circuit acts as a stimulus and so "strikes" the circuit and it "rings".

The frequency at which the circuit rings or oscillates is controlled by the resonance of the tuned circuit, so if it's tuned correctly it will be the same as the input signal. This phenomenon of circuit ringing is utilised in nearly all r.f. amplifiers. It is also referred to as "fly-wheel" action because of its similarity to the way a fly-wheel helps to maintain constant mechanical velocity.

The frequency at which the circuit **rings** is controlled by the resonance of the anode tuned circuit. Although the circuit is tuned to the input frequency it is possible for its resonance to change slightly with changes of temperature. You may think this could cause drift of the transmitted frequency, but that doesn't happen because the anode tuned circuit has control for only **part** of each r.f. cycle. Every positive half-cycle of the input signal causes anode current to flow and so drags the frequency back into step, i.e., it is corrected once every cycle. The result is that the frequency **always** remains the same as that of the input signal.

As the valve is conducting for only half of each cycle and is effectively switched off for the other half, the d.c. power input to the valve is quite a bit less than for the same r.f. power output with a Class A stage. That is, it's more efficient. There is a drawback and it is that the distortion level is somewhat higher. Looking carefully at Fig. 12.1 you can see that the beginning and end of each half-cycle of anode current is not part of a sinewave, it's curved quite a lot where it should look nearly straight. This causes a bit of a "kink" in the waveform, although the fly-wheel action of the tuned circuit does remove much of the distortion before it reaches the output terminals. When used as a linear amplifier, the result of this small amount of distortion is usually noticeable in the level of intermodulation products. Using just a little less grid bias, so that anode current flows for a greater part of the cycle, removes most of the kink and reduces the level of the intermodulation products. This mode of operation is **Class AB**, the most popular class used for linear amplifiers in modern transceivers.



Intermodulation products? They're caused by intermodulation distortion, which was introduced in Part 7 when we looked at the theory of the superhet receiver. The products are the beats produced when two (or more) signals are applied to the input of an amplifier at the same time. "But", I hear you cry, "we don't apply more than one signal at a time." Oh yes we do! Speech contains several different frequency signals at the same time depending on the sound we make. You would be quite correct though in assuming there is only a single input signal in the case of a c.w. transmitter. The distortion then would be in the form of r.f. harmonics of the input signals. These harmonics could be removed by suitable filtering before reaching the antenna.

Class B amplifiers are often used for a.f. amplification especially where high power output is required. Now, a.f. amplifiers don't have anode tuned circuits because they have to be wideband devices, handling over three octaves just for speech and at least nine octaves for hi-fi amplifiers. So, they have no fly-wheel activity to put in the half-cycle of zero anode current. The way out of this problem is to use two valves operating in "push-pull". See Part 9 for an explanation of push-pull operation.

During the time that one valve is conducting the other is cut off and vice versa, so by combining the output from each valve in a suitable a.f. transformer, there is no missing half-cycle to make up. Again, the kink at the cross-over of the output waveform (where the input waveform is around zero, changing from + to −) would introduce some harmonic and intermodulation distortion in a.f. amplifiers. Moving the grid bias point a bit positive into Class AB operation is again the answer if distortion levels need to be reduced.

Class C

The graph in Fig. 12.2 illustrates that anode current flows only during the time that the grid input cycle is at its **most positive** (the region marked "X"). The anode current pulse triggers the anode tuned circuit making it ring, and the operation is similar to that for Class B.

Class C is more efficient in converting d.c. power into r.f. power than the other classes of operation, but it can't be used for a sideband transmitter. Why not? Well, as only **large** input signals make the grid potential high enough to produce anode current, small signals such as those found in parts of speech waveforms would just not appear in the output. Look at Fig. 12.2, where a small input waveform at the grid (marked "Y") would produce no anode current at all because it is too small to overcome the fixed grid bias voltage.

For transmitters intended to operate on c.w. only, Class C operation is the best choice, for the grid signal is either zero (key up) or of an amplitude sufficient to drive the anode current to the maximum permitted for the valve (key down), with no in-between levels.

This maximum anode current may only be obtainable when the grid is driven with such a high amplitude signal that it actually becomes positive on peaks. In this case the grid will draw a small amount of current which is measurable on a d.c. milliameter (M2 in Fig. 11.1) connected in series with the negative grid bias lead. This can be quite useful to ensure correct fine tuning of the grid circuit by simply adjusting C2 for maximum M2 meter indication, i.e. maximum grid current (maximum r.f. input voltage).

So, it's a Class C amplifier that would be the best choice for our beginner's Morse transmitter.

Wireless in 1928

In Part 1 John D. Heys G3BDQ begins his look at a very important year in radio history

1928 was the year of the first Micky Mouse cartoon film and also, irrelevantly, the year when the author entered his local Infant School and suffered under the basilisk-like gaze of a certain Miss Wildgoose! During that year he became an avid listener to the "Aunts" and "Uncles" on 2ZY (Manchester) but otherwise took no particular interest in wireless matters. Not many radio enthusiasts recognise that 1928 was a most important year in the development and exploitation of broadcasting and amateur wireless. It is hoped that this article will highlight the milestones of those now forgotten times and perhaps generate an interest in an earlier technology. Fortunately the author has been able to collect and assemble a wide range of contemporary documents. QSL cards, radio magazines and other publications which cover the year under review. This has enabled preparation of this short article.

Triodes with Everything

Broadcasting began in Britain in 1922 and much has already been written about those early days. Commercially made receivers were most expensive and thousands of enthusiasts set-to and built their own sets. The home construction hobby boomed and the manufacture of wireless parts became a growth industry. Many small firms mushroomed and then foundered, but the successful enterprises prospered and many survive today. There were many popular magazines which described in great detail the construction of all kinds of simple receivers. *Popular Wireless* came out every Thursday and cost 3d. *Amateur Wireless* also appeared each Thursday at the same price, and of course the still flourishing *Wireless World* (which was first published in April 1913) was even then one of the most authoritative popular journals. *WW* appeared each Wednesday and also cost 3d.—an amount which would then buy five good quality cigarettes and was considered a fair price to expend regularly.

Straight t.r.f. receivers which used from one to four valves with "reaction" on the detector stage and output feeding headphones or balanced armature speakers with horns were the most common designs. In those days r.f. amplifiers were seldom used or described because only triode valves were then available. Even if such valves were properly neutralised they had very little gain. The early superhets were unpopular for the same reasons and in addition the radiation from their local oscillators could upset the neighbour's reception.

The New Valves

The Editor of the *Wireless Constructor* which was a 6d. monthly, Mr. Percy W. Harris introduced his readers to a new valve in his November 1927 issue. This new valve, called the "screened valve" was a tetrode made by Marconiphone and designated the S265. The firm offered readers circuits which used this revolutionary new valve, and it had connecting pins at both ends and was generally mounted horizontally through a metal screen.

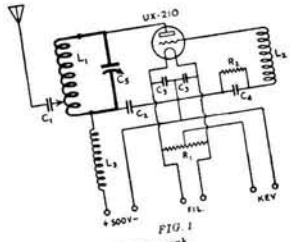
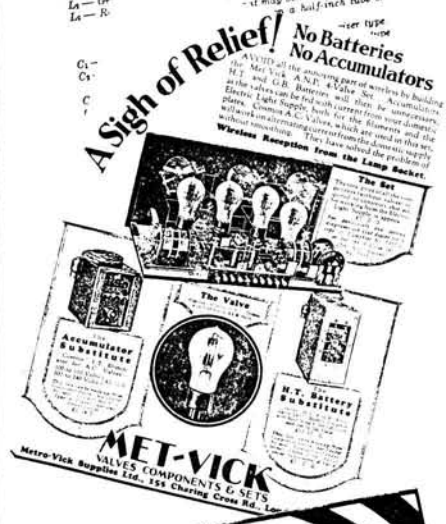


FIG. 1



Other valve manufacturers jumped quickly on to the "bandwagon" and during 1928 these new screened grid valves became popular as effective r.f. amplifiers with a voltage amplification of 100 or more. Their use led the way to the manufacture of efficient, easy-to-tune superhet receivers in later years. During 1928 another multi-electrode valve appeared, the pentode. In September of that year *Wireless World* had an article titled "A new receiver—the Megavox Three", which had a screened grid r.f. stage, a triode detector and a pentode output stage. Messrs. Osram and Ediswan began the manufacture and sale of screened grid valves with 2 volt filaments; the S215 and the SG215. Osram asked readers of their advertisements to "look out for the Osram pentodes! These wonderful new five electrode power valves will shortly be placed on the market . . ." At 22/6d. each the valves were not cheap, for this sum represented about half the weekly wage packet of an ordinary working man!

Royalties

A few "giants" in the wireless industry such as the Marconi organisation held five key patents which were an effective stranglehold on the manufacturers of wireless receivers. There was a 12/6d. (almost £20 at today's prices) Royalty per valveholder in each set and this induced the early manufacturers to use as few valves as possible in their receivers. Such an imposition limited the design parameters to simple O–V–1 or O–V–2 circuits and held back superhet development. The introduction of the German Loewe multiple valves which had two or three valves and their *RC* interconnecting circuits within one valve envelope and only one valve base brought this matter to a head, and following Court action changes were made. In 1928 a decision by the Controller of the Patents Office decreed a reduction in the Wireless Royalties. The new scale introduced a Royalty of 10 per cent on the wholesale selling price of a receiver with a minimum of 5 shillings to be paid for the first valve and 2/6d. for each additional valve. This opened the door for a rapid expansion of the wireless receiver manufacturing industry.

All Mains Sets

There were additional major developments in wireless receiver design

A selection of advertisements from 1928

during 1928. The most significant of these was the introduction of the "all mains" set which did not need expensive dry h.t. batteries and the heavy and messy lead-acid accumulators for filament supplies. Initially many well known manufacturers including Igranic, Ekco, Tannoy and Westinghouse produced a variety of so called "eliminators" which could be connected to the mains supply either d.c. (which was most common at that time) or to the rapidly growing number of a.c. outlets. These "eliminators" replaced the h.t. battery and provided around 120V of fairly smooth d.c. with perhaps a 60V tap. Some of them also enabled the slow trickle charge of the l.t. accumulator. *Wireless World* ran a special issue on August 22 which dealt almost exclusively with the operation of wireless receivers from the electric light supply.

A new series of valves with indirectly heated cathodes and specially designed for mains operation were offered by Metro-Vic under the name "Met-Vick-Cosmos". They cost 22/6d. each which was quite an alarming price then. Marconi were offering a double diode valve rectifier, the U5, which had a directly heated 5V filament and could be safely used with maximum r.m.s. voltages of 400 and provide some 60mA of current. Metal rectifiers made their appearance in 1928 and they were often used in "eliminator" designs. Although marketed successfully by several manufacturers the basic principle by which these solid-state devices operated was not understood. One expert suggested that the action ". . . might be electrostatic, electrodynamic or thermoelectric or a combination of one or other of these physical conditions . . . it is as obscure as the operation of a crystal detector." Smoothing capacitors for mains power supplies were expensive. TCC paper capacitors for 400 volts working cost 10/6d. for a 4μF item and £1 for 8μF. Electrolytic high capacitance types were not available. The development of parts for mains powered equipment opened yet another door for the manufacturers of receivers for a later mass market.

Speakers and Motorboating

Another "breakthrough" in technology was the development and marketing of the moving coil loudspeaker. During 1928 this new type of speaker came into its own and became almost a "fad". The superior bass response when compared with the ubiquitous horns ensured the success of moving coil units. They too were not cheap! A Marconiphone moving coil unit, complete and only needing a baffle cost £6.6.0d. If it was mounted in a mahogany cabinet and equipped with a rectifier valve to enable its use with a.c. mains it would have cost you a staggering £17.7.0d. The electromagnets employed in these early speakers were often powered from 6V accumulators, and kits of parts to build your own speaker were available. These even included suitable "cone paper"!

The old battery operated receivers had little or no decoupling circuitry and when they were connected to a mains "eliminator" (most of which had a high source impedance), they suffered from a nasty complaint which was called "motorboating". *Amateur Wireless* in its August 18 issue published a design for an "anti-motorboating" unit which could be attached to almost any "straight" receiver.

BBC Stations in 1928

Location	Call	Frequency	Wavelength	Power
Aberdeen	2BD	600kHz	500m	1·5kW
Belfast	2BE	980kHz	306·1m	1·5kW
Bournemouth	6BM	920kHz	326·1m	1·5kW
Cardiff	5WA	850kHz	353m	1·5kW
Daventry	5XX	187kHz	1604·3m	25kW
Daventry	5GB	610kHz	491·8m	30kW
Glasgow*	5SC	740kHz	405·4m	1·5kW
London	2LO	830kHz	361·4m	3kW
Manchester	2ZY	780kHz	384·6m	1·5kW
Newcastle	5NO	960kHz	312·5m	1·5kW
Dundee	2DE	1·02MHz	294·1m	200W
Edinburgh	2EH	1·04MHz	288·5m	200W
Hull	6KH	1·02MHz	294·1m	200W
Leeds–Bradford	2LS	1·08MHz	277·8m	200W
		1·19MHz	252·1m	200W
Liverpool	6LV	1·01MHz	297m	200W
Nottingham	5NG	1·09MHz	275·2m	200W
Plymouth	5PY	750kHz	400m	200W
Sheffield	6FL	1·1MHz	272·7m	200W
Stoke	6ST	1·02MHz	294·1m	200W
Swansea	5SX	1·02MHz	294·1m	200W
Chelmsford	5SW	12·5MHz	24m	20kW

*Experimental

The Broadcast Stations

On 31 March 1928 there were more than 2 470 000 receiving licences in force in the UK and just three months later the total had grown by more than half a million. Listeners near London could easily receive the most powerful of the regional transmitters, 2LO on 830kHz with a power of 3kW. Many of the smaller regional stations on the medium wave band were only using 200W, and Daventry 5XX on 187kHz long wave relayed 2LO with its 25kW. 1928 saw the opening of the BBC's short wave broadcasting for overseas listeners in the "outposts of the Empire". The station callsign was 5SW and its 20kW emanated from a site near Chelmsford on a wavelength of 24 metres (12·5MHz). By mid-1928 there were 72 short wave stations operating below 100 metres wavelength and they were located all over the world. Of these stations, 58 were in Europe or the USA, five were in Australia, four were in Africa, two were in Japan and surprisingly three were located in Java.

The real pioneer of British short wave broadcasting was Mr. Gerald Marcuse G2NM, who with GPO permission ran a power of 1·5kW on a wavelength of 32 metres from his home in Caterham. He was heard consistently in distant places much better than the higher powered BBC transmissions on a lower wavelength. G2NM continued with his almost daily broadcasts until the end of August 1928 but history and the BBC neglect mention of him. Even during the recent BBC celebrations of their 60 years of broadcasting, the efforts of Marcuse in showing that long distance broadcasting was practical were simply forgotten. (But see "The Start of Empire Broadcasting", *PW* July 1978).

On the medium and long wave bands there were 57 major broadcast stations in Europe outside the UK by the start of 1928. Many of these could be received after dark in this country and the inherent poor selectivity of the straight receivers that were almost universally in use meant heavy interference to the BBC broadcasts. Ingenious wavetrap circuits were devised and described which sought to overcome the worst of the heterodyne interference, and receiver builders were always seeking coils with a higher *Q*.

Components

A look at the advertisements for wireless components during 1928 reveals the intense rivalry between the manufacturers. Each one was eager to be one step ahead with the latest idea or what we would now call "gimmick", but many of the seeming bright ideas dimmed after a few months and the new product was then no longer advertised. A lot of the simple receiver designs using two or three valves had one or even two intervalve a.f. coupling transformers to give more gain than *RC* coupling could offer. Messrs. Mullard advertised their new "Permacore" intervalve transformers which

for 25 shillings promised there would be no resonant peak in response between 8 and 10kHz. This development was made possible (so they stated) by the use of a primary winding of silver wire and a secondary of nickel. Anyone with "Permacores" in their junkbox is advised that he or she is unwittingly hoarding treasure! The rival firm of Ferranti had an a.f. transformer called the AF3 which sold at the same price and which had a claimed response curve which was flat between 100Hz and almost 4kHz. If this component had a peak above 8kHz Ferranti certainly kept very quiet about it for the response curve illustrated did not extend beyond that frequency! The AF3 however acquired a good reputation and these transformers were still being sold several years later, but the Mullard devices never achieved lasting success despite their expensive windings. A fact to remember when examining old advertisements is that in 1928 the present legislation covering advertising standards did not exist and any prospective purchase of wireless equipment or components had to avoid an acceptance of exaggerated or "hyped" advertising copy.

Television

The now defunct Baird Television Development Company ran a full page advertisement in the August 15 issue of *Wireless World* and other magazines to announce their intention to commence TV broadcasting. Demonstrations of their new combined broadcast receiver and Televisor sets were to be given at the forthcoming 1928 Radio Exhibition at Olympia. Baird pioneered a mechanical televison system which certainly worked but it was incapable of giving a fine resolution or pictures much larger than a postage stamp! This announcement by the Baird Company

caused some consternation for it seemed to encroach on the BBC monopoly on broadcasting that had been granted by the Post Office.

Towards the end of 1927 the BBC brought out their *1928 Handbook*. This was the first Handbook produced by the BBC and it contained a wealth of information on broadcasting and the social climate at the time. Later the Handbook was re-named and it became the *BBC Yearbook* in 1930. In the 1928 edition a foreword by the Earl of Clarendon who was Chairman of the Board of Governors began, "The issue of this handbook is a reminder that Broadcasting is an established and accepted institution . . .". The early experimental days were obviously over and 1928 heralded a new phase in broadcasting.

The Handbook's introduction was penned by no lesser a person than Sir John Reith the BBC's Director-General. This introduction is really an essay which expounds that great man's whole outlook and philosophy regarding broadcasting; a point of view which would be quite unacceptable in 1988.

The Handbook is divided into main sections within its 382 pages and covered Programmes, Engineering, Round the World, The Wireless Trades, etc. There is even a chapter several pages long entitled "The Installation of an Aerial System" which mentions the now largely forgotten fact that under the terms of the broadcast receiving licence then in force the combined height and length of an aerial was limited to 30m! These old BBC Handbooks may often be found gathering dust in second-hand book shops, and for those who are interested in the early days of wireless they are well worth tracking down. The dust jacket on the 1928 Handbook is a striking Art Deco design by the celebrated American artist E. McKnight Kaufer and is in itself a collector's item.

So far I have only touched upon some of the important developments here in Britain which took place in 1928. Part 2 of this article will be devoted exclusively to the amateur radio scene in that year. For amateur radio too 1928 was an important point in time, separating the early more primitive wireless techniques from the later "modern" age which led up to the second World War.

Acoustically Tuned CW Loudspeaker

Here's a natty idea from Richard Q Marris G2BZQ for all you Morse fanatics—an acoustically tuned c.w. filter. This simple low-cost audio device will clean up the Morse from the crudest receiver, it won't make up for the lack of good i.f. filtering, but then few audio filters will. Build it and see what you think.

Manufacturers of communications receivers go to a lot of trouble to produce sets that will recover good quality audio from both s.s.b. and c.w. signals. This normally means including several i.f. filters to give the necessary selectivity for each mode. However, sometimes to keep the price of the receiver within market parameters, corners are cut and it's normally the c.w. mode that suffers. This is where a little outboard audio filtering comes in handy.

To make a c.w. signal audible on an a.m. detector, a b.f.o. is needed. This is set to a slightly different frequency to that of the receiver's i.f. The difference between the i.f. and the b.f.o. frequency, is the note of the recovered audio signal. The difference, on a more complex receiver, is often preset to between 400Hz and 1000Hz. However, a receiver with a tunable b.f.o. allows the listener to select his favourite note, the author's preference is around 850Hz. Unfortunately, what with the overcrowding on the h.f. bands and all the man-made static, the 850Hz c.w. signal isn't all that one hears.

The compromise mentioned earlier regarding the i.f. filter, is also to an extent true of the receiver's audio transducer, loudspeaker or phones. These are often high quality devices capable of reproducing a far too wide a band of audio frequencies. This is where the author started to think about producing a transducer that had tailored response for c.w. signals.

Experiments followed to re-tune the response of a loudspeaker, which by design, already had a limited bandwidth. The loudspeaker used is an 8Ω, 50mm (2in) dia Mylar cone device, which has a 500mW rating and a frequency response of 400Hz–5.5kHz. Hardly hi-fi! Mylar loudspeakers have ferrite magnets and are generally used for sirens and alarms, hence the limited frequency response. This speaker combined with the tubular enclosure shown in Fig. 1 forms the basis of an acoustically tailored c.w. speaker. The enclosure is a 56mm outside dia. tube, 227mm long, the speaker is sealed into one end and the sound exits through a small hole in a cap at the other. The prototype speaker made roughly to the dimensions given, showed a marked peak in its response at 850Hz.

Construction

The enclosure is made from a 227mm section of cardboard plan tube. These are generally available from most large stationers and come complete with tightly fitting plastics end caps. The tubes are made in a variety of lengths right up to 1m, however, the internal diameter is important and must be just slightly larger than the diameter of the speaker.

Having selected a suitable diameter tube, remove one end-cap and roughen its inner face. Using silicone rubber compound, glue the speaker magnet to the cap. Wait the recommended setting period of the glue, then take the speaker assembly and carefully make a small hole in the cap just behind the speaker terminals. Thread a length of miniature screened cable through the hole and connect it to the loudspeaker. Make the cable entry airtight with a small amount of the silicone compound. Finally, wire a suitable audio jackplug to the speaker lead and fit the cap plus loudspeaker into the tube.

Adjustment

The diameter of the small hole in the other end cap determines the applied top-cut frequency; the smaller the hole, the greater the top-cut. The hole diameter needs to be between 1.5mm and 6mm, beyond this size the background noise rises rapidly. On the prototype the final hole size chosen was 4.5mm diameter. The bass-cut frequency can be adjusted by decreasing or increasing the length of the tube. It should be noted that adjusting either the bass-cut or top-cut will have an interactive effect.

In practice the best method to determine the hole size required, is to drill a number of different diameter holes into a piece of thin plastics sheet and then hold each one in turn over the mouth of the tube. The resonant frequency of the tube may then be found by sweeping the receiver b.f.o. across a reasonably strong c.w. signal and noting when the desired note is considerably enhanced. The correct hole size can then be made in the centre of plastics end cap. The plastics sheet used for the experiment was cut from the side of a 1.5 litre milk container, as this material is very similar to that of the end cap.

Results

The end result is a low-cost, narrow band c.w. speaker, the construction of which although simple should be done with great care. The resonance of the speaker is quite sharp as when tried on a normal a.m. broadcast signal, all that will be heard is a rather strange "Donald Duck" sound.

During the experiments a formed steel tube was tried which gave a pleasantly crisp, slightly ringing note. Unfortunately a secondary low-level resonance occurred producing a background hissing noise, or sea-shell effect. In this experiment the hissing noise defied all attempts to remove it acoustically without losing the crispness of the c.w. note as well.

The audio from the loudspeaker has a rather unfortunate penetrating effect not appreciated by other householders, particularly during early morning and late evening DX sessions.

This speaker is a low-level device and is somewhat directional. It should be placed as close to the ear as is practical. Finally the speaker could be mounted to a wooden plinth using either large Terry or plastics plumbing clips. ***PW***

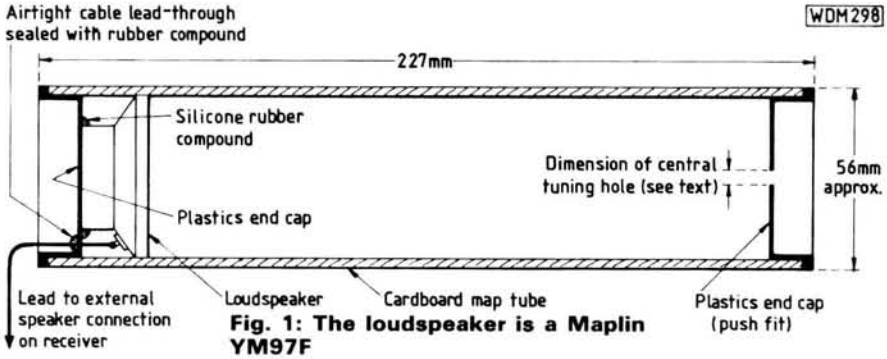


Fig. 1: The loudspeaker is a Maplin YM97F

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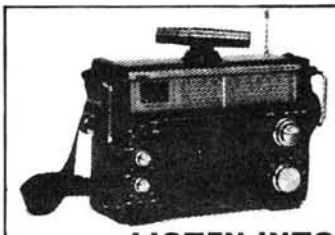

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On The Air
On The HF Bands

Reports to Paul Essery GW3KFE
287 Heol-y-Coleg, Vaynor, Newtown, Powys SY16 1AR.

No doubt about it as I write, we are in the dead of winter . . . but tomorrow the days will start to lengthen. Again, no doubt about it, the shorter days have reduced the liveliness of the bands but having said that, I wonder just how much of this is due to conditions and how much to reduced activity? This doubt is sparked off by observation daily of a particular band/path, for example 14MHz and ZL. To hear them talking of temperatures of 24 degrees Celsius on Christmas Eve made me quite envious, until Christmas Day turned out to be as warm or warmer than we have ever known. However, the pre-Christmas gales have kept me on my toes, checking the guys of the mast every few hours!

Of course, as always, the hooking of a bit of rare DX tends to put a rosy glow on one's view of conditions, as also does the act of bumping into an old friend on the band.

Pest

First, I must mention that Martin OY7ML has a pirate; a pirate at that who is definitely a G, who uses a bug where Martin has an electronic keyer; and notably a pirate whose manners are, shall we say, not of the best. As a result, Martin has received abusive letters resulting from the activities of this oaf. Information, please, urgently to G4DYO, by telephone, particularly if you can get a bearing.

Silent Key

In mid-November, **Stanley Thomas** GW3AX at the age of eighty became a silent key. He had been a low-band addict for as long as I can recall; giving, for instance, my first faltering steps on 7MHz s.s.b. DX quite a lift, as indeed he did on 3.5MHz. Stan was a man who knew how to brew up a big signal and how to use it. Many a newcomer has cause to remember the help GW3AX gave. He will be missed by many.

Activities

The recent Rotuma DX-pedition is stated to have made some 30k contacts; and at the time of writing there are "buzzes" that indicate that the DXAC have recommended that Rotuma go on the countries list, which should result in ratification by the awards committee later on.

Still on history, the HA DXpedition to 3W8 returned home after the CQWW CW leg. They should be congratulated on what was undoubtedly one of the best expeditions I can recall.

The Mellish/Willis Is expedition should set off in the next day or so from the time of writing, from Cairns; arrival at Mellish was slated for around January 7, and then continuing to Willis. The QSLs are being handled for this one by NM2L.

A7SR has been reported several times, giving QSL route as Box 6372 Doha, Qatar. Alas, the call isn't in the series of amateur issues, and Saad can only work 10 metres or 11 . . . Slim does get around a bit!

Reports

As always at this time of year a mite thin on the ground—it would be absolutely magic to get lots of letters EVERY month!

The 1.8MHz Band

Not many reports for Top Band this time. **Ron Pearce** (Bungay) and his home-brew receiver picked up W1WCR on s.s.b.

G2HKU (Sheppey) used his s.s.b. for the regular contact with ON7BW, while the c.w. locked on to LX/DF3CB.

Our other reporter on this band is **G3BDQ** (Guestling). On Top Band c.w., John managed to raise UA1OHL, RA3DOX, UP8A, UA9FAR, UA9XJV, UZ0AB (Krasnoyarsk), HG0D, YO3APJ, W4MGN and 4X1VE.

The 3.5MHz Band

The only correspondent who spent much time on 3.5MHz (80m) was **G0HGA** (Stevenage); with the lower power, Angie managed LA6BD, DJ7YS, G3SVK, LA2YE, DL6ZBA, LA4XFA, HB0HTB, LA2J, DL0DAM, DL1LBI, LA8DW, Y23PL, SP6GNK and DL2DI; while a spell on higher power collected LA9HFA, DL9RDL, DK6HN, DK0HSC, DL6ZBA, DF2YK, ON4CW, Y47YN, OK2UZ who was running one watt, DL2NY, Y22UI, DL0ER/DL1EED, NP4A, UV6AIT and SM6OEF.

G3BDQ made just two s.s.b. contacts on the band; these were with PT7WX and JA6XMN.

The 7MHz Band

This is one band you either love or hate! Those who love it seem to pile up great numbers of countries quietly, while those who don't never go near the band. No doubt about it, if you want to work the DX you need to have a strong constitution on the one hand and a receiver of good dynamic range on the other.

PA3CWN (Leeuwarden) stuck to 7MHz (40m), running fifty watts into a vertical on top of a three storey flat in the middle of the city. Oene was unlucky in not being able to hoof the Vietnam expedition, but continues to hope for the next one. On the other hand, over the past couple of months some 15 new countries were raised on the band to take him up to 156 worked. The main mode was c.w. and it raised JA9YBA, JA1CXC, JA3SNK, JA4CSH, JA4FCS, JH1XYR, JA4GQK, JA5RH, VK2FEX, VK2KM, VK3EGN, VK3MR, J3/K8CV, 9M2AX (QSL via JA5DQH), VQ9QM (QSL via W4QM), TF3WW (via OH4NRC), ZS6QU, K3IPK/VP5, EA9EA, EA9EO, TK5IU, TA2/G3UIN, GD4UOL/A, PY0FC (via PY7XC), ZB2/G4VXE, ZB2/GW3NYY, P40R, 6V6A, EL7U, D44BC, FM5BH, SU1ER, F2JDX/J7 (QSL via F6AJA), 8P9HT (via K4BAI), KP2A, P40V, PJ1B, HD8EX, PZ1DV, PP6SS, YV4DD, HZ1AB (via K8PYD), HL1EJ, VEs, and Ws; on s.s.b. there were just JA1VKV, 3A0M, OX3SG (via LA5NM), TF3SV, G4LJF/V2A, YI2LVB and 9K2RA.

Finally, an appeal for help. PA3CWN needs the QSL information for the following stations: HD8EX, EL7U, D44BC, 3A0M, P40R, 6V6A, SU1ER, KP2A and FM5BH. Anyone with the needful, please drop me a line here and I will pass on to PA3CWN. However, I have to comment that that 6V6A sounds suspiciously to me like another manifestation of Slim, at least until someone comes up with a sound reason why it shouldn't have 6.3 volts up its heater!

P. Davies G1EMD (Market Drayton) is also a keen s.w.l. and among his other loggings noted G4LJF/V2A on 7MHz s.s.b.

It was c.w. all the way for G2HKU (Sheppey) who raised TA1AZ, K0RF/KP2, 7X3DA, P40R, P40V, KP2A, YO4BX/MM and HK7DSZ.

Over now to G3BDQ. John found PY0FZ on Fernando de Noronha for the Plum of the Month using s.s.b., which mode also sorted out CN8ST, CU2AN, PT7WU, UF7FWR, UA0FEK/U3W, YC0DB, YB0BAQ, JA3RRA and 4X6LD, while the c.w. was carefully reserved for the USA plus OH7JT/CT9, RU1DZ, UH8DC, UZ0AWD, RL1P, VU2TEC, EA9EA and P40R.

The 14MHz Band

While the spotlight has been on 28MHz of late months, at least in terms of reports, there can be no doubt that 14MHz is probably the place where the majority of DX is worked.

G2HKU has his regular early morning sessions, on s.s.b., with ZL3FV as he has done for the past two decades or more.

G0JFM (Brixham) offers VE1NQ at full power, then SM0FQW with five watts and a G5RV, plus VE8RCS at the beginning of December, again on full power judging by the reports exchanged.

Damnation by faint praise about sums up **G3NOF**'s (Yeovil) feelings; he made a QSO with FO5LZ in the Marquesas (and doubtless wished he had their climate!) plus G4LJF/V2A—possibly the shortest list Don has ever entered.

That two-transistor receiver of Ron Pearce's found VP5GT, KC3RV, VE3LE, WB9BCL and K4LR.

As far as my rig was concerned, it hardly had an airing all month, thanks in the main to the problems of a sick dog; but I did manage on occasion to raise ZL, and one Sunday afternoon heard and raised GB75DH in short-skip conditions; this station was laying down a very strong signal all over the Midlands and the Wirral from Dunnet Head—so it was of interest to overfly Dunnet Head by TV on Boxing Day and catch a glimpse of the site.

The 21MHz Band

The preferred mode for G2HKU was c.w.; K8CW, K1AR, N3RS, FY5FE, K1ZX, 9Y4VU, plus two-way QRP at five watts with WA2HZR.

Ron Pearce found VK4NPM, K2JFK, K0YWV and W1NED.

Turning to G3NOF's analysis, he found

the morning long path opening quite good between 0803-0930, followed by the short path up until 1300Z. Africans were poor, though a few were heard weakly around 1800. It added up to s.s.b. contacts with AX8AZ, BY4AJT, BY5RT, JA2AEY, JH0FBH/1, KD7MX (Oregon), TA4A, VK2KLU, VP5SL, VP2M/WQ5W, VS6TK/DU1, WB6BPA, WB6YUM, WE0D (South Dakota), ZD8JP, ZF2AG/ZF2 and 4U1VIC. G0JFM offers OY9R and VE3KWT.

QRP it was for G0HGA, who used her c.w. on YU4EGR, as indeed on all her other reported QSOs.

Before taking his dipole down, **GM4SVM** (Stirling) found PY7FNE, a QRP station with five watts to a dipole, UA0CIM, JA5CV, JA3GCM, UL8CWA, CU3GD and ZS6BUD.

G4ITL (Harlow) mentions that his 12AVQ is shortly to go back up and he is even speculating whether he could get verticals fed in phase into his garden.

Finally, G1EMD listened in to ZF2AG/ZF8, VK8AV, DX1DBT and YS1ECB for his pick of the crop.

WARC Bands

Again not much activity reported in these areas. Angie G0HGA gave a new country on the band to EA7FZY for her only QSO on these bands. Alas the rig now in use only covers five bands.

Still with 24MHz, GM4SVM hung up a Zepp for this band and his first call resulted in a young pile-up; KD6EU, K6VV, K4II, N4EJK, W1BFT, NM1C and N9FC all calling together. Interesting ones otherwise were VK5BJW and 8P9HT. Also noted, several DX stations using the band on s.s.b. to pass log details and so on to their QSL Managers.

The 28MHz Band

Ron Pearce listened to s.s.b. signals from K5RE, TA5C, WD8WED, W1CUX, WA4WDG, K1MBX, KP2A and VE2BYR.

I'm a bit puzzled as to what to list, confesses **G0KDZ** (Thirsk). Most people just list what they regard as DX, and everyone's idea of DX is different. Guess it all depends on the degree to which the thrill of ANY contact relates to the thrill of the very first one! Mike used f.m. to raise OX3CS, c.w. for PJ1B, VU2IT, 5H1HK, HZ1HZ, OH4NS/TF, ZZ0F and s.s.b. to hook AP2UR, TU4BR/5U7, HC1OT, HI3ADI, TU2OQ, YX5A and YV5CAX.

Next G3BDQ; WP2BAM, KP2AH, K3IPK/VP5, HL9TF, EL2DK, V21AZL (Antigua), 5B4ES and 8P6OV, all on sideband went into John's log.

A ZL/G calling frequency of 28.7MHz will be implemented when necessary, writes ZL1CCS. The idea is that when conditions are borderline, or when the ZLs have to batter their way through a wall of Ws to make a QSO, at least people will know where to look. The kick-off date will be, all being well, March 1, giving time for the word to get round; already the VKs are aware, and we gather the idea has worked well in the Pacific area in the past. John's own report for the period includes such as TR8SA, GI3YDH, EI6EW, BV2A, BV1QH, TL8KH, FR5DN, 5H3RB, 9Y4DR, ZS4TX, ZS6ABM and ZS6BJH both long-path, PY5EG/PY0F, 8Q7DL, AP2P, 3W8DX, T77C, VS6BL, FH8CB, FP5HL, T28RK, OH0NJ, JY5HH, GJ0KKB, 9J2BO on long-path, HK0HEU, G4LJF/V2A, XE0DX and GU0ELF.

ZB2/GW3NYY on c.w. was the only QSO mentioned by G2HKU on this band.

G3NOF's linear gave up the ghost and at the time of writing, parts were still awaited from USA. However, Don is back on the band; he finds it, naturally enough, not so good as in previous months, although the morning long path opening around 0830Z to VK/ZL/JA was noted, Africans around 0900, VK by short path 1100-1200. The USA stations were noted between noon and 1900, although on some evenings they were about until 2100. G3NOF notes that allowing the Yanks into the 28.3-28.5MHz has meant that where there used to be DX s.s.b. QSOs they are now totally buried under a wall-to-wall carpet of Ws. Be that as it may, Don managed s.s.b. contacts with CM6CG, CO3JA, FJ/K2IBW, HH7PV, JA6WFM/HR2, JX1UG, N6ND, N6SFV, NP4CC, NQ6X/SV5, NT7C (Nevada), NZ7E (Nevada), P40ZZ, UA0ABK, VE4ACN, VO2AP, VP2M/WB3FSB, W5RRR (Houston Space Center), W0ACD (S. Dakota), W0YK (Colorado), WA9YHW/HR6 (Roatan Is), ZD8JR, ZS6HO, 3W8DX, 5V7WD and 9Q5NW.

Now we turn to **G0JBA** (Sittingbourne), who bewails the fact that he seems to be out of luck on this band; first there was a ZL on a quiet band, but just as soon as Phil called him, so did the rest of the world and their wives, something which also happened with 3W8DX. However, c.w. did get out to CN2AQ, G4LJF/V2A, IT9FQF, KA1DMO, KA2YZW, K5WFL, KI6GV, LZ1KXA, N0BZM, N3AD, N4IIC, NP2CM, OX3SG (QSL via LA5NM), P40V (Aruba), RW3AH, SZ2COT for an SV "special", TA3C, VE3HFG, VP2ET (Anguilla), W3LPL, WQ4J, WA6PBJ, W7MVF, WA8HSV, and 8P9XJ; while on f.m., Phil made it to KC3VO, LZ1UH, N3BRY, OH8MBN and PT7AQ.

Now G0JFM, who managed VE1BQU (c.w.), VE1XG, TV6GIR (Patiros Is), NB1V, JY7HH, XE1IQZ, KU1G, W200AA and VK4BFO.

Angela (G0HGA) is now using a Century 21. Her ten watts input or less on 28MHz noted W6OV, WL7AEC, K6OU, K3EI, W2LZX, K2AGJ, KJ0B, W9SFU, WA2SON, W4BC, W2SDJ/4, K8JL, 4N3D, UB5BZ, KQ3V, KV1E, OH2BDA, YU7IBF, SM2BJE, OH6PJ, DK3KD/CT3, RA3QL, LZ2MC, I8FXT, RA4AR and UB5RG.

Polar!

The Polar Unsupported Expedition for 1989; Laurence GM4DMA and Morag GM1ILL are off to Canada again to Ward Hunt Island at the beginning of March. They have jacked up the power to 120 watts on 6m, and will have two skywires; rhombics for the link back to UK, and dipoles laid on the ice for the high-angle signal required to work the field party. The latter will have PRC319 military manpack sets having up to 50 watts p.e.p. in the 2-40MHz range. For last year's efforts, GM4DMA says he would like to publicly thank the chaps at 81 Signals Unit, RAF Bampton for all their help in maintaining links under poor conditions, and also the British Telecom group at Portishead Radio. For the record, their frequencies will be around 14.345, 28.885, 50.110, 144.123, with satellite and all other bands available to them. Calls will be GM1ILL/VE8 (Morag) and GM4DMA/VE8 (Laurence).

The next three deadlines are Feb 27, Mar 29 and Apr 26

VHF Up

Reports to Norman Fitch G3FPK 40 Eskdale Gardens, Purley, Surrey CR2 1EZ

With an earlier than usual deadline for December reports, it was almost inevitable that the more interesting events would occur later in the month. This is just what happened with at least half a dozen 50MHz openings occurring to the Caribbean, North and Central America plus reception of beacon FY7THF in South America.

144MHz Tropo DX — Feedback

After the memorable tropospheric opening between the British Isles and the Canary Islands on Sept 9/10 last year, there were rumours of EA8 to LA QSOs. I have received a letter from **Egil Johannessen LA8OJ** from Sandnes in which he says, "To my knowledge we had no tropo in Sept 9/10 . . ." So it seems that the GM0KAE/EA8BML contact on 9.9.88 is the current IARU Region 1 record at 3264km.

But, Egil did work EA8BEX on 144MHz via Sporadic-E on 31.7.88, as did LA1YCA, so that is probably how this rumour arose. The QRB of 3803km is not far short of a Region 1 record for the mode; I recall a Portugal to Lebanon Es QSO some years ago over a slightly greater distance.

Polar Expedition Report

Laurence Howell GM4DMA has sent a progress report on the preparations for this year's "Polar Trek 89" expedition, initial details of which were included in the January issue. All the communications equipment has been environmentally tested by partial immersion in liquid nitrogen.

The team, which includes his wife **Morag GM1ILL**, is due to depart for Canada on Feb 20 with arrival on Ward Hunt Island (FR23WB) scheduled for March 3. The callsigns will be GM4DMA/VE8 and GM1ILL/VE8. The v.h.f. frequencies will be 144.123MHz and 50.110MHz. The cross-band liaison frequency for 50MHz will be 28.885MHz and they will monitor the European v.h.f. net on 14.345MHz. Operation on other h.f. bands and via satellites is also planned.

The team leader is Sir Ranulph Fiennes, with Captain Oliver Shepard and Dr. Mike Stroud, the team's doctor. Laurence and Morag will stay at the base camp on Ward Hunt Island maintaining communications links with the outside world and carrying out numerous scientific tasks.

The goal of the expedition is to achieve an unsupported walk of about 450 miles to the Geographic North Pole by at least two people. Laurence and Morag will be in contact with the walkers on various radio frequencies throughout the expedition. Last year, atrocious weather defeated them so we all wish them success this year.

Awards News

Congratulations to **Gerald Nenner DL8FBD** from Rodgau (EK75f) who was awarded his "275" sticker for 144MHz QTH Squares Century Club certificate number 39 on 22 Dec 1988. 29 cards were submitted bringing his confirmed total to 280. 15 QSOs were via Es, 13 on m.s. mode and only one by tropo. 18 contacts were on c.w. the rest on s.s.b. The Es opening on 8.7.86 brought QSLs from UA3s in QP, RR, SN, SP, TP and UR squares. One on 10.7.87 provided confirmations from QN, SM and SO.

Any reader wanting details of the QTHCC and the VHF Century Club rules should send an s.a.e. to the Purley address. An IRC from overseas readers would be appreciated.

Repeater Notes

Alex Scott GM0HNX, Secretary of the Scottish Borders Repeater Group, has advised that the u.h.f. repeater GB3HK commenced operation from a new site near Hawick (BDS) on 20.11.88. It is on channel RB14. The Group is also responsible for GB3BT and GB3SB and would welcome donations for the upkeep and running of these relays. GM0FGJ (QTHR) is the person to contact.

The 50MHz Band

With the solar flux exceeding 250 on some days, December produced some excellent F2 openings on the band. Several new countries were worked from the British Isles so there is a number of "firsts" to record.

DL8FBD, in common with all German radio amateurs, does not have permission to transmit on 50MHz but Gerald does a lot of cross-band work which has resulted in QSOs with over 250 stations in 1988. He has contacted 12 countries but no Ws or VEs up to mid-December.

Mike Gotch G0IMG (ESX) was very pleased to work VP5D in the Turks and Caicos Islands on Nov 30 for an all-time new country, along with VE1YX (FN74) in Nova Scotia, to bring his 1988 countries total to 17.

Bob Nixon G1KDF (LNH) caught the opening on Dec 20. Between 1330 and 1745 he worked VE1YX and VE1ZZ (FN74), K1JRW (FN32), K2BWR (FM29), W3EP (FN31), W2IDZ (FN20), W1IMM (FN42), WB8VYF and WA8LXJ (EM79) and KA2GOJ (FN02). Four new squares and one more state with K5VGE and K9HMB (EN52) heard.

Clyde Hinton G1TCH (SXW) is a new contributor who will be entering the tables this year. On Dec 20 he worked VE1YX at 1347, OH1VR/2 and OH2TI an hour later, and about 1700 he heard two Ws, one in Illinois. The next day he contacted VE1YX again at 1319, then from 1455 made QSOs with K1RZ (FM19), N1EFM (FN55), K3CAV (FN10), K2QWD (FN13), W2IVZ (FN20), WC2K (FM29) and WB2IFC (FM27).

At 1310 on Dec 22 Clyde worked P43AS (FK52) on Aruba Is, a QRB of just over 7500km. The band opened again the next day to the USA and from 1606 he contacted WA1OUB (FN43), WA1DOH (FN31), WB8IGY (Ohio), WA1HLR (FN54) and N1EFM again. Reports were exchanged with W9IP but at 1623, while working KA2GOJ, the signals faded out.

Mike Devereux G3SED (HPH) sent in two reports, the first covering the Nov 30 event. At 1350 he heard HC2FG when GB3SIX was S9 on back-scatter at a beam heading of 240°. At 1359 FY7THF was S9 and at 1436 he contacted VP5D who was very loud. QSOs with VE1YX and K1JRW followed with WA5HNK (EL29) heard at 1450. PA0HIP and GW4LXO were worked by back-scatter and at 1520 he heard G4JCC work P43AS. In the evening at 1845 the Maltese beacon 9H1SIX appeared and QSOs ensued with 9H1s EL and BT before the band went dead at 1945.

In his second report Mike remarked that December was quite a month on the band with long DX openings recorded on 16 days. In summary to VE1 at 1415 on the 7th and at around 1330 on the 8th and 9th. On the 11th from 1740 to VE2BKL, VE2DFO, VE2EFL, WA1OUB and VE1YX. On the 13th J52US appeared from Guinea-Bissau and contacted SZ2DH, G3s JVL, WQY and COJ, G4s UPS, GLT, JCC and BAO, GJ4ICD, GW4LXO and PA3EUI.

In the Geminids shower on the 13th G3SED worked GM8MBP, PA0RDY and PA3DOL from 2355. The 14th brought VE1YX again at 1340 and 9H1SIX was heard from 1600 for an hour but with no 9H1s active. On the 20th some OHs were worked by G4JCC and around 1600 W9OEH worked Mike and seven other Gs.

Calls mentioned on Dec 21 from 1315 were VE1YX, HC1BI, K1JRW, HC5K, KP2A and K1IKN, and from 1730, WC2K, VE1YX, KM1E and VE1ZZ. The next day from 1250, KP2A, WP4G, KP4EKG and P43AS. At 1540 ZD8MB worked G4IJE and others. On the 23rd HC1BI, K1TOL, WA1TRE and VE1YX were worked. G4CVI (HPH) worked eleven assorted stations in W1, W2, W3, W8 and VE3.

On Christmas Eve Mike lists HC5K at 1245, J52US at 1425 and from 1518 to 1616 Ws in the 1, 2, 8 and 9 call areas. On Christmas Day at 1136, PZ1AP and from 1401 HC5K, TI2HL, KP4EIT, KP2A, WA1OUB and WB4OSN up to 1630. The 5B4CY beacon was heard at S5 from 0920 on the 27th for 20 minutes. More W1s and W4WHK were around from 1515 on the 28th and beacon ZD8VHF was audible from 1621 for several minutes. The J52US keyer was heard for over half an hour from 1550 on the 29th and on the 30th, FY7THF was copied from 1140 to 1235, peaking S9. Finally he lists K9OEH at 1600. Thanks for most comprehensive reports, Mike.

Writing on Dec 7, **John Palfrey G4XEN** (NHM) wonders how some readers can work 20 countries on the band. He asks if they have included contacts with stations in countries where amateurs are not officially licensed and/or cross-band QSOs. On Nov 2 he heard the Irish TV carrier on 53.757MHz which is ". . . a superb auroral beacon." The only station worked was GM0ATQ.

Regarding the number of "legal" countries reported as worked in 1988 from the British Isles, I have looked through all your reports and find it to be 39, including those mentioned in this issue.

Ela Martyr G6HKM (ESX) did not work anything exciting on the band up to Dec 18 but did hear VE1YX at 1340 on the 9th, and a few Ws as well on the 11th. She thinks that stations in her part of the country were not being heard in North America.

Bill Biltcliffe G6NB (OFE) wrote to say

Annual v.h.f./u.h.f. table
January to December 1988

Station	50MHz		70MHz		144MHz		430MHz		1296MHz		Total Points
	Counties	Countries	Counties	Countries	Counties	Countries	Counties	Countries	Counties	Countries	
G1KDF	39	17	—	—	93	22	67	12	38	7	295
G4XEN	50	16	39	5	73	35	55	15	—	—	288
G6HKM	47	15	—	—	78	28	54	19	31	15	287
G1SWH	59	20	—	—	95	20	55	9	—	—	258
G8LHT	38	8	33	5	67	32	48	17	6	2	236
G1LSB	37	12	—	—	71	25	55	19	—	—	219
G4SEU	35	13	67	9	48	11	29	4	—	—	216
G0IMG	49	17	36	6	50	12	26	5	—	—	201
GM0EWX	57	20	—	—	58	24	7	3	—	—	169
G4DEZ	33	16	—	—	30	16	27	6	34	10	162
G6MXL	27	9	19	4	43	18	20	9	9	3	161
G4VOZ	28	14	60	8	—	—	35	8	—	—	153
GW6VZW	50	16	—	—	70	17	—	—	—	—	153
G1IMM	35	11	—	—	56	12	31	7	—	—	152
G0EHV	—	—	50	7	68	23	—	—	—	—	148
G6NB	47	19	—	—	54	15	7	5	—	—	147
ON1CAK	—	—	—	—	72	34	23	15	—	—	144
G1EZF	—	—	30	5	76	33	—	—	—	—	144
GM0HBK	48	13	—	—	54	22	—	—	—	—	137
G4YCD	12	9	—	—	84	30	—	—	—	—	135
GJ6TMM	30	15	—	—	44	21	10	11	—	—	131
ON1CDQ	—	—	—	—	66	34	16	15	—	—	131
G8PYP	22	9	2	1	51	17	10	2	—	—	114
GI4OWA	19	18	—	—	58	16	—	—	—	—	111
G8XTJ	34	5	—	—	58	14	—	—	—	—	111
G4ARI	—	—	33	4	60	13	—	—	—	—	110
G4ZEC	—	—	—	—	78	29	—	—	—	—	107
GW4HBK	22	18	51	7	—	—	3	2	—	—	103
G3FPK	—	—	—	—	80	22	—	—	—	—	102
GW4FRX	—	—	—	—	71	30	—	—	—	—	101
G7ANV	—	—	—	—	75	26	—	—	—	—	101
G6MGL	19	10	—	—	49	10	—	—	4	2	94
G1SMD	21	17	—	—	25	18	—	—	—	—	81
G4AGQ	—	—	15	2	38	8	12	4	—	—	79
G2DHV	5	1	22	2	32	6	8	2	—	—	78
G1DOX	16	2	19	2	22	5	5	2	2	1	76
G1CEI	—	—	—	—	59	12	—	—	—	—	71
G4WHZ	6	4	—	—	33	19	—	—	6	2	70
G3NAQ	—	—	60	8	—	—	—	—	—	—	68
G4WND	—	—	60	7	—	—	—	—	—	—	67
G3EKP	12	3	16	4	7	4	5	1	—	—	52
GU4HUY	—	—	—	—	35	16	—	—	—	—	51
GM0JOL	—	—	—	—	30	11	—	—	—	—	41
G4ZVS	—	—	—	—	34	5	—	—	—	—	39
G0HGA	—	—	—	—	31	6	—	—	—	—	37
G0HDZ	—	—	—	—	30	5	—	—	—	—	35
GM1ZVJ	4	3	—	—	14	7	—	—	—	—	28
G8PNN	—	—	21	3	—	—	—	—	—	—	24

he was not the first G to work Nigeria, after all. He has since learned that G3NOH and G3SED contacted G3GJQ/5N28 at around 1310 on Oct 22. He mentions J52US running QRP and working four W1s on Dec 11 prior to installing an amplifier.

Julie Yates G8MKD (WMD) uses 25W to a 2-ele HB9CV antenna in the loft. On Dec 11 at 1750 she managed a QSO with KA1PE (FN53) in Maine and heard VE1YX, K1TOL, W3HQT and others. **Steve Damon G8PYP** (DOR) decided to swap his 50MHz antenna for a 430MHz one while making adjustments to the matching arrangement. He confesses, "I shot myself through the foot by not being QRV on the band during the recent F-layer openings. Murphy's Law, I suppose!"

Gerard Elliott GI4OWA (LDR) was fortunate to catch the Nov 30 opening in his lunch break. He heard G4ASR and G4IJE working HC2FG but the Ecuador station was not audible in Londonderry. On Dec 11 between 1755 and 1812 he worked K1JRW, VE3RM (FN25) for a new country, VE1YX, K1GPJ (FN44), K1TOL (FN53) and W2CAP/1 (FN41). Best DX heard was Michigan.

Geoff Brown GJ4ICD has bought a Sony PRO80 scanning receiver which covers 150kHz to 108MHz continuously on s.s.b., a.m. and f.m. On Dec 7 he heard the Jamaica Water Company on 44.265MHz and the m.u.f. just reached 50MHz that day and the next. On the 9th he worked WA1OUB at 1416. VE2DFO was heard at 1749 on the 11th and ZD8MB at 2128 the next day. At 1616 on the 13th, Geoff completed the first GJ/J5 QSO when he worked J52US at RST589.

From 1645 on the 13th the band was open from Jersey to North America but they were not working any Gs. He contacted W2DEW, W2RTW, K1IKN, WA1OUB, VE1YX who was S9+40dB, VE1BNN, K2QWD, W2MPK, K1GPJ, the last station worked being WA1OUB again at 1713.

Calum MacPherson GM0EWX (HLD) sent two letters the first covering the Dec 11 opening in which he worked 38 Ws and four VEs from 1730 at the rate of one per minute; real contest stuff. All were in FN field in squares 11, 13, 25, 30, 31, 41, 42, 44, 53, 54, 74, and 84, and most were S9+ in strength.

On returning from work at 1532 on Dec 21, he again found the band wide open and worked 30 stations in North America at one per minute. At 1752 he contacted F5QT (JN02) and heard FC1BGF, via Es he wonders? On the 22nd FY7THF was heard at 1207 and at 1216 many Gs were heard calling/working P43AS. Through static from hailstones Calum finally contacted the P4 at 1229 and then worked KP4EOR (FK78) — his first GM — WP4G (FK68), HC5K, KB4CRT (EL87), HC2FG (FI07), HC1BI (FI09) and KP2A.

GM0HNX is the new call of GM8BDS who was a regular correspondent for many years when he lived in Duns. His new QTH is Coldstream in Berwickshire from which he operates on the band using c.w. and s.s.b. using a dipole antenna.

Finally to Wales and **John Baker GW3MHW** who worked VE1YX at 1336 on Dec 20. He reports strong solar noise and TV "sprogs" at about 120° bearing. At 1254 on the 21st he worked HC1BI on s.s.b. followed by HC2FG, VE1YX, VE1ZZ, K1IKN, KP2A, HC5K, VE1APA and 39 others in the USA. The 22nd brought another two new countries, P43AS and WP4G in Puerto Rico at about 1240.

On Dec 23 John worked WA1OUB, VE1YX, K1JRW, W3JO, WC2K and K1TOL in a 20 minute period from 1340. On the 24th, FY7THF was copied at S5 for about half an hour from 1134 and was audible again on Christmas Day for over an hour from 1130. At 1229 he contacted PZ1AP on s.s.b. for country number 32. Stations heard around 1500 included CO2KK, TI2HL, KP2A and KP4EIT. At 1320 on the 26th KP2A was heard calling CQ on 50.095MHz c.w. The m.u.f. was up to 49MHz on Dec 27.

QTH Locator Squares Table

Station	Band (MHz) 1296	430	144	Total
G8GXP	45	151	331	527
G3XDY	86	138	191	415
G3JXN	87	134	179	400
G1LSB	—	133	150	283
G3UVR	79	129	239	447
G3IMV	48	124	410	582
G4KUX	—	120	372	492
GJ4ICD	59	119	253	431
G4RGK	48	115	274	437
G0DAZ	—	114	249	363
G6DER	78	110	183	371
G4TIF	—	110	200	310
G8HHI	38	110	148	296
G4XEN	—	109	270	379
G6HKM	44	105	191	340
G3COJ	44	103	186	333
G1KDF	37	99	170	306
G8PNN	63	98	128	289
G1EZF	32	93	263	388
G4SSO	—	93	229	322
G8ATK	45	91	143	279
G4MUT	28	90	149	267
G6MGL	59	89	141	289
G6DZH	—	87	154	241
G1EGC	23	80	198	302
G3NAQ	—	80	175	255
G8LHT	4	80	146	230
G0EHV	—	75	146	221
G6STI	24	69	130	223
G1GEY	—	68	158	226
G4RRA	—	62	254	316
G6AJE	5	57	95	157
EI5FK	—	56	172	228
G0EVT	—	49	177	226
G8MKD	—	49	145	194
GJ6TMM	—	46	150	196
G6MXL	15	42	91	148
G4AGQ	1	41	104	146
G4DEZ	48	37	248	333
ON1CAK	—	33	204	237
ON1CDQ	—	32	182	214
G4ZTR	29	29	37	95
G0FEH	—	24	88	112
G1VTR	—	23	32	55
G1WPF	—	22	93	115
GM0GDL	—	20	73	93
G1IMM	—	17	98	115
G2DHV	2	7	33	42
G8PYP	—	7	65	72
GW6VZW	—	6	123	129
G4PCS	—	3	258	261
G4DHF	—	—	307	307
G4SWX	—	—	293	293
DL8FBD	—	—	280	280
G4IGO	—	—	238	238
G3FPK	—	—	233	233
G4MEJ	—	—	213	213
G8LFB	—	—	209	209
GW4FRX	—	—	203	203
G4YCD	—	—	197	197
G4DOL	—	—	186	186
GI1JUS	—	—	181	181
G7ANV	—	—	131	131
G4TGK	—	—	118	118
G8XTJ	—	—	110	110
GM0HBK	—	—	107	107
GI4OWA	—	—	103	103
G1SMD	—	—	93	93
G4WHZ	7	—	76	83
GU4HUY	—	—	73	73
G0HEE	—	—	73	73
G1CRH	—	—	62	62
G0HDZ	—	—	61	61
G1NVB	—	—	58	58
G7AHQ	—	—	34	34
GM0JOL	—	—	32	32
GM1ZVJ	—	—	22	22

Starting date 1 January 1975.
No satellite or repeater QSOs.
"Band of the month" 430MHz

The 70MHz Band

Ian Cornes G4OUT (SFD) has bought a Microwave Modules transverter and has been on 70MHz since early December. Power output is about 8W and the antenna an HB9CV in the loft, initially. He took part in the Dec 11 contest and on c.w. contacted EI9FK/P, GW4MGR/P and a dozen G stations. On the 15th, c.w. brought G0HUM/A, the next day G4LTK and G4VOZ.

John Jennings G4VOZ (LEC) operated G8LM in the contest, best DX being EI9FK/P. He worked 14 stations but the portables were not sending high serial numbers at the end. He achieved his goal of getting at least 100 stations on the band on c.w. in 1988.

One of the new stations G4VOZ worked was **Geoff Grayer G3NAQ** (BRK) and Geoff told me he started operating on 9.6.88 running 100W to an HB9CV antenna. Without too much effort he had worked 60 counties and eight countries in 30 squares up to just before Christmas. His QTH is quite good for v.h.f. at about 200m a.s.l., which does help a lot.

GW3MHW has had TX trouble due to a failed valve rectifier which feeds the 350V supply to the driver stage. His p.a. stage is a pair of 35T valves, by the way. John reckons that G3NAQ is the best signal on the band these days. **Dave Lewis GW4HBK** (GWT) reports his best contest DX was EI9FK/P near Bray (WKW). He remarks that, "Activity was reasonable and operating standards good; a very relaxing contest."

The 144MHz Band

Eddi Ramm DK3UZ (EN20c) used to write and telephone fairly often in the past, so I was pleased to receive a list from him covering m.s. activity up to the end of October 1988. He completed contacts with many of last year's expeditions to rare squares. From his long list I see OH9NDD and OH9NLO (MA39e) on Jul 8; OH9/SM6CMU (MC) and OH9NDD/6 (MX60g) on 26th; 3A/DL8LAQ (DD28a) on 27th; IA5/DL8LAQ (ED80f) on 29th; LA/DL4EA in FY, GY, FZ and GZ between Sept 1 and 6 and EA6/DF5GX in CA, BA and CZ between Sept 20 and 27. Eddi did not include a letter and did not mention his present squares total.

Way back in November c.w. contest, G0DJA worked 17 stations and hopes that one of them, GM4YXI, will QSL. Two GMs worked in the 1987 event did not. **Angela Sitton G0HGA** (HFD) just sent the latest c.w. ladder score for December and 219 stations is very good for her station and antenna situation.

Peter O'Dowd G0HLT (NOT) wrote briefly to update his ladder totals but did not anticipate many more contacts due to unsocial shift working. **John Hunter G3IMV** (BKS) had an m.s. sked with a Russian in QQ square in the December Geminids but heard nothing. However he

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did complete in 45 minutes on Dec 13 with SP9KUR/9 in KK square to bring his tally to 410.

Ron Wilson G4NZU (NOT) has not written for ages but has now put in an eleventh hour entry for the c.w. ladder which places him second. However, I am puzzled by your reference to a shortfall, Ron, and wonder if you have got your 144MHz figure right? He mentions an Aurora on Dec 17 at 2200 when two GMs, OZ4VV and an LA were heard but nothing worked.

After listening to the RSGB News Bulletin on Dec 11, G6HKM discovered FC1ADT (ZE) calling CQ and had a QSO with Pierre. Then Ela found a clear freguency, called CQ, and spent the morning working Fs; F6DRO (AD), F6HZL (ZD), F6IPG (YH), F6CCH (ZG), FC1BUU (ZE), FA1MQM (BF), F6BZA/P (AF) and F6FSK (AE), a square not yet confirmed. Next she was called by HB9MY (EH) and HB9RDE (DH). At 1259 HB9SLU was heard calling CQ while Ela was beaming north-west so she turned to the south-east and exchanged S9 reports with Ben. Very few people seemed to be about, though.

G6NB has ended the year from his new Bicester QTH with a satisfactory score. Bill is using a 5-ele Yagi on this band at 9m a.g.l. and expects to improve things this year. G8PYP heard U2MIR on 145.55MHz f.m. from MIR spacecraft at 1943 on Nov 22. Apart from that novelty, Steve only mentions GD4IOM on Dec 4 for a new square, county and country.

GI4OWA enjoyed an excellent day's tropo operation on Dec 10 to southern England and France, which, ". . . made up for an otherwise mediocre month." Gerard lists G1THD (BKS), G1JAF (HPH), G8PZH (IOW), G1RER and G1ECY (LDN), G0JFM (DVN), G4TRA (WLT), G1VGJ (SXE), G1LRS (SRY), G0EMH (GLR) and G1BTU (KNT). The French QSOs were in the late evening with F6GIF, FC1HDI and FC1DME all in BI square.

Now the Scottish scene starting with **Colin Robertson GM0HBK** (HLD) who has moved his shack back indoors for the winter and is only QRV on 144MHz at present. On Nov 30 in an Ar he worked SM6SKY (GS) at 1457 on s.s.b. and Y22ME (HM) on c.w. at 1527. Another Ar on Dec 2 brought GM4IPK (ZT) on s.s.b. at 1437 with GB3LER quite strong but no other stations heard. On the 12th he completed an m.s. QSO on s.s.b with F6DRO in 20 minutes but it was his only success in what he thought was a poor Geminids shower.

In another Ar on the 16th Colin heard SK3LH (JX) and SM5DCX (IT) on c.w. at 1545 but could not work them. He did get OZ2ST (EP) on c.w. at 1748 though. There was yet another Ar the next day in which he worked OZ4VV (EQ) on c.w. at 2232.

GM0HNX operates on the band using s.s.b. and f.m. with some c.w. Alex's antennas are a 9-ele Yagi at 6.1m and a collinear at 7.6m a.g.l. **John Lincoln GM0JOL** (HLD) has been off the air for some while with transceiver problems, hopefully now cured.

John Hilton GM1ZVJ (LTH) is currently still using his Yaesu FT-290R at 2.5W with a 10-ele lightweight Jaybeam Yagi. His plans for this year include passing the Morse test, commissioning a 100W amplifier and installing a pair of 19-ele Yagis.

K. P. Crocker GW1ZSE (GNW) is a relative newcomer to the hobby. He describes his QTH as terrible for v.h.f. so plans a fair bit of portable operation from

Annual c.w. ladder

Station	Band (MHz) 50	70	144	430	Points
G4ZEC	—	—	763	—	763
G4NZU	7	17	291	—	315
G4XEN	42	26	221	11	300
G4OUT	—	15	277	—	292
G0HGA	—	—	219	—	219
G4AGQ	—	37	167	12	216
G0HLT	14	—	195	—	209
PA3FAQ	—	—	199	—	199
G4WHZ	21	—	157	—	178
G4VOZ	31	102	—	23	156
G0DJA	12	—	107	—	119
G0HEE	—	—	111	—	111
G4ARI	—	29	80	—	109
G2DHV	10	37	45	4	96
G4ZVS	—	—	80	—	80
G3FPK	—	—	70	—	70
GU4HUY	—	—	59	—	59
GW4HBK	21	33	—	—	54
G0GKN	—	—	52	—	52
G1SMD	21	—	15	—	36
G6DIF	2	—	30	—	32
G1DOX	3	5	—	—	8

Number of different stations worked since January 1

290R Mk 2 and a 5-ele ZL-Special on a 3m sectional mast. He asked about DX warning nets but I do not think there are any "official" ones these days. He also wondered if -/P QSOs could be included in Annual Table scores but the answer is, "No."

John Nelson GW4FRX (PWS) had a few delays in installing his four 18-ele Yagis but at the end of the year they were all securely on the frame on the tower, ready for final "tweaking." He is using LDF5-50 cable between the shack and the tower and the measured loss at 144MHz is a mere 0.8dB. John figures that these four Cushcraft beams will give about 5dB improvement over the two 17-ele Tonna Yagis they have replaced and that he should hear his own echoes off the moon in average conditions.

At G3FPK in December, I found GM4TMS (CTR) for a new region in the Dec 4 contest. On the 10th the propagation to Ireland was good and I contacted EI9FD in Navan (MTH) for the 80th county in 1988. On the 16th GM0EXN passed on an Ar warning via G4BIO at 1430 but in the limited time available, I did not find any Ar signals at my latitude.

On Christmas Day morning our 14MHz net with ZL stations was joined by **John Eden GM0EXN** using his special event call GB75DH from Dunnet Head (HDL). I discovered an Aurora at 1705 and was delighted to contact him again on s.s.b. on 144MHz. He has his antenna fixed at 035° until he can rearrange things and install a rotator at the bottom of the pole.

The event was quite good but the activity was understandably low. The only others worked from ZL60j were GM1SZF (HLD) on s.s.b. and GM4ILS (GRN) on c.w. Ron now has a crank-up tower with his v.h.f. antenna above an h.f. tri-band beam. Best QTE for me was 15° and the GMs were beaming at about 50°

The 430MHz Band

G4VOZ found the Cumulatives sessions last October to December quite useful in accumulating table points and 23 on c.w. is not bad. G6HKM's activity was confined to the last two sessions of the Cumulatives on Nov 23 and Dec 9. Ela made 53 and 43 QSOs respectively which appear to be

G8PYP mentions working a few new counties and a new square in the Dec 9 leg of the Cumulatives. GM0HNX operates on the band using f.m. and Alex's antenna is a collinear at 5m a.g.l. GW4HBK is now QRV on the band. Dave's gear comprises a Microwave Modules transverter, 10W through 25m of low-loss cable to a 19-ele Yagi. Best DX up to Dec 10 from Pontllanfraith was the West Midlands.

The Microwave Bands

G0DJA reports that a number of stations from the Midlands area have been active on the first Sundays of the winter months. In November Tim Lloyd G6UED went to The Wrekin, Phil Pedley G1RLR and Sven Vaiciunas G1MUW were on Barr Beacon and Dave went to Lickey Hill. In December G6UED, G1RLR and Geoff Reid G6UEU operated from Barr Beacon while G0DJA travelled to Burton Dassett, just north of Banbury. The 57km path was easily achieved, presumably on 10GHz.

G6HKM took part in the Dec 1 leg of the 1.3GHz Cumulatives and made 15 QSOs However, Ela was unable to come on for the final session on the 17th. GW1ZSE intends to be on 1.3GHz soon using a transverter by Piper Communications.

Amstrad Computer Programs

In the November 1988 issue I mentioned the Amstrad printer's annoying habit of printing a £ sign instead of the # you actually type in the program. A letter from **Brian Farrelly G4MLE,** currently living in Norway where he uses the call LA0DG, drew my attention to resetting the default parameters of the printer by the use of Escape Codes.

He referred to an article by Pete Gerrard in the *Amstrad PCW Magazine* for June 1988 which dealt with the topic and included a short program to illustrate the effects of several different ESC routines. To get the # to print correctly you have to change the language from the default setting of 3 (UK) to Ø (USA). This is effected by including the line:

LPRINT CHR$(27)+"R"+CHR$(Ø);

Note that if you boot up the CP/M disc and type in **LANGUAGE Ø** you will still get £ instead of # printed.

Another problem is that the monitor screen is 90 columns wide but the printer only does 80 columns in pica type. To reset the printer to 90 columns you should add the following line:

WIDTH LPRINT 90

and to change to elite type you should add:

LPRINT CHR$(27)+"M";

If you prefer the zero Ø with the slash add:

LPRINT CHR$(27)+"X";

The default setting is for draft quality printing which is usually adequate. However, if you need high quality for printing out a program list you can achieve this by adding another line:

LPRINT CHR$(27)+"x"+CHR$(1);

Be careful to use the lower case letter "x" in this line. Instead of typing **CHR$(27)** each time, you can begin with **es$=CHR$(27)** and use **es$** thereafter. All the control code lines are best entered early on in a program where you define PI, for instance.

All this, and much more, is covered in

Further control of the printer, in pages 121–135. I have incorporated these and other printer control codes in my programs for the PCW-series computers.

I have added to the collection a database program called PCW-INDEX which was included in a book that I borrowed from the local public library. You can create files for anything to do with amateur radio, such as WAB records. Each record can accommodate up to eight fields which may be used for callsign, name, date worked, county, area, etc. I am currently transferring the QTHCC records to it in spare moments.

The main disadvantage is that it takes several minutes to sort out more than about 40–50 records as it is not in machine code. So the answer is to create a number of small files rather than one large one with hundreds of records. For example, I have separate names, addresses and telephone numbers files for amateur radio, relatives, business and so on.

Several readers now have copies of the various programs. Some have offered programs as well so it is becoming a two-way process. This is all to the good as there is so much to learn about programming. It is worth looking carefully through other people's programs as you sometimes discover a time-saving ruse that may not be obvious from the manuals. For example, when entering a program on the keyboard you do not need to type the word **PRINT**, just press the ? key instead. When you call up **LIST** later on it will have become the word **PRINT**.

The next three deadlines are Feb 27, Mar 29 and Apr 26

Sign Off

These words are being written at the very end of 1988 so I would like to thank all of you who have helped make compiling *VHF Up* such a pleasant task, for your Christmas cards and for your wishes for 1989. In my bones I feel that this year will be a good one for DX on the v.h.f. bands and that 50MHz will continue to surprise and delight us.

RTTY

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

ANATS Contest Results

John Barber G4SKA recently sent me a copy of the results for this Australian international contest. The single operator section was won by VK5RY with an impressive 8 371 668 points which was nearly 2 000 000 more than his nearest rival IK5CKL with 6 407 250 points.

The highest placed UK station in this section was G0ARF who achieved a creditable fourteenth place with 1 709 260 points. Other UK amateurs in the top thirty were G0ATX nineteenth and G0AZT/W6 in twenty-sixth place.

Moving on to the multi-operator section, this was won by VU2JX with 8 461 440 points with John Barber's team (G4SKA) managing a very good sixth place with 2 099 440 points.

In the short wave listener section we had a very good UK win by G1DPL, scoring 1 584 880 points which was particularly good as it was his first attempt at this contest. Perhaps this will inspire a few more amateurs and short wave listeners to try their hand at contest operating.

Readers' Letters

Mr R. Selmes recently sent some FAX pictures to the editorial office which were intended for this column. Unfortunately I haven't received them yet, but hopefully they will turn up soon so my apologies for that. This does conveniently raise the point that all material for inclusion in the column **must** be sent to the address at the head of the column or delays are bound to occur.

John Pyle has sent me a very useful set of FAX pictures which were received on 1.1.89. If I remembered to send it with the column you should find an excellent example of a FAX contact between DJ3JN and G3GAW. The equipment in use at John's station comprises a Lowe HF-125 receiver fed by a 25m long wire. The FAX decoder is the FAX-1 from ICS Electronics and the printer is a Citizen 120-D. My thanks to John for his contribution.

Scouting and Radio Amateurs

I'm sure many of you have been involved in the occasional JOTA (Jamboree On The Air)—which in my experience seems to be met with rather varied success. One of the main reasons for this lack of success is due to the fact that in a lot of cases JOTA is organised as a one-off event and a lot of the scouts and cubs don't appreciate the potential of the medium. Looking through the many messages on the local packet mailboxes, I see that there is now a list of radio amateurs who are involved in the Scouting movement being produced. The object of this list appears to be to provide some continuity and co-ordination to the amateur radio/scouting activities which seems to be a very good idea.

Personally I have been involved in several JOTA events and on a more regular basis the Brownie and Guides Thinking Day of the Air. What's this got to do with the data modes I hear you ask. Well, in my own experience I have found that the use of RTTY, AMTOR and to a lesser extent packet are very popular with scouts and guides. It seems to be less nerve racking for them to prepare a message using a type ahead buffer than to speak live on 'phone. Once the ice has been broken on the first contact they very often become quite chatty and thoroughly enjoy composing the greetings messages. So if you hear any of these stations on the air, spare them a few minutes and perhaps you'll interest another youngster in this hobby.

Back to the operator list. If you are involved in scouting and would like to be registered, the people to contact are G6NDS (QTHR) or you can use the packet mailbox system to send your details to G8WPU at GB7AAA. The details required are: Name, Address (including postcode), Telephone Number, Callsign/RS number, Scout Group, Scout Appointment, JOTA Callsign and your local BBS callsign.

ARRL RTTY Round-Up

How many entered this popular contest which has recently been extended to include packet operation? Unfortunately, this column had to be prepared just before the contest so I am unable to include any reports this month. One point I would like to discuss though is the idea of packet contests. There is a lot of discussion among UK data enthusiasts as to the future of v.h.f. contests. From recent results it would seem that RTTY has all but disappeared from the v.h.f. bands and competition entries are very low indeed. One suggestion is to widen the contest rules to allow packet operation, as this is where most of the v.h.f. data operators seem to be. This would certainly be useful experience for a lot of amateurs and is the best way I know for sharpening-up operating procedures and really testing your equipment.

In order to be really effective, I think operators would have to use f.s.k. rather than the more common a.f.s.k. on f.m. A top quality station would also need some very effective filters and a good tuning indicator. Having said that, I'm sure that a lot of fun could still be had by people using a.f.s.k. on f.m. providing they avoided repeater frequencies and were not hindered by a strong local station. On the subject of repeaters, contacts via repeaters are fairly obviously not allowed during a contest!

One of the most critical factors in achieving successful transmission of a packet is the packet length. For best results the packet length should be kept as short as possible. Fortunately, most contests require only short messages to be exchanged i.e. reports and serial number, but on v.h.f. the locator is also often required. With such a small amount of information to exchange it can all be sent in one packet with no problems. One point to remember is that the system is fully error correcting so there is no need to repeat any information, in fact any repeats have a negative effect as they increase the packet length and hence increase the risk of a failure!

Any experienced contest operator will tell you that user defined message memories are essential if you are making a serious attempt to win. These are needed to hold your locator and any other fixed information that you may need to send. Some of the more crafty operators even use the memories to store a selection of common reports.

The reason for using the memories as opposed to manually typing the data is that while the memories are being sent automatically you can be better employed completing the log and preparing for the next contact.

So, if you have entered or would like to enter any contests using packet, drop me a line with your views and suggestions on the topic and perhaps between us we can revive some of the ailing v.h.f. contests.

Amiga Users Group

Are you the proud owner of an Amiga computer which you would like to employ in the shack? If so, then there is a user group just for you. In addition to a regular

newsletter they can help with public domain (free) software and probably some advice too.

The contact point is G3LMH (QTHR) who can be also contacted via the GB7KCM mailbox. If you would like a copy of the newsletter and a database listing of current members, then please send a large s.a.e. to G3LMH. If anyone else out there is running a radio related computer user group then please contact me with details and I will do my best to help spread the word.

IBM PC Clones

If anyone is looking for one of these computers. I have recently received a letter from Andrews Computer Services offering some quite good bargains. As an example, their bottom of the range model is configured with the radio amateur in mind and comes in a metal case with a full 101-key keyboard. Standard features of this model are 20Mbyte hard disk, 360K floppy disk, 640Kbytes RAM, 4.77/10MHz switchable main board and a multi I/O card. The multi I/O card is particularly useful as it contains two RS-232 serial ports, battery backed clock, games port, parallel port and a floppy disk controller capable of handling two 360K double-sided double density drives.

The price is £695 excluding VAT and carriage. For further details, contact Andrews Computer Services.[1]

Computer FAX

The range of equipment available for this fascinating mode seems to be expanding rapidly. One of the latest additions which is also one of the best is the AMIGA-FAX system from ICS Electronics Ltd. This system for the Commodore Amiga computer, is produced by a West German company with ICS acting as the sole importers. The package comprises a program disk, hardware interface, IFF conversion program and a detailed manual all for £99.95 including VAT but plus £2.50 postage is pretty impressive.

The choice of the Amiga computer is particularly appropriate as it has some very impressive graphics capabilities and produces FAX images with a resolution of 640 by 400 dots with 16 grey levels! As if this wasn't enough the program can actually store FAX images with up to 3840 dots per line which can then be displayed later on screen or a printer in strips. In addition any image can be manipulated once it has been received. This manipulation allows for the image to be reversed either top to bottom or left to right. It can also be inverted to produce a negative image and the contrast and brightness are also fully adjustable. The ability to alter the brightness and contrast is very handy as this usually has to be done by fine tuning during reception.

One really useful feature is that you can add your own text to the image which can be handy to identify towns on a weather map or perhaps to include details of the transmitting station, etc.

As mentioned earlier the image can be sent to a printer if required and for maximum versatility the program includes drivers for both Epson compatible 9-wire printers and NEC compatible 24-wire types.

As if all this wasn't enough you can also send FAX pictures with this package, the only snag being that the images need to be stored in the computer first. Having said that the program is set-up to be able to import images from standard graphics packages like Digi-view and Deluxe Paint so it really is quite versatile.

Although I have not used this program myself I have seen it running and it really is very impressive and hopefully will play a part in increasing the amount of UK FAX activity.

1: Andrews Computer Systems Ltd., 6 Ash Hill Close, Bushey Heath, Hertfordshire WD2 1BW.

The next three deadlines are Feb 27, Mar 29 and Apr 26

Amateur Satellites

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

MIR v. Multitudes

The cosmonaut crew of the Soviet MIR manned space station have been very active on 145.550MHz f.m. over the past month, particularly during the weekend before they returned to earth via the Soyuz-TM-7 on December 22. Other than the South African stations mentioned last month, the list of stations making full two-way QSOs with either U1MIR, U2MIR (mainly) or U3MIR by 5 December 1988 read as follows:

UK3KP, UA3CR, RA3APR, UZ3AXJ, RA3AGS, UZ3DWX, UZ3QYW, UZ6LH, UA4WPF, UA3DGU, UT5BN, UB5ICR, RL7GD, UL7TQ, UL7TZ, UL7TBT, UL7GAN, RL7RX, RL7FCF, UL7FBE, UL7BAT, UL7PG, UL7FAO, UL8TWA, UA9FDZ, UA9FAD, RA9FMT, UZ9AWQ, UA9CKW, UA9CS, UZ9CXM, RA9MBN, UA9MAX, UA9MD, all in the USSR.

Outside the USSR, in the rest of the world, only fifteen stations were listed, these being:

OK3AU (with both U2MIR and U1MIR, U3MIR nearly worked), IW8AOK, IK8YU, ON6UG, SM2PWG, OH5LK, OH1AYQ, DL4AAZ, VP9LE, W4BIW, W2RS, N4HY, WD0GML, PY2BJO (with Vlada U1MIR) and OE5IY.

Since that closing date, a few more stations from Europe have had contacts, including G3IOR at 1416UTC on 17 December 1988, using 145.550MHz simplex f.m. On the following day, Dr. Hans Rath DL6KG near Ulm also made a full contact. Outside Europe, a number of stations in North America have reported success, several more Ws, and Gordon Whiteman VE5XU, who made three QSOs.

As can be seen, up to the time given, only twenty-one stations were worked in Europe, with all but three of these almost exclusively at the far eastern, north-eastern or south-eastern end of our continent, with the vast majority of QSOs being made with stations in the USSR. Virtually all the stations worked, e.g. in European USSR, Ukraine, Finland, north Sweden, Czechoslovakia and Italy are all geographically remote from the main centres of v.h.f. f.m. activity in western Europe.

At first it might appear that some degree of personal preferential selection was taking place, as it was very obvious that where the far greater concentration of active stations on 145MHz f.m. existed, the least number of QSOs were being made. In part, this was due to the operating times possible, they favoured the parts of the world where the passes were occurring in the "MIR time" early evenings, as dictated by the orbital characteristics of the spacecraft and the free periods

Fig. 1

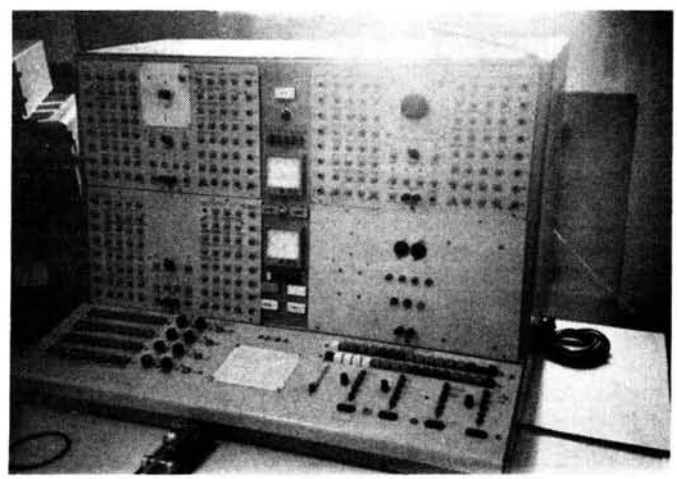

Fig. 2

of the cosmonauts. Sadly, the limiting factor referred to in last month's column came into being, i.e. that previously experienced by astronaut Owen Garriott W5LFL, during the Shuttle "Ham in Space" mission. It was this very concentration of callers itself that produced the least chance of completing a full QSO.

One could almost see a formula at work, where the number of successful contacts were inversely equal to the square (or even cube) of the numbers of stations calling. Theoretically, at first sight, one would expect hundreds of contacts in western Europe, and possibly even more in Japan, where even greater numbers of 145MHz f.m. stations are active. Despite many UA9 contacts, no JA stations whatsoever were worked up to December 5.

The basic cause is "the great QRM of silence", the complete deadening of the receiver that occurs when vast numbers of similarly powered line-of-sight f.m. stations are on the same frequency at the same time. It was very apparent from the initial attempts of MIR to reply only to a few partial callsigns, and the failure of the contact continuity, that this effect was taking place. Unless a way could be found to create the "capture effect" that produces a stronger signal from the otherwise total silence of multi-station receiver suppression, western Europe would continue to be a dead zone for the cosmonauts.

It became apparent that Musa was working simplex on 145.550MHz, S22, an overlap from other parts of the world where split frequency operation was unnecessary, as the band occupancy was very low. As QSOs were serialising as he went round the three IARU regions (each with different band plans) every one and a half hours, he was tending to try to copy the stations he could in part already hear as they passed through his footprint, with new in-range arrivals by the second.

At G3IOR, after numerous fruitless attempts, it was decided to aim the 2 x 10 element crossed r.h.c.p. Yagi in both azimuth and elevation to that point of the sky where MIR would be at the time of closest approach, and hence use the 17dB gain brought about by the inverse square law at that optimised time. Precise passes were calculated from close observance and tracking of the 143.625MHz signal of earlier passes, as to be only a few seconds out would have meant being many decibels down, the rate of positional change of MIR being faster than a beam could be rotated. By using 100 watts of f.m., Doppler adjusted to give 145.550MHz at the spacecraft, success evolved for a short exchange. It could not be sustained, as optimum conditions lasted only some thirty seconds, after which the capture effect was lost. Really, this should not be necessary, as even a 2 watt hand-held would have produced a 5 and 9 signal at the station, but, not under the competitive conditions we have in our very crowded 145MHz f.m. spectrum. Whilst never being an advocate of the use of high power for spacecraft, it is seen that this approach is perhaps the only way in which we can show the enthusiastic MIR operators that there is life and activity in our zone—the problem is that we are too keen, not the reverse!

The new transceiver should be aboard by now and hopefully the tradition of enthusiasm set by Musa Manarov U2MIR and his fellow crew members will continue, with future activity by the new cosmonauts. Dr. Valeri Polyakov is expected to stay aboard for a while longer yet and will probably be active as U3MIR from time to time. It is expected that we shall now hear activity from Alexander Volkov and Sergei Krikalov as U4MIR and U5MIR during their free periods, which will probably be maximised at weekends between 0600 and 1400UTC; Tuesday, Wednesday and Thursday evenings between 1600 and 1800 and some weekday mornings between 0600 and 0700UTC. Naturally, this depends to a very large extent upon the constraints imposed by the mission experiments, so it cannot be assured.

If you are lucky enough to make a QSO, or wish to send a s.w.l. report, the QSL manager for MIR is Boris Stepanov UW3AX, PO Box 679, Moscow 107207, USSR.

As orbital changes will be effected between the time of writing this column and its receipt, and the new Keplerian element so produced is unknown, it is not possible to predict the pass times for so many weeks ahead. They will be provided on the numerous AMSAT nets, Sundays at 1015 on 3.777MHz, at 1900 on 14.282MHz, Mondays and Wednesdays at 1900 on 3.777MHz and Saturdays at 1000UTC on 14.280MHz.

RS3A

Undoubtedly, many readers who regularly use the "RS" series of satellites, and who have also worked RS3A through them, would like the chance to see the command station. Such an opportunity is now produced, as **Danny Kohn SM0NBJ**, a leading member of the AMSAT-SM group, has recently done just this. He has sent us some interesting information and photographs so that we may visit it too. "Thanks to Glasnost and Perstroika, I was the very first western visitor to see the RS3A satellite control station in central Moscow," says Danny. "The trip was organised by Leonid UA3CR, his XYL Sonja and his son Evgeni RA3APR, who also hosted me in their home one evening, a highly enjoyable and unforgettable experience."

At RS3A, Leo RA3AT, who has recently acquired his own amateur radio licence, is employed to run the station. He works with two others. They observe the telemetry and command the satellites in order to maintain them permanently operational and in good condition, and dictate the schedule, codestore information, etc. They also handle the ROBOT function, and the QSL work arising from the communications. At this time, all of the earlier "RS" series are now dead, so the station is devoted to controlling the well-being of the RS-10/11 complex, and building for the forthcoming RS-12/13 operation.

The station can be seen in the photographs taken by Danny during his visit. Fig. 1 shows, from left to right, Danny SM0NBJ, Leo RA3AT and Evgeni RA3APR, standing in front of the RS3A command station. A close up of the older control panel is shown in Fig. 2, the different sections being distinct controls for the different satellites. The command control functions provided are as follows:

1. Switch on/off the 29MHz transponder.
2. Switch on/off the 145MHz transponder.
3. Adjustment of the transponder receiver attenuator between the −20dB maximum to 0dB minimum levels.
4. Switch on/off 21MHz transponder.
5. Adjusting the sectional bandwidth of the passband of the transponders' receiver i.f.s. (The i.f. has two modes of operation. In the narrowest mode, many filters are used in the passband, whilst in the wide band mode the entire bandwidth is covered by one filter only. This system is a commandable protection against the overload of the receiver preventing the attenuation of the entire downlink passband that would otherwise be brought about by stations running excessive uplink power to the satellite. When the loading is excessive, the narrow mode is brought in.)
6. Switching off and on the various beacons.
7. Adjusting the beacon output between high and low power.

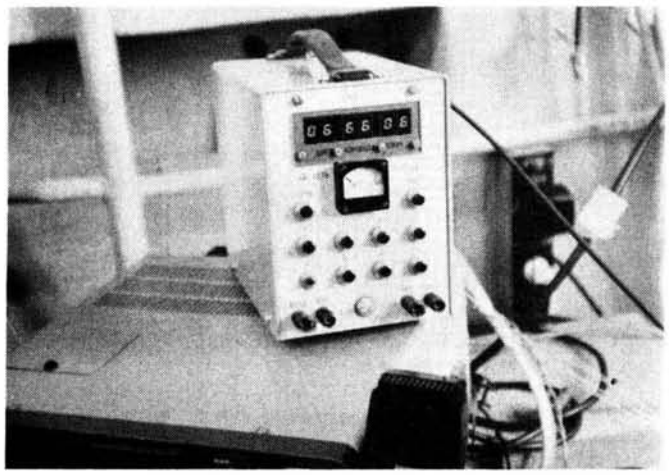

Fig. 3

Fig. 4

8. Switching the output of the service channel transmitter between high and low power operating states.
9. Downloading the digital telemetry from the satellite.
10. Memorising the 10 or 90 minute storage sequence of the telemetry frames from the memory.
11. Downloading the memorised telemetry.
12. Switching off the digital telemetry.
13. Reading out the memorised log of the ROBOT.
14. Erasing the ROBOT log memory.
15. Switching the ROBOT on and off at 21 and 145MHz.
16. Switching the ROBOT auto-answer on and off.
17. Commanding the attenuation level dictating the sensitivity of the ROBOT receivers.
18. Switching the BBS 1 and 2 on or off.
19. Transmitting up from the BBS command.
20. Uploading to the BBS command.

The station equipment consists of the control panels for satellite command, both the original (Fig. 3) and the new and updated digital control panel which functions for all the RS satellites shown in Fig. 3. Coming from the left the first two digits show the satellite number, the third and fourth the command number, and the last two the password number.

They have good h.f. and v.h.f. commercial equipment, part of which can be seen at the bottom of Fig. 3, an excellent frequency counter for the 145MHz transmitter, and a home-brew computer made by Leonid Labutin UA3CR, complete with cassette storage. It is 8085 based, and known as the RADIO 86 RK. It is very popular among the USSR radio amateurs, and has recently been adapted by Leonid and his son Evgeni RA3APR, as a packet radio TNC. The RADIO 86 RK has also been adapted as a "suitcase" portable system, which can also command the satellite, up and download messages, etc., which model was used for communications between the USSR South Pole expedition and RS3A via the RS BBS (Bulletin Board System).

Satellite tracking is performed by Quicktrack software running on an IBM clone computer, with output to screen or printer. This can be seen on Fig. 4, a photograph taken by Danny of Leo RA3AT, whilst commanding the RS-11 satellite from the control panel.

The 145MHz uplink antenna at RS3A consists of a single two-element 145MHz fixed turnstile. This is used both for sending the command signals to the satellites and also for the uplink of RS3A when making QSOs via the transponder. For the downlink, four three-element 29MHz Yagis are employed, all mounted horizontally in such a way that the entire horizon is covered. These antennas are used mainly for receiving data, but double up as the 29MHz downlink antennas for making contacts.

As regards the ROBOT operations, two versions are retrieved daily, and the necessary QSLing is done at that time. The maximum storage of the ROBOT memory is 128 QSOs, and as an average of 115 QSOs are made daily, mainly from the USSR, regular emptying and clearing is needed.

We are very grateful to Danny and both Leos for this interesting insight into the workings and functions of RS3A, which gives us a much wider appreciation of all the work that goes into keeping the RS series of satellites on and active with such a degree of reliability.

Amateur Satellite Update

UoSAT—alias OSCAR-9—continues to give good service, despite it now being seven years and four months old. Despite the atmospheric expansion, it is expected to be with us for two more years at least before re-entry, having now dropped almost 100km from its 556km original launch altitude. As the solar flux rises, the propagation of the 14 and 21MHz beacons becomes more fascinating, with many sub-horizon hearings, and with strong auroral multi-Doppler effects when the satellite is at the far north horizon.

UoSAT-2, OSCAR-11, is to have its 435MHz operation resumed on Wednesdays and Sundays. The 145.825MHz current schedule on Thursday to Tuesday inclusive is for 45 seconds of telemetry, followed by 20 seconds of digitalker, 15 seconds of computer status message, then 115 seconds of the latest bulletin. It then goes to 10 more seconds of digitalker, 240 seconds of Whole Orbit Data, 10 more seconds of digitalker, and concludes with 60 seconds of the Digital Communications Experiment (which includes the latest sets of Keplerian elements) before resuming.

On 145.825MHz Wednesdays it will run 150 seconds of telemetry followed by 10 seconds of digitalker from 0000 to 1400UTC, and then full time continuous Whole Orbit Data from 1400 to 2359UTC. The 435.025MHz schedule for 4800 baud DSR data is to run from 0000 to 1200 Sundays and from 0600 to 1800 on Wednesdays. Wednesdays is education day, so data is not interrupted so as to allow the maximisation of data by receiving stations. The Whole Orbit Data, until further notice, will have channels 2 and 61 each Sunday: 1, 2, 3 and 61 each Monday; 19 Tuesdays; 29 Wednesdays; 1, 2, 3 and 61 again each Thursday; 0, 10, 20 and 30 each Friday, and 10, 11, 19 and 29 each Saturday.

The University of Surrey is now busy working on the thermal design for the new microsats, which, being in very different orbits from the benign near-polar sun-synchronous OSCAR-9 and 11, will require special active thermal control to overcome the adverse conditions that could lead to premature battery failure and the early loss of the satellites.

OSCAR-10

This ageing but highly functional first elliptical orbiter is performing extremely well, and its downlink can be clearly heard at G3IOR and even in G3IOR/M using a straight receiver and a simple ground plane antenna. It is on Mode "B" only and, and unless a battery or pulse condition results that changes the status, will remain that way. Updates on the post perigee mean anomaly periods for non-transponder use are given out regularly on the AMSAT nets.

The beacon on 145.809MHz is unmodulated, and can be heard as a steady carrier. **John Newman G6ZQE** of Wymondham, Norfolk reports that since the advent of OSCAR-13, very few amateurs appear to be using A-0-10. "I have been running just 8 watts to a 9M2CR type 10 turn helix, and my return signals have been very strong, but there are very few people to work," reports John. **Ron Broadbent, G3AAJ** reported that he too had found the satellite to be in excellent shape. "I worked a couple of EAs and a DL as if we were QSOing in 20 metres," writes Ron. "No fading, solid s.s.b. and c.w. copy all the way, and the beacon was knocking my S-meter up to S9."

OSCAR-13

The same favourable comment cannot be stated for "B" mode on OSCAR-13 as, unless the pointing is optimised, grave problems can be experienced by the potential user. It is, in more ways than one, all a question of attitude. On this satellite, G6ZQE reports: "Using 50 watts to my 10T helix, I am often completely unable to hear my own signals." Despite the problems encountered, John has recently had contacts with W0ZZQ, K4HAR, WD6AKG, KL7GRF, NR7U, W2APU, VE7WQ, WB4MOX, K4TSU, VE4AMU, N4AAU, JS1ERM and G8XXJ. His station consists of a TS-770E transmitter for the uplink, and a TR-1930, fed via a home made, dual gate, m.o.s.f.e.t. pre-amplifier from a 10-element vertically polarised azel NBS Yagi.

On Mode "J", apparently the best mode, lots of activity is in evidence. The sensitivity is quite amazing, with various 145MHz beacons in evidence when the uplink loading is not excessive. Stations have been heard calling one beacon, which continuously calls "QA de UZ9XXA". The mode "J" uplink band problem is still not fully resolved, and comments are appearing in the various amateur radio journals. *DL-QTC* has published a letter from one reader who is not keen on satellites. His feeling is that satellites are like repeaters, relying on the help of other amateurs to make contacts, and hence using satellites is ". . . second class amateur radio . . ." and furthermore ". . . does not comply with the band plans . . ."(!)

The use of "J" mode of course does not violate the IARU Region 1 band-plan, and if used properly according to one's licensing conditions and amateur operating ethics, fits in well with any other use in this 50kHz band section.

Mode "L" usage is on the increase, with more activity by the day. **Rod Clewes G3CDK,** has realised six more needed decibels from his pair of 23cm uplink helixes. Whilst it is obvious that the exact phasing of Yagis is vital, and can be achieved by equal power distribution, common phasing by equal feed lengths and parallel antenna positioning, another not-so-obvious factor comes in when phasing helixes. Rod had one antenna erected with the end of the last turn at the top of the antenna, and the other with the turn terminating at the bottom of the last turn. By making them alike, he has now the gain he needs for good access.

It has been noticeable that the beacon has been subject to frequency modulation undulation at and just after Mode "L" periods, due to the heavy power demand. **Peter Guezlow DB2OS** reports that this is nothing to be concerned about, and is a natural and expected phenomena.

Mode "S" has now resumed again on OSCAR-13 during the optimum earth pointing antenna times within the "JL" mode period, but no reports have come in on this lesser used mode this month.

The A-0-13 schedule operative from January 6 to March 16 is for the following mode operations:
Mode "B": From Mean Anomaly 003 to mean anomaly 100.
Mode "JL": From Mean Anomaly 100 until MA 150.

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10 off 100uf 10v	at	40p
10 off 220uf 25v	at	45p
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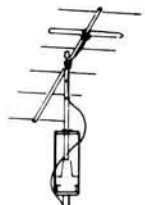

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In early March further magnetorquing will be needed to adjust the satellite position to allow for the changing sun-angle, and additional long eclipse periods occur, meaning a further operational change in order to maintain the power regulation at optimum. From March 13 until May 3 the transponder schedule will be:
Mode "B" from Mean Anomaly 100 to Mean Anomaly 150.
Mode "JL" from Mean Anomaly 150 to Mean Anomaly 210.
Mode "B" again from Mean Anomaly 210 to Mean Anomaly 0.
All transponders off from Mean Anomaly 0 to MA 100.

For those that need a good read on understanding the complexity of the whole system, the *OSCAR-13 Handbook* is now available from AMSAT-UK, s.a.s.e. to AMSAT-UK, 94 Herongate Road, Wanstead Park, London E12 5EQ please for details.

OSCAR-12

"Fuji" is back on again, within the limits of its slowly ailing battery and solar cell power production, and the short-term operational schedule is regularly updated on the various AMSAT nets. **Heinz Hildebrand DL1CF** reports that in a week using "JA" mode he only worked G4CUO, with zero activity most of the time. On "JD" mode, things have been much more active. **Dave Rowan G4CUO** reports that one can clearly hear an intermodulation product of the beacon on 435.843–845MHz under low conditions. FO-12 is indeed a most sensitive satellite and when devoid of users, re-transmits and exposes many of the f.m. simplex stations trespassing in the 145MHz space band. HB9RHV plans to be on from San Marino over Easter with the callsign T77T, possibly OSCAR-10 and 13 also.

RS-10/11

Despite the problems being caused by large numbers of f.m. intruders in the downlink passband during daylight passes (added to by the high degree of downlink E and F layer attenuation, the often split and multi-Doppler affected downlink when the satellite is in the northern auroral region), RS-11 is supporting many QSOs as well as ever, with RS-11 still in reserve. Sunspot numbers of up to 195 have already arisen, plus many auroral events, and are expected to rise to a peak about next February, with a split cycle in store.

AMSAT-UK Computer Software

AMSAT-UK now have in stock 2000 copies of the new software catalogue available to anyone who requests same by radio, post, telephone, FAX or PRESTEL. The programs available cover many types of computer and all sorts of space tracking requirements. Also available is a listing of many other items useful to the satellite enthusiast. The proceeds resulting from the sale of these go toward supporting the amateur radio satellite programme, to which AMSAT-UK has contributed considerable sums in the past year. £10 000 went to fly the launch team and OSCAR-13 satellite to the launch site, £5000 to securing the Phase III-D launch as a "down payment", £25 000 toward funding the AMSAT-UK transponder on the UoSAT-Delta launch, as well as a donation of DCE equipment to RS3A in Moscow.

The next three deadlines are Feb 27, Mar 29 and Apr 26

Propagation

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

Using the Radio Telescope

Although I updated the equipment in October 1978 (Microwave Modules converter and Yaesu FRG-7 receiver as i.f. amplifier) and moved the observational frequency to a clear spot around 146MHz, this made no difference to the results. During 1979, a multitude of individual bursts of solar radio noise appeared on the recording charts. In addition, continuous noise storms were recorded on Jan 11,12,19 and 23, Feb 12, 17–21 and 23, Mar 30, Apr 3, 5 and 24, May 1, June 1–3, 9–14, 20, 25 and 30, July 4 and 15, Aug 16–18, 20 and 22, Sept 5, 9 and 30, Oct 1, 4–6, 9–14, 27 and 29 and Nov 8–10.

Aurora was reported at 1800 on Jan 4 and around 1915 on the 7th. An ionospheric disturbance was announced by the BBC's World Service around 0630 on the 6th. While the noise storm was in progress on Feb 12, I heard a burst at 0915 on 50MHz and **Cmdr Henry Hatfield** (Sevenoaks) had positive results on his newly installed solar equipment at 1296MHz during the afternoon. At 1309 on the 23rd a burst swept from 28–146MHz. In March a sudden ionospheric disturbance (s.i.d.) occurred between 1035 and 1143 on the 9th when solar noise was recorded at 60 and 136MHz, aurora manifested from 2200 to midnight on the 10th, h.f. blackouts were logged on the 23rd and 30th and World Service reported an ionospheric disturbance at 0300 on the 29th. The noise storm on March 30 was mainly between 28 and 30MHz.

Aurora at 0100 on April 4 followed the noise storm on the 3rd when Henry counted 35 sunspots and saw an arched filament about a quarter of the sun's diameter. Solar bursts were heard at 50 and 70MHz during the noise storm from June 9 to 13 and Henry logged a slight increase in noise level at 1296MHz while the storm was in progress at 146MHz on July 4. Aurora was reported on August 13 and 29, a s.i.d. occurred on the 18th and World Service announced an ionospheric disturbance on the 21st. Henry saw a flare on the east-limb and a group of 7 spots just past central meridian on the 14th and a bright spray, followed by an eruptive prominence, on the 15th. He logged bursts at 28 and 1296MHz on the 14th and solar noise between 50 and 60MHz was reported at 1715 on the 29th.

A bright loop prominence, seen by Henry, could have accounted for the s.i.d. and noise storm on September 14. I heard bursts at 50MHz during the storm on October 12 and the fact that Henry observed "too many sunspots to count in many groups spread across the sun" was no doubt the reason for the storm between November 8 and 10.

During 1980, I recorded continuous noise storms on Jan 28, Feb 1–5 and 9–14, Mar 30, Apr 3–11 and 22, May 3–6 and 24–29, June 5 and 9, July 17, 18 and 20, Sept 14, Oct 9, 14, 16 and 24, Nov 1, 2, 13, 27 and 28 and Dec 15, 16 and 23–27.

Aurora was observed by its effect on terrestrial radio signals between 1500 and 2100 on Jan 27 and ionospheric disturbances were reported by World Service over the period 27 to 30. Henry Hatfield logged solar noise at 1296MHz during the storm on Feb 2 and 3 and bursts of noise were heard at 50MHz while the storm was in progress on Feb 10, 12 and 13. An h.f. blackout took place when the solar noise was "off scale" on Apr 7 and very large bursts manifested at 50MHz at 1823 on the 11th and on 28MHz at 1244 on the 28th.

Ionospheric disturbances were reported by World Service on Oct 5 and 12 and Henry logged solar bursts around 210MHz on days 1, 14, 22, 23, 25 and 30 and again during the storm on November 1, 2, and 3. At 1124 on October 9, Henry, using his spectrohelioscope, saw a triple flare inside a 6 spot group and, 16 mintues later, he began to record radio noise at 136MHz. Faint aurora was reported from an observer in Scotland on November 19 and 23 and a larger event was tracked by tone-A radio signals at 1900 on December 19. The latter was followed by an ionospheric disturbance, reported by World Service, on the 20th. The radio noise from the sun was really severe with the recording pen off scale on the 26th. But now we must consider the happenings toward the end of 1988.

Fig. 1

Solar

"The monthly mean sunspot number for November was 125.6 with a high of 220 on the 15th and a low of 72 on the 26th," wrote **Neil Clarke G0CAS** (Ferrybridge). He reports that the mean solar flux was 157 units. Details of the daily fluctuations can be seen on Neil's computer print out, Fig. 1. From their respective observatories in Bristol and Selsey **Ted Waring** counted 16 sunspots on December 11 and 40 on the 19th and **Patrick Moore** made a drawing, Fig. 2, of the sunspots as he saw them at 1340 on the 19th.

With his spectrohelioscope, Henry Hatfield observed 2 sunspot groups, 17 filaments and 6 quiescent prominences on

November 27; 4g, 16f and 5 qps on December 5; 3g 15f 7 qps and a detached wispy prominence over the west limb on the 7th; 3g, 20f 6 qps on the 10th; 3g, 18f, 9 qps and a very black narrow filament on the 12th and 5g, 13f, 9 qps and the remains of two flares on the 19th. His observations were hampered by cloud on the 6th and 17th. Henry also recorded a variety of individual bursts of solar radio noise at 136MHz on December 7, 9, 10, 14 and 17 and varying degrees of continuous noise on November 29, December 2, 5, 7, 11, 13 and 19. Details of Henry's spectrohelioscope are the subject of a well illustrated, 9-page article, reporting his Presidential Address, in the December 1988 issue of the Journal of the British Astronomical Association.

Magnetic

"From the first to the 17th the Ap index ranged between 9 and 25, which are basically unsettled conditions. From the 18th to 25th it fell to quiet and to very quiet, with a low of 3 on the 20th. On the 26th, it became unsettled again and on the 30th it turned stormy," wrote Neil Clarke.

Ron Livesey (Edinburgh) using his "jam-jar" magnetometer detected storm conditions on November 2, 4, 12, 13, 15, 18, 23, 24 and 26. At Wishaw Doug Smille, using his Hall effect magnetometer, logged "magnetic pulse" on days 7, 12 and 13, "short storm" on the 8th and 15th, "mid-day storm" on days 19, 23 and 25, "evening storms" on the 17th and 18th and "storms in 4 phases" on the 30th.

The automatic recording magnetometer used by Karl Cooper detected "very unsettled conditions" on November 2, 3 and 26.

Aurora

Ron Livesey is the Auroral Co-ordinator for the British Astronomical Association and he received reports of radio aurorae from Doug Smille and Shetland Sumburgh Airport on November 2, 5, 7, 8, 9, 10, 11 and 30.

Auroral displays were seen overnight on November 1/2 (Maximum activity "quiet arc"), 2/3 ("Coronal rays"), 3/4, 10/11 and 11/12 ("active rays"), 8/9 ("quiet rays"), 12/13 ("rays") and 13/14 ("glow"). "The aurora of November 2/3 was spectacular for its shortness," said Ron in his report to the BAA and continued, "At about 1833UTC there was a 'flash" aurora lasting about 10 seconds which was observed all over Scotland. After some quiet activity the aurora rebuilt itself at 1900 and continued to 1945."

Ron's words rang a very strong bell with me when I received a letter from **Tim Jones** (Chiddingfold) saying that, around 0300 on October 27, from Wimbledon, "an arc of white light" was seen illuminating the whole sky. It lasted between 5 and 10 seconds and covered about 1/3 of the sky in length. Was this an auroral arc or beam seen down here in the south? We know that many auroral events are associated with sunspots and that particles from sunspot activity can take between 20 and 40 hours to reach earth therefore we must look at the state of the sun prior to Tim's report. On the 24th, Henry observed 1 group of 30–40 spots, 20 filaments and 7 quiescent prominences and by the 29th there were 4 groups on the sun's disc containing 10, 3, 3 and 4 spots, plus 10f and 2 qps. That large group was also drawn by Patrick Moore at 0925 on the 24th, Fig. 3.

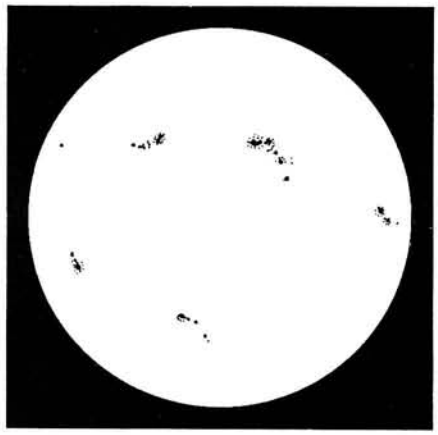

Fig. 2

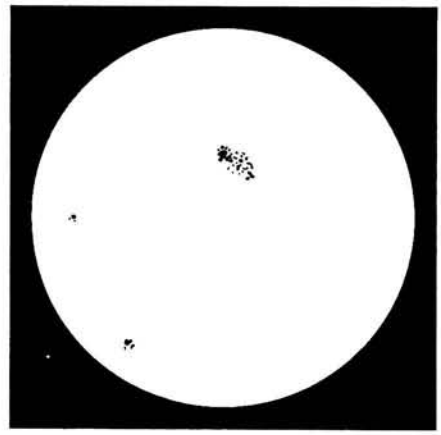

Fig. 3

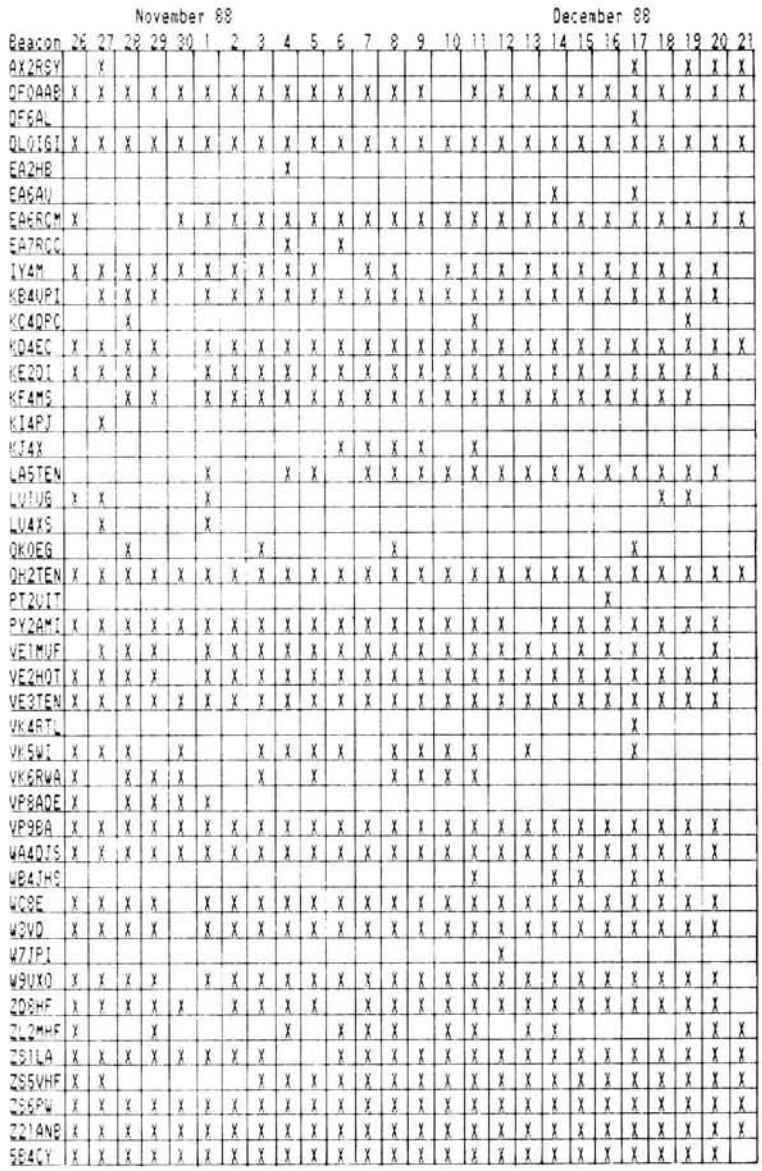

Fig. 4

The 28MHz Band

In Bransgore, **John Levesley G0HJL**, received signals from a number of stations in the USSR on November 26; Europe, Scandinavia, USA and USSR (including W1 on f.m.) on December 8, 10 and 11; South America and the USSR on the 9th and across the globe from the USA, via Scandinavia, through Europe to the Middle East and on to India and Japan on the 17th.

Propagation Beacons

First my thanks are due to **Chris van den Berg** (The Hague), **Mark Appleby G4XII** (Scarborough), **John Coulter** (Winchester), **Vaclav Dosoudil OK2PXJ** (Kvasice), **Don Hodgkinson G0EZL** (Hanworth), Henry Hatfield, **Ken Lander** (Harlow), John Levesley, **Greg Lovelock G3III** (Shipston-on-Stour), **Ted Owen** (Maldon), **Brian Mulleady GM1PVG** (Falkirk), **Fred Pal-**

lant G3RNM (Storrington), Ted Waring and **Ern Warwick** (Plymouth) for their beacon logs which enabled me to prepare the extensive chart seen in Fig. 4.

For their beacon observations, Brian Mulleady uses a Trio TS-120S and loft dipoles and Ted Owen uses a ground plane antenna.

Ken Lander and Greg Lovelock added "KE2DI/B FN12" (28.280MHz) and "EA7RCC PBOX 204 7 CORDOBA" (28.200) to their new beacons score and Greg reports hearing the Brazilian beacon PY2AMI on 24.9MHz on most days. Mark Appleby tells me that EA6AU nr Palma (28.230MHz) was S6 at 1000 on December 14 and that WB4JHS appears to have shifted frequency from 28.252 to .258. Don Hodgkinson added PT2UIT (28.225MHz) (Brasilia), running 5W to a ground-plane antenna, to his new beacon score on December 16. John Coulter logged "W7JPI AZ" (28.231MHz) on the 12th and a continuous signal, "Vs" then "TEST de DF6AL" (28.195MHz) on the 17th.

Between November 28 and December 14, Ern Warwick often heard the beacons DK0WCY on 10.144MHz, CT3B, OH2B, ZS6DN and 4X6TU on 14.100MHz and IK6BAK on 24.916MHz.

Tropospheric

The slightly rounded atmospheric pressure readings for the period November 26 to December 25, Fig. 5, were taken at noon and midnight from the Short and Mason barograph installed at my home in Sussex. I have daily records, produced by this machine, covering the past 25 years and few have shown such predominately high pressure for corresponding periods.

In Maldon, Ted Owen's barometer peaked at 1039mb on December 4 and his low for the period was 995mb on November 30.

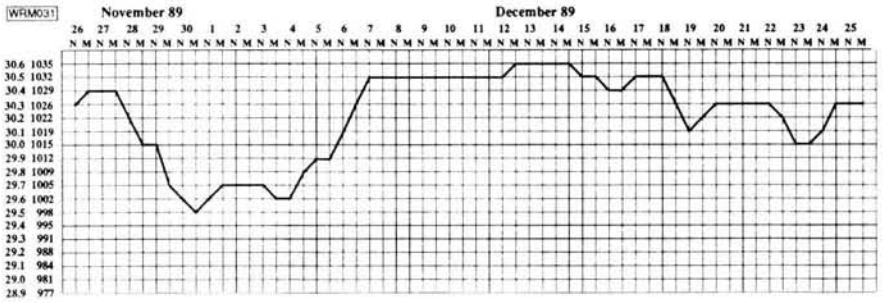

Fig. 5

934MHz

My thanks to John Levesley (UK-627) for the results of the 934 Club UK's National Contest, which shows up plenty of DX on this band in mid-October. The leaders in the Multiple Operator Home Base, Single Operator Home Base and Single Operator Mobile sections were South Devon Radio Club UK-1429, UK-717 (Felixstowe) and UK-1390 (South Downs) respectively. Longest contacts in each section were Brixham to Greater Manchester (467km), Felixstowe to Burnley (317km) and South Downs to Ripon (370km). The event produced 61 contacts over 80km, 35 over 161km and 74 over 240km.

The next three deadlines are Feb 27, Mar 29 and Apr 26

Broadcast Round-up

Peter Shore

What an excellent few weeks it has been for short wave radio listeners throughout the world. The day after last month's column went to press, jamming of broadcasts from Radio Liberty in Russian and Soviet regional languages stopped, and transmissions by Radio Free Europe in everything but Czech and Bulgarian were also freed from deliberate harmful interference. Russian language programmes from Deutsche Welle and Kol Israel were similarly heard clearly for the first time, although Deutsche Welle's Dari and Pashto service to Afghanistan was still interfered with.

Then, later in December, the short wave bands became clearer still when RFE's Czech service was cleared. Jamming by Bulgaria of almost everything from Radio Tirana to Radio Free Europe continued until just before Christmas when "glasnost" permeated Sofia and all western broadcast to the Eastern Bloc could be heard interference-free.

This truly is a step forward, freeing vast areas of the bands from the noise which has infuriated listeners for decades, and will doubtless enable new catches to be made on frequencies previously made worthless by jamming, particularly as we approach the sunspot maximum. Let us hope that this state prevails for many, many years to come and that we never return to the madness of major jamming by the East. It should be noted that jamming still persists in some areas: Iran and Iraq, for example (Radio Australia on 6.035MHz in the evening here in Europe is unaudible because of this), and clandestine stations in the Middle East and Asia continue to be affected, but clearly this is not of as much consequence as the widespread interference in Europe which spilled out to the rest of the world, too.

Meanwhile, other news is that Radio Moscow is planning major changes on January 1, just a day or two after this column is written, so details are still somewhat sketchy. However, it is known that a new Russian language "World Service" is to be inaugurated (perhaps to replace the 5th Programme Domestic Service which is a composite service for "compatriots abroad") and new language services are to come on stream—details, where known, are included in the European news section.

Signals from the west have been booming in during the weeks around Christmas: it has been possible to hear Pacific stations fluttering over the Pole even on portable radio sets—New Zealand is proving to be a particularly easy catch at present.

Europe

Note: all times are UTC (=GMT)

We have caught up with a number of changes to Radio Tirana's schedule of external broadcasts. Currently English is heard:

0800 on 11.835 & 9.50MHz
1130 on 11.855 & 9.48MHz
1400 on 11.975 & 9.50MHz
1530 on 9.48MHz
1830 on 9.48, 7.12 & 1.395MHz
2230 on 7.215 & 1.395MHz

All broadcasts are 30 minutes long. The domestic service on short wave continues to be heard on 5.057MHz between 0300 and 2200.

Programmes in English from Radio Sofia are heard:

0800 on 11.72 & 9.70MHz
1530 on 15.31, 11.735 & 9.74MHz
1830 on 15.31, 11.735 & 9.74MHz
1930 on 11.72, 9.70 & 6.07MHz
2130 on 11.72, 9.70 & 7.115MHz
2230 on 11.72 & 9.70MHz

Radio Finland was reduced to music programmes for a couple of weeks during December when a strike by Finnish journalists crippled the country's broadcasting. As a result, BBC World Service, which has a number of bulletins carried on local f.m. stations in Finland, boosted its audience at a single stroke!

English from Helsinki is currently:

0515-0530 on 11.715, 9.635, 6.12MHz, 963, 558 and 254kHz
0730-0755 on 11.755, 9.56, 6.12MHz, 963, 558 and 254kHz
0900-0925 on 21.55 & 17.795MHz
0930-0955 on 15.245 & 11.855MHz
1200-1255, 1300-1355, 1400-1425 on 15.40 & 11.945MHz
1505-1530 on 15.185, 11.85 & 9.64MHz
1930-1945 on 11.755, 9.53, 6.12MHz, 963, 558, 254kHz and at 2200.

Greece uses 17.56MHz at 1200 in parallel with 15.63 and 11.645MHz and has news in English at 1235 or thereabouts.

Radio Portugal which now boasts new studios is still difficult to hear as the station seems reluctant to choose a frequency clear from interference. English is still broadcast to Europe at 2000 on 11.74MHz, with an African Service at 1900 on 15.25 and 11.82MHz. The Middle East and Asia gets English at 1600 on 15.21MHz and the Americas at 0200 on 11.84, 9.705, 9.68 and 9.60MHz. All broadcasts are weekdays only.

Radio Sweden has moved to 9.565MHz for the 1200-1400 transmission span from 15.19MHz, and includes English at 1230.

The Soviet Union will introduce its new Russian service on January 1, and beam to Europe at 2100, 0400, 1000, 1400, 1800 and 2000 with all broadcasts one hour long except at 1000 which will run until 1200. Precise frequencies are not known, as announcements have only referred to metre bands, and are more than likely wrong! More details next month.

A new broadcast in English from Radio Station Peace and Progress, the "Voice of Soviet public opinion" will be heard at 2100-2130 on 263kHz long wave from January 1, and the 1530 broadcast in German will be heard on 1.323MHz medium wave from the same date. It is a matter for conjecture as to why Moscow should have inaugurated this rather dated Peace and Progress for Europe during 1989 . . .

Africa and the Middle East

Morocco finally changed its long wave frequency during December—ten months late! Rabat now uses 207kHz ex 209, bringing it in line with the rest of Europe and the European long wave plan.

Radio RSA is heard in English at 1500 on 25.79, 21.59, 21.535 and 11.925MHz.

Radio Kuwait carries English between 0500 and 0800 on 15.345MHz and in the evening from 1800 until 2100 on 11.675MHz.

The Voice of Turkey in English is on the air at 1330 to Asia on 15.255MHz and to Europe at 2100 until 2150 on 7.215MHz.

Asia and the Pacific

Radio Australia has been testing on 15.14MHz from 1430 until 1800 in English with fair to poor reception in the UK. Meanwhile, with good conditions lately, the Tok Pisin service which is on the air between 0800 and 1100 is heard with fair reception on 6.08 and 5.995MHz from time to time. New Zealand is heard well from sign on at 0900 until 1115 close-down on 9.85MHz, with less good reception on parallel 11.78MHz. It was most interesting to hear carols on Christmas Day from Radio New Zealand, using just a pocket sized Sony receiver—even the family was quite amazed!

Radio Pakistan is now using the 21 metre band for a number of language transmissions, including at 1115 Hindi on 13.665MHz. English at 1600 to the Middle East and Africa is heard on 17.80, 15.135, 13.675, 11.615, 9.775 and 9.475MHz and to Europe from just after 1715 on 15.27 and 11.57MHz.

The Sri Lanka Broadcasting Corporation is audible at weekends on 11.80MHz with English at 1845 when Radio Portugal does not use this channel, and Trans World Radio in the island is heard between 1200 and 1330 on 11.83 and weakly on 5.99MHz.

The Voice of Vietnam has reverted to 12.02MHz from 15.01 for its services, which include English at 1330, 1600, 1800, 1900, 2030, 2230 and 2330.

Far Eastern services from the Soviet Union are audible in the morning now, with Vladivostok heard on 9.905MHz u.s.b. with Radio Station Pacific Ocean at 0815, and the local Moscow First programme on 7.290MHz u.s.b. from around 0700—all in Russian, naturally enough.

The Americas

Brazil carries English on Radiobras at 1800 on 15.265MHz.

Bogota may be heard on 4.755 and 9.51MHz with the Caracol radio station, which seems to be on the air for most of the day on short wave.

WHRI from the USA is on the air at 0600 on 9.495 and 6.10MHz and from 1600 on 13.76MHz.

Any reports for Broadcast Round-Up should be sent to the PW offices

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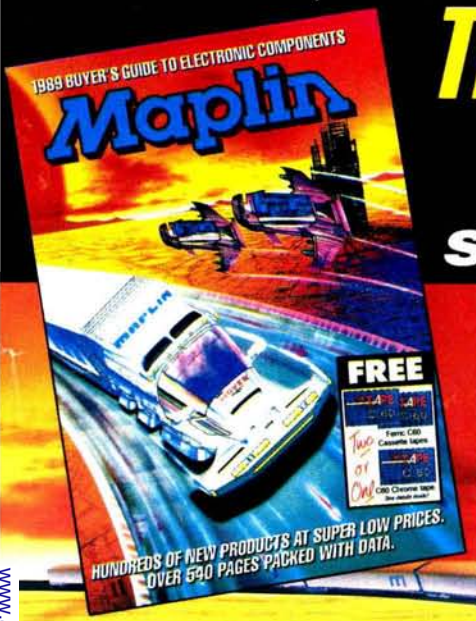

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