

# HRT

## HAM RADIO TODAY

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# KENWOOD TM-732E REVIEWED

**HRT 'AMATEUR  
OF THE YEAR'**

In Praise  
of Excellence  
The Collins  
KWM-380



**Presentation to G3AAJ**



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# HRT

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VOLUME 11 NO 4 MAY 1992

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Left; John Wilson G3PCY with his Collins KWT-6 HF Transceiver

Below; Kenwood TM-732E Reviewed



# CQ de G8IYA

## Make your HRT Editor suffer!

The rally and exhibition season has well and truly begun. As you read this, in the last few weeks our staff will have attended the Pickett's Lock show, the VHF Convention, and the ASP Sandown show, to name just the 'exhibition' types of shows. At these, as well as the traders displaying their wares, you'll also see various clubs and groups also 'displaying their wares', inviting visitors to indulge in their offerings. For part of the time, groups such as local clubs and specialist interest groups are, of necessity, 'preaching to the converted' in radio amateur terms, in that many visitors to the rally or exhibition are already interested in these aspects of amateur radio, their stand acting as a 'focal point' for interested parties. But their main aim in many cases isn't just a 'flag waving exercise', instead it's a 'recruitment drive' to get people interested in what their branch of amateur radio, or their club, has to offer. This all fosters a growing awareness of the wide range of activities our hobby has to offer.

But they're nearly all at specialised amateur radio rallies and exhibitions! The recent ASP exhibition catered for amateur radio, computer, electronics, and CB enthusiasts, with groups such as the RSGB and AMSAT-UK having stands to promote the world of amateur radio to potential newcomers to the hobby itself.

### Getting to the Public

This of course is at a national level, out of the reach of what most readers can organise. But what about on a local level. No, I'm not suggesting you go out right now organising an amateur radio stand for a local community event, that's the *next* stage for your local club! But when did your club last have an announcement of its activities in the local press? Maybe one of your members contacted someone in a disaster-stricken part of the world? Or maybe someone has linked up on packet with the Mir space station and left one of the cosmonauts a greetings message? No doubt your SWLs will have heard QSOs between amateurs in Russia and the USA discussing their respective lifestyles and passing totally non-political greetings of friendship between their families? These may be everyday occurrences to amateurs, but they're of interest to others. Don't be shy, let them know the interesting things radio amateurs can do! In my street, when I tell our neighbours that the 'strange' aerial sys-

tem on our family house is used, amongst other things, to link up with dedicated amateur satellites and a computer on an orbiting space station, we normally get a stare of disbelief. But when they saw our family on the local BBC TV news having a QSO with Helen Sharman on board the Mir space station it was a little different! Before we knew it, we found ourselves teaching a dozen newcomers how to become radio amateurs.

### If you've got it . . .

In the UK we're a naturally reserved bunch of people, often keeping ourselves to ourselves. But what about radio clubs? Those open to the public *must* be aware they need 'new blood' to survive and prosper. You think they've not all open to the public? Well maybe some say they are, but reality is occasionally very different. Regular readers of HRT will have seen that some 'elite' clubs incredibly seem to go all-out to discourage new members.

Some clubs publicise who they are, and, if you're lucky, say when and where they meet, but don't bother to add any incentives, i.e., the all-necessary 'carrot', to get more amateurs to come along to their meetings. These clubs invariably don't bother to say what speaker they'll be having, or what project they'll be doing, at their meeting next Tuesday or whatever. 'So what' if the such-and-such club meets on the second Tuesday of each month? What do they do? Why should someone bother going? Would it be worth the petrol, or will it just be the same bunch of people sitting down bemoaning the way amateur radio is going?

### An Example

A couple of weeks ago, my Consultant Technical Editor made a round trip of around 300 miles to speak at a radio club on converting ex-PMR gear onto the amateur bands. The Club Chairman had taken the trouble to send a mail-shot to every single club member about the club's lecture. The result was the club's highest attendance in over two years, the hall filled to capacity with additional seating having to be brought in. The Club Chairman also made sure his lecturer was well looked after by providing him refreshments and a superb meal after his journey, as well as offering to reimburse travelling expenses. At the same meeting, a number of the audience had just received their Novice RAE pass slips, a 100% pass rate, having been taught by



Some club secretaries get rewarded for their efforts!

the Club's committee members. Is it any surprise?

What does *your* local club do to attract new members? Anything? Do they organise a programme of events for their forthcoming meetings? If they don't, why not? Maybe it's because they're happy just sitting around. Maybe they don't want any more members to join them?

These clubs *don't* get into the HRT 'Club News' section! Because I don't put them in.

I don't just idly list every club's details and their meeting venue. With word processors that would be simple, month by month, just transferring old information with maybe the odd addition or two. I could just enter the details once, fill about five or six pages of the magazine with them (over 14 pages if I really wanted to list all the clubs). Instead I update each individual entry every single month, often burning the midnight oil in my own time to do so.

Take a look, are *your* local club's details printed there? OK, you're not a member of your local club. No doubt it's because they don't do anything you're interested in. Maybe they do, and you don't know about it because they don't tell anyone. Even if you're not a member of your local club, *get them doing something about it!* Tell them the Editor of HRT told you so if they're not happy. Who knows, I might even publish a list of 'moaning clubs'! Tee Hee.

### Get your own back

Right then, now's your club's chance to get their revenge. Make me work even harder, longer, up until 2.00am sometimes instead of midnight. Make me suffer! If you get your club's events calendar off to me, the deadlines are published each month in the club news section, I'll have to work even harder updating it all each month! If your club has a 'logo', send that as well, I'll try and get that alongside the club's details. Let's see if I have black lines under my eyes in next month's Editorial photo!

Let's see what the next few month's worth of HRT 'Club News' looks like. Remember HRT is published on the first Friday of every month, in the month preceding the cover date, look out for it, if you can't see it, ask.

# LETTERS

## Letter of the month

Dear HRT,

Every radio magazine seems to have a moaning letter from a repeater group. We know it costs money to run a repeater, it costs money to run a contest station, all amateur radio costs money. Other groups do fund raising, our CB club has raised hundreds of pounds for charity. I don't see as a RSGB member that I should pay for something I will never use, I know for a fact that repeater users are not all RSGB members.

I am sorry that there is interference on the repeaters, but in the AM days we

had carriers come up on QSOs. A wise G3 told us to ignore them, don't make any remarks whatsoever about them, and they will go away. It worked.

73 John G4BYU

### Editorial comment;

**Hear Hear. If you want to voluntarily support something, especially something you make use of, then all well and good. No-one's forcing people against their will. Unless our readers know different. And yes, it normally does work.**

Dear HRT,

I would like to comment on my experiences whilst travelling through Wales one evening.

I overheard a QSO on the GB3BC repeater, between what I thought was two repeater group members (all fixed station I hasten to add), trying to educate a station not to use the word 'break'. Unfortunately the station had quite a ticking-off for this. But like myself being a stranger to the area, we frequently use the word 'break', to enforce a gap, to give us a chance to call somebody else or make an emergency call for help. I understand the committee members have made their own ruling on ignoring the word 'break'.

Although I have heard comments that simply using the word *break* or *break please* constitutes a breach of licensing conditions, by not giving your callsign at the start of the transmission, saying your callsign and the word *break* takes twice as long, regardless of some repeaters having two pips or a 'K' as the end of over signal. Why don't we use an abbreviated callsign similar to the way Raynet sometimes do, e.g., the last three letters of your callsign.

I would like to comment on the attitudes and behaviour on some repeaters. Committee members seem to think that the repeaters belong to them, and no one else should use it. Why aren't there

any questions on their own operating procedures?

Give us a chance, after all it's only a hobby.

### Editorial comment;

The use of 'Break' is, quite correctly, frowned upon by many repeater users. If you have an emergency call then in our opinion you should just go ahead with the information, not wait to be invited to enter the conversation at some future time. The policy in some areas is, quite correctly and legally, to simply ignore these (illegal) 'break' transmissions. However, a kind word by one of the repeater group's members to a newcomer operating incorrectly doesn't go amiss, rather than a stern public ticking-off. Today we've had a phone call from a newly licensed 2m repeater user who tells us he and many others are 'barred' by the repeater group from using the repeater because they live outside the boundary of the (small) city it's located in. The city also has a 70cm 'community' repeater for local use, 2m repeaters instead being licensed as 'area' coverage units. We're helping him take this matter up. To spare retributions, we've not published our readers' details.

Dear HRT,

I thoroughly enjoy your magazine. I'm disabled but I love radio whether CB or SWL, I'd love to have a RA licence, but cannot remember one day from the next, never mind what's in the RAE manual. Maybe if there was a Novice group near I'd give it a try, but no one is interested, it's sad but true. I think it is right in a way to continue with the Morse test, so frequencies wouldn't be overcrowded as with CB. At the same time, any amateurs I have spoken to at clubs and rallies say they haven't used it since their exam, and probably couldn't do it now.

I keep hearing about 'wallies' on CB, but recently I was listening to 2m and was really surprised to hear music being played, bucketmouths, and also mike keyers. I couldn't believe it, it seems to be happening everywhere.

Yours sincerely,  
John Redmond.

### Editorial comment;

**In our area, no-one bothered either, sad but true also, so we registered as Novice instructors. We don't want to 'keep the numbers down', the more amateurs, suitably regulated with appropriate licences, the better in our opinion! The difference appears to be education in on-air practices, we haven't heard any 'wally' Novices yet.**

Dear HRT,

In reply to Robert Cooper's letter in the March issue of HRT, I have found that you can get better service when dealing with the smaller dealer, rather than the national chain shops. I have found this when buying computer accessories. Also after having bought my scanner by mail order, the dealer was only too pleased to be of help with advice on how to get the best out of it, even after it was bought and paid for.

Maybe it would be a good idea if you

## £10 for the Letter of the Month

Do you have something constructive to say on the state of amateur radio today? Perhaps you'd like to put your viewpoint to the readers, get some discussion going, or give an answer to one of the issues raised? We'll pay £10 for the best letter we publish each month. So write in with your views, to HRT, A.S.P., Argus House, Boundary Way, Hemel Hempstead, HP2 7ST.

# "TONE" BURST

DRAWN BY GEMINI



printed a league table of dealers in order of helpfulness, this might prompt the less helpful dealers to pull their socks up.

Yours sincerely,  
Mr. J. H. Thomas

## Editorial comment;

**We're pleased to publish letters from amateurs saying which dealer they've had good service from, send them in! Maybe we'll give an award to the one with the most testimonials at the end of the year!**

Dear HRT,

With reference to the Gulf War communications in the January 92 issue. Remember that it was lack of communications that killed most of our troops by the so-called friendly fire.

73, John G4BYV

## Editorial comment;

**Maybe the people initiating the 'friendly fire' should also have used packet radio to communicate!**

Dear HRT,

With reference to 'Helping Russian radio hobbyists'. A very practical way would be to send small parcels of components and circuit boards, mixed in with a few transistors and strips of multi-core solder.

If one of the second hand component suppliers wishes to expand, there would be unlimited opportunity to establish a system of selling components over there, using imported components as the inward investment, and acquiring shops and staff, and living

there in the Russian cities by means of the Roubles paid by the young (and not so young) experimenters for the goods.

Yours sincerely,  
Maurice Hatley, GM3HAT

## Editorial comment;

**Anyone fancy setting up in UA land then?**

*We've had many letters regarding the mandatory Morse test, most of these simply expressing personal opinions for or against the use (rather than mandatory testing) of CW, rather than offering constructive ideas. As we stated in the March 92 issue 'letters' page, only constructive discussion will be published, here's a roundup of such;*

If there was an alternative course of study running alongside the Morse requirement for those who find technical or operating techniques more profitable to learn, then I would be the first to enrol. All aspects of HF operation could be encompassed and experienced by novices to those bands. For those who wish to enter the A licence category by way of Morse, then there is no reason why this choice should remain as is.

The operating standards of this fine hobby will only be advanced by education, and leading by example of those who have an appetite to improve themselves, and wish to make a positive contribution to the world of amateur radio. To those who feel they have 'arrived' or whose attitudes have hardened over the years, I would say sit back and take a look at the hobby from a fresh perspective, there is a lot going on out there, every bit as enjoyable as Morse to those involved at whatever level.

Les Wolstenholme, G0RDF, Novice Instructor.

If the Morse test is to be replaced by a paper on EMC, how is the quality of Morse code being transmitted on the HF bands going to be assured? Perhaps those of us who are interested in Morse would be required to take the Morse test as a third hurdle before gaining access to our preferred mode of communication on HF? If that must be so for Morse users, why not a third paper for those like G7JCJ who are interested in Packet Radio? I suppose I will have to accept that the days of the Morse test are numbered. For my own selfish reasons, I only hope I can pass the RAE and the Morse test before the rules are changed.

C. H. Hawes.

I decided to ask my wife (who knows nothing about radio) what she would do if she were head of a governing body. I explained briefly each band 160m up, and their allocation for each mode, and then A and B licence allocations. Her reply was "why not let them use the parts of the band that are not allocated to CW only, if the Morse test hasn't been passed". Why not? If any stipulation or extra qualifications should be gained, then logically this should be in band planning, licensing conditions, and operating practice and procedure.

Justin Johnson, G0KSC

In order to permit all licensees the right to derive pleasure from the hobby, would it not be a simple matter for the powers that be to find some other method (if necessary) to separate the A from the B licence, without having to take the Morse? Those wishing to use Morse could then take a separate course 'on the key' if they so wish. Those not wishing to will have no need to.

L. R. Rees, GW0RIL

Why do the authoritative body insist we take a CW test to allow us to operate on the HF bands? Is it philosophical to separate the chaff from the corn. Discipline + dedication + perseverance = achievement, produces a conscientious operator. They could ask us to learn the Euro languages, then take a mental test with a linguist, it would achieve the same result (hard work) and dedication. It would be a retrograde step not to carry on with the CW test, but there could be an alternative system which could be run side by side, the student having the option of choice.

J. A. Blake, G8FYD

Given that A and B licences are to continue there will indeed have to be a distinction in qualification and of course in facilities afforded. I propose the Class B should allow use of up to 100W pep, and Class A the maximum power to be permitted at any one time. This would fit in with the frequent and natural progression from 'barefoot' operation of a 100W rig to linear amplifier, and a supplementary examination to qualify for Class A, with emphasis on the practicalities, limitations and dangers of higher power valve and solid state amplifiers would be seen to be meaningful. The status of existing Class B licensees would have to

be determined, even if the power restriction were applied that might be acceptable with access to HF as compensation.

A problem with any such approach is to develop and demonstrate to authority a wide measure of support for it, not uniquely, I have found the RSGB exasperatingly negative to anything not of its rulers' invention. We have sorely needed a mechanism to collate and express the view of the amateur body within and without the Society, and I am grateful to see signs of just that.

Sandy, GM0IRZ

Dear HRT,

I refer to the article in the Radio Today section of the May 1991 issue entitled 'CW Kills?' This article came to my attention just recently, hence the delay in writing.

During the year 1990 I sat for and passed the RAE, and in order to get on the air I purchased a second hand FT-290R. For some months thereafter, before I built an outside shack with external vertical aerial, I used the rig in my living room with the extendible metal aerial which is part of the unit.

In the early months of 1991 I became aware of a growth on the left hand side of my head behind the ear and eventually having sought medical help I underwent

an operation for the removal of a sarcoma (cancer) and am only now getting back to normal after some weeks of radiotherapy treatment.

During the period prior to the operation I mentioned to the consultant that I was a radio ham and asked if perhaps this could be the cause of my problem, he said that he thought it very unlikely. I personally was of the opinion that the electromagnetic effect could have acted as a trigger but in view of the consultant's comment I did not pursue the matter.

Your article 'CW Kills?' however now raises the issue again in my mind and I wonder if in light of your comment that you 'will be keeping an eye on this one' and have any further information which, while not helping me a great deal, might serve as a caution for others?

Yours sincerely,

R. J. MacKenzie, G0NVH

#### Editorial comment;

The brief feature on this concentrated on the on-off keying aspects affecting the brain, rather than constant RF fields. There's much medical research being done, and we learn new things each day, this of course being called progress. As said then, we'll be keeping a careful eye on this one!

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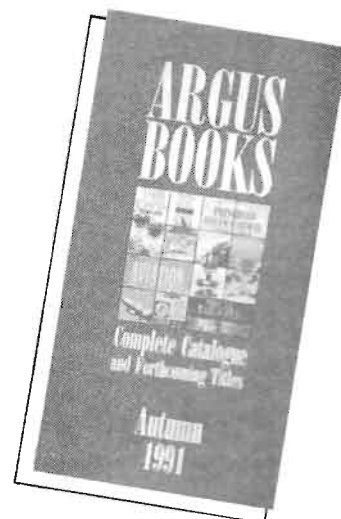
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two external speaker sockets are fitted. Using these lets you to have 2m audio and 70cm audio coming out of separate speakers, either one internal and one external, or both external.

The microphone socket is one of the so-called 'American telephone' types which are now starting to be used on mobile rigs. An optional adaptor lead to a 'normal' socket is available in case you have problems wiring accessories, such as a hands-free microphone, up to this.

**Chris Lorek G4HCL**  
*goes fully remote control with Kenwood's latest Dual Bander*

# Kenwood TM-732E Review

On opening the box, I looked at the tiny rig in front of me. Is this *really* a 50W dual band mobile? A detachable front panel as well? Where's the heatsink? These things are getting smaller each day!

## Features

I'm not going to bore you with all the usual 'it operates on 2m and 70cm in the usual way with lots of memory channels and this is a description of what every knob does' stuff, suffice to say it does all the things you'd expect of an up-to date dual bander to do. In a tiny box. It measures 141mm x 42mm x 175mm, giving 50W maximum output on 2m and 35W maximum on 70cm, plus 'mid' and 'low' power levels of around 10W and 5W on each for when you don't need to hit every repeater on channel within 100 miles of you.

With a few clever button-pushes when you switch the set on, it can operate as a cross-band repeater, for local control from your handheld for example (as our licence in the UK allows us to). If your handheld has a DTMF pad on it, you can even remotely QSY the TM-732E in your shack while you're sitting in your lounge or whatever, and carry on your QSOs using the rig into your rooftop aerial system, all from a handheld. 'I'm going to have great fun with this' I thought.....

## Basics

Down to a few basics. The rig comes supplied as shown in the photos, with a mobile mounting bracket and a remote control microphone. What's this, more remote control? As well as the usual Up/Down, PTT and 1750Hz toneburst buttons, three extra buttons control VFO and Memory channel functions, plus a 'programmable' function which initially comes as 2m/70cm band change. Even though the set itself is quite small, the entire front panel of the set can be detached, and if you delve into your wallet a bit deeper you can buy a remote mounting kit which lets you place the radio section somewhere out of the way, like under the car seat or in the boot, and the fascia where you can see it, for example on top of your car's dashboard.

## Connections

A single aerial lead comes out of the set, terminated with an N-type socket. This lets you use one of the many dual-band mobile and base stations aerials without needing an external diplexer, alternatively you can add one of these if you want to use dedicated 2m and 70cm aerials for optimum performance on each band. As well as the small internal speaker mounted on the top of the set,

## On the Road

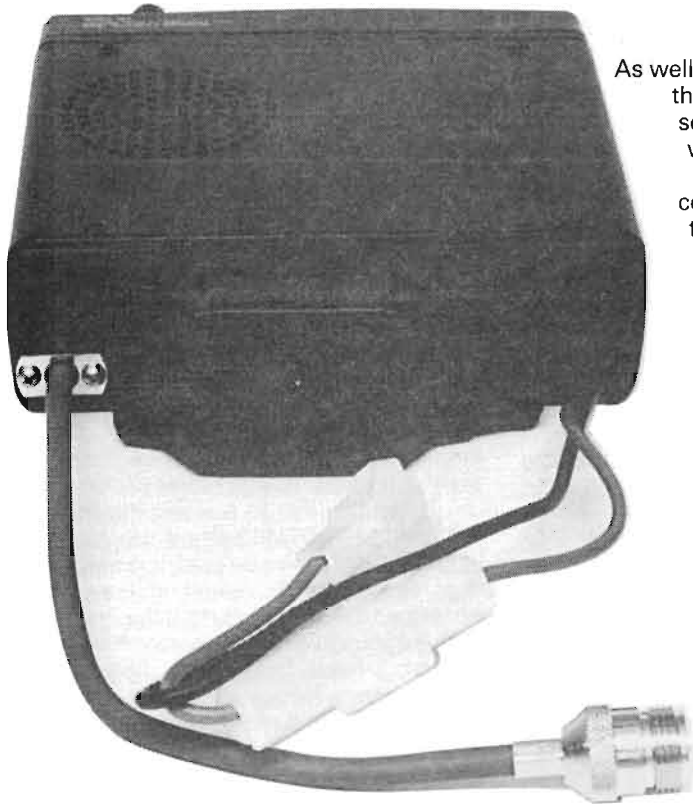
The size of the set allowed it to fit in many places in the car, I eventually settled with it in my 'usual position' on top of the car's dashboard, allowing a minimal shift between looking at the road ahead and at what the rig was doing.

After the usual 'memory programming' operations I found I used the remote buttons on the microphone to control the rig most of the time. I did however find it difficult to remember when using this rig that I had to keep the 'MR' button pushed for a second or so to set the rig scanning, rather than holding one of the 'Up/Down' buttons pressed for a second or so as I've become used to.



With the speaker mounted at the top of the set, I found there was plenty of receive audio available due to the 'wind-screen deflection' in the position I located the set. You may find an extension speaker useful to save distortion at high volumes if you have the set mounted under the dash. But I found that during lengthy on-air chats the set got hot, very hot, and I had to make very sure it was well ventilated so 'glove-box'

four levels, with a multi-button operation, for operation at night. I did find this awkward to have to do each day, and I'd have preferred a simple 'dim' button or an 'auto dimming' facility. When trying to dim the display while on the move, I often placed the rig into low power mode by mistake using the combined button, the 'L/M' TX power indication on the LCD being tiny which I could hardly see at a quick glance.



### In the Shack

As well as giving the set an 'on the road' test, I also spent several days of operation with it in my shack, both locally and remotely controlled. Connected up to my rooftop dual band colinear, I found the 2m receiver to be very sensitive, hearing distant repeaters with ease, although probably due to this I found my local 2m packet node 'desensitised' these weak signals, more so than

I'd noticed using other sets. As with mobile operation, I found the set became very hot in use, although the quiet thermostatically-operated fan kept the rig from melting away!

A novel use of the set was its ability to receive two frequencies on the same band in place of dual-band receive, each with independent control with transmit ability. Of course it wasn't possible to receive on one frequency whilst transmitting in the same band, but I found it very useful to be able to listen out on a given channel whilst leaving the 'other band' to scan around for general activity.

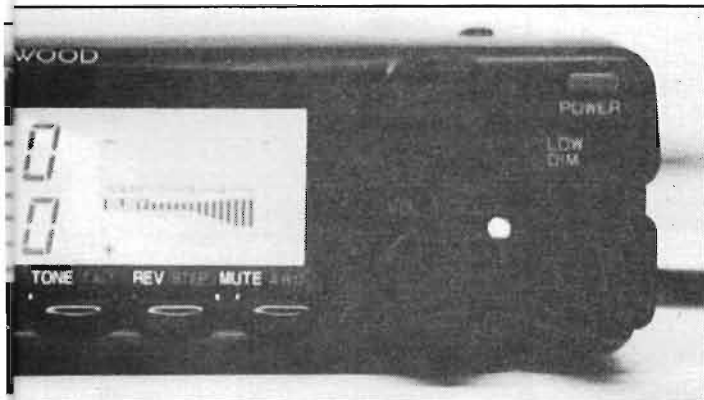
As well as the usual 'noise squelch', where an absence of noise causes the squelch to raise, the set could also be programmed into a 'carrier squelch' mode where the squelch knob controls the S-meter level needed for the squelch to raise. This was handy for monitoring one of my semi-local repeaters (which doesn't yet use CTCSS), co-channelled with a distant repeater, to give my ears a rest when both were coming through. I also found it very useful for 'remote monitoring'.....

### Remote Operation

A little-realised fact amongst UK amateurs is that we are allowed to remotely operate our transceivers, using amateur frequencies for control and linking, within the confines of our premises (read your licence).

mounting was definitely out.

A useful feature of the set when operating in memory channel mode was to have the channel, i.e., 'CH 05' displayed in large digits, in place of the frequency in similar size digits accompanied by the smaller memory channel number. This again helped me see what the set was doing with a quick glance when I was on the move. The LCD backlight could be manually 'dimmed' in





**Squelch Sensitivity;**

	145MHz	433MHz
Threshold;	<0.06uV pd (<2dB SINAD)	0.08uV pd (3dB SINAD)
Maximum;	0.150uV pd (19dB SINAD)	0.240uV pd (24dB SINAD)

**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	433MHz
+12.5kHz;	58.0dB	57.5dB
-12.5kHz;	36.0dB	42.0dB
+25kHz;	74.0dB	74.0dB
-25kHz;	73.5dB	72.5dB

**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	433MHz
+100kHz;	89.5dB	89.0dB
+1MHz;	92.5dB	94.5dB
+10MHz;	95.5dB	96.0dB

**Intermodulation Rejection;**

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

	145MHz	433MHz
25/50kHz spacing;	70.5dB	69.5dB
50/100kHz spacing;	70.0dB	69.5dB

**S-Meter Linearity;**

Indication	145MHz		433MHz	
	Sig.Lev.	Rel.Lev.	Sig.Lev.	Rel.Lev.
S1	0.23uV pd	-17.4dB	0.26uV pd	-15.0dB
S3	0.37uV pd	-13.2dB	0.37uV pd	-12.0dB
S5	0.64uV pd	-8.4dB	0.57uV pd	-8.4dB
S7	1.06uV pd	-4.1dB	0.97uV pd	-3.8dB
S9	1.70uV pd	0dB Ref	1.50uV pd	0dB Ref
S9+	2.89uV pd	+9.2dB	2.68uV pd	+5.1dB
S9++	6.24uV pd	+11.3dB	5.25uV pd	+10.9dB

**LABORATORY RESULTS:  
RECEIVER;****Sensitivity;**

*Input level required to give 12dB SINAD;*

145MHz	433MHz
0.110uV pd	0.160uV pd

So I read the TM-732E instruction manual carefully, placed a 2m/70cm diplexer in line and a dummy load on the 70cm port, put the set into cross-band repeat mode, and hey presto, it worked. Well it did one-way, playing about with a few buttons sorted out the operation manual omissions and I was then pleased to wander around my house, listening to 2m from my rooftop aerial on my 70cm portable. Using my portable in 'extra-low' power mode I could nicely reply back once the 2m carrier had dropped. Hence 'remote' operation on a repeater channel was virtually impossible, but listening on a local simplex 'chat channel' was rather useful.

Extending this to full 'remote control' using the DTMF pad on my 70cm handheld also took a bit of experimentation, again due to operating manual omissions, but eventually I got the 'hang' of this. I found I had to remotely disable the cross-band talkthrough before I could change frequency and the like, then place cross-band talkthrough back in use to listen, with all the DTMF tones going out on 2m (repeated from 70cm) this eventually became rather awkward although still useful.

In cross-band remote operation, the audio quality was excellent both ways, and I really did find it handy to have a 'wireless microphone' to use around the house and shack!

**Maximum Audio Output;**

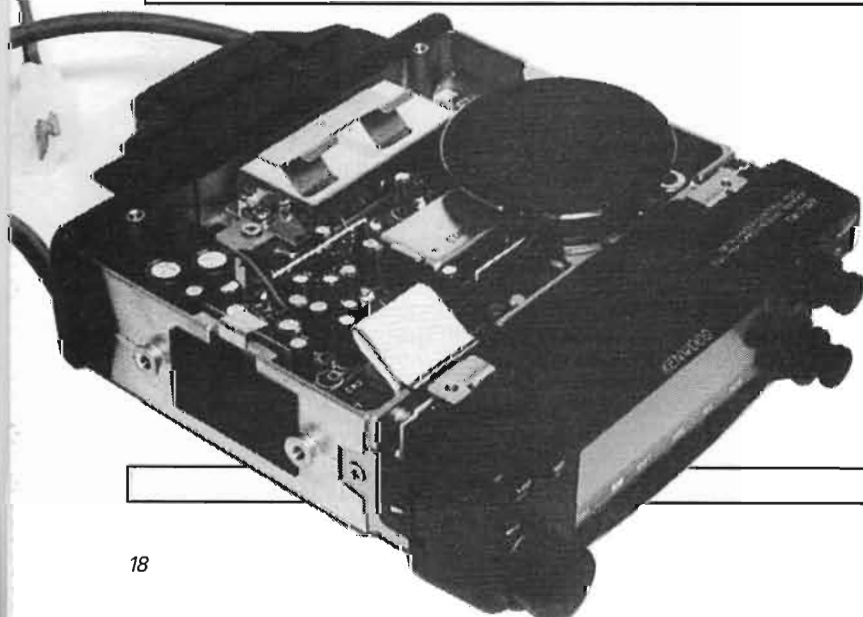
*Measured at 1kHz on the onset of clipping, 8 ohm load;*

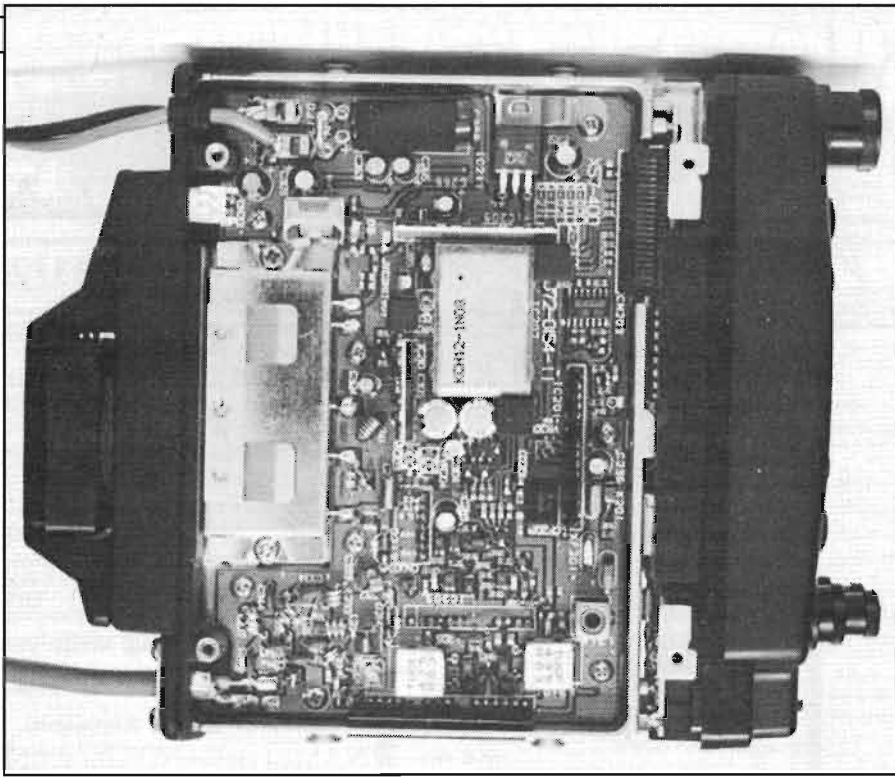
145MHz	433MHz
2.08W RMS	2.23W RMS

**Image Rejection;**

*Increase in level of signal at first IF image frequency over level of on-channel signal to give identical 12dB SINAD signals;*

145MHz	433MHz
> 120dB	83.5dB





### Insides

Not surprisingly with its small size, the set's internal construction is tightly packed with circuitry galore. The PA modules are fitted to the rear of the set's case, a fan being fitted to a small heat sink/cooling duct on the rear panel to cool the set when needed, for example during transmission periods.

Two independent receivers are used, the VHF one also having a switchable AM detector stage in the IF, no doubt included for aircraft band reception in 'extended receive' coverage versions of the set in countries where this is allowed. High IFs of 45.05MHz and 58.525MHz are used for VHF and UHF respectively, to give good image rejection over a wide receive bandwidth. The transmitter uses separate RF circuitry for each band with a combined microphone amplifier, the two PA outputs being fed through a combination of low-pass and high-pass filters functioning also as the VHF/UHF twin-band aerial combiner.

### Laboratory Tests

The 2m receiver sensitivity was very good, and looking at the measured maximum squelch setting on this band it equates to a 'normal' sensitivity of some sets. This confirms the usefulness of the 'carrier squelch' facility which I found handy when monitoring from home! In general, the strong signal handling capabilities of the set were very good, the on-air 'desense' probably being due to the good sensitivity, all 'dB' figures as measured of course being relative to the ultimate sensitivity of the set.

On transmit the set gave a good account of itself, with sufficient output power very close to the specified levels

and with good rejection of harmonics, particularly so on 70cm. The deviation was correctly set at below the 5kHz mark, but I noticed the 70cm side to be about 1kHz off frequency, although this didn't seem to cause any problems on-air. This could have been due to heat, as the set did get very hot when used on transmit.

### Conclusions

It's a tiny set, offering a wide array of operating functions, I particularly liked the remote control microphone facility for mobile use. The capability of 'remote operation' of the set at home was useful for simplex contacts, and I'm sure amateurs will eventually 'catch on' to this method of 'being in the shack when you're somewhere else in the house'. The set performed very well all-round, but I was concerned with the heat generated, it's small case not helping this. If you're going to use it for long 'ragchews' I'd advise switching the transmitter onto a lower power level.

*My thanks go to Lowe Electronics Ltd. for the loan of the review set*

### TRANSMITTER

TRANSMITTER;				
<i>TX Power and Current Consumption;</i>				
<i>Voltage Supply</i>	<i>Power</i>	<i>145MHz</i>	<i>433MHz</i>	
10.8V	High	42.7W/9.90A	19.7W/6.35A	
	Mid	11.0W/5.20A	11.4W/4.75A	
	Low	5.70W/3.90A	5.33W/3.55A	
13.2V	High	49.7W/10.65A	33.7W/7.20A	
	Mid	11.1W/5.40A	11.7W/4.75A	
	Low	5.70W/4.10A	5.38W/3.60A	
15.6V	High	51.6W/11.05A	41.3W/8.55A	
	Mid	11.2W/5.50A	12.0W/4.80A	
	Low	5.75W/4.30A	5.44W/3.80A	

Harmonics;		
	<i>145MHz</i>	<i>433MHz</i>
2nd Harmonic;	-64dBc	<-90dBc
3rd Harmonic;	-73dBc	<-90dBc
4th Harmonic;	<-90dBc	<-90dBc
5th Harmonic;	<-90dBc	-
6th Harmonic;	<-90dBc	-
7th Harmonic;	<-90dBc	-

Peak Deviation;	
<i>145MHz</i>	<i>433MHz</i>
4.97kHz	4.66kHz

Toneburst Deviation;	
<i>145MHz</i>	<i>433MHz</i>
4.09kHz	4.06kHz

Freq Accuracy;	
<i>145MHz</i>	<i>433MHz</i>
-360Hz	-1.10kHz

# Conversion Project — Storno 900

The more I speak to other radio amateurs, the more I realise there are so many areas of amateur radio that can be enjoyed. I for instance never use CW, despite having passed the Morse exam twice! But I do get a great deal of pleasure from construction and modification of equipment. With this in mind, I decided to put together a complete VHF packet station within a target cost of around £100, this consisting of a TNC, terminal or computer, and a transceiver. I already had several power supplies and aerials (ants have antennas, not amateurs!).

## TNC

The cheapest and simplest stand-alone TNC available is by far the G0BSX TNC designed by Peter Meiring, and after building this it's surprising how much more you understand packet!. I know there are systems designed to run within a PC computer but this would have taken me far outside my £100 budget.

The board, circuit, full data and TAPR Eprom cost £15-20 from Peter, it's all you need. The rest of the components cost £30-£35 (maybe cheaper if you shop around), and I never did buy a case!

## Computer or terminal?

After visiting several rallies and looking at what was on offer, I decided that rather than have a simple dumb terminal, I would look for an old CPM computer. For younger amateurs, CPM is the operating system that was around before the MSDOS on the IBM PC compatibles.

It was at the Holsworthy rally I found an old Kaypro 2 computer with twin disc drives. This cost me just £15, including the operating system and terminal software. It was then simply a case of plug in and away you go. I currently use it with XON/XOFF protocol in communicating with the TNC, thus only pins 2, 3 and 7 are used on the RS-232 serial port. Pins 4 and 5 are linked together as also are pins 6, 8 and 20 at the computer end, which I believe works with the majority of older CPM computers.

## Transceiver

My next acquisition had to be a transceiver. I wasn't worried about size, as with my eyes the bigger the set was the better! At the Bristol rally I saw a card

**Barrie Kissack G3MTD  
converts the Storno 900 to  
2m for packet use**

board box under a stall and what should it contain, but a largish transceiver, about 30cm x 35cm x 8cm. The stall holder told me it was a high band FM rig made by *Storno*, and as I could see high band frequencies on its label I decided to buy it for £15. It came complete with controller, a junction box and cabling.

Armed only with the part number I later rang Storno (now Storno-Motorola) to enquire if a manual was available, the answer was yes but there was £25 minimum charge and the manual didn't have any alignment details! I eventually managed to get some photocopies of the required data.

The part number of my box was SM9114D025AP, and from the data supplied this stood for;

SM9 — Product code (Storno/Motorola?),

1 — TX frequency range (138-174 MHz),

1 — RX frequency range (138-174 MHz),

4 — 12.5kHz channel spacing,

D — Duplex,

025 — Power output 25W,

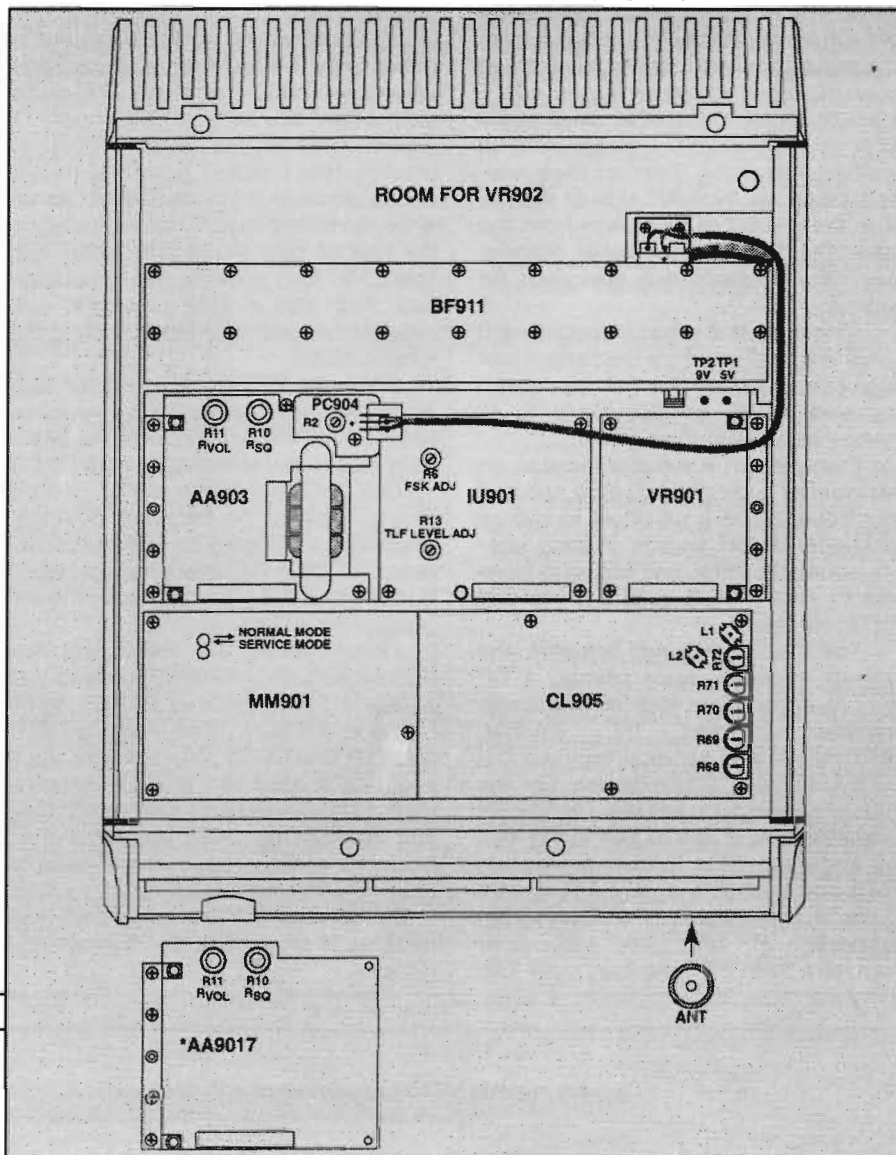
A — Synthesised,

P — Public.

I had already decided that all I wanted the Storno for was packet usage. As it used 12.5kHz channel spacing filters it would not be particularly suitable for voice, although little problem with packet.

## The Conversion

Here's how to get the set going on 2m. Open the case by simply turning the key and moving the carrying handle forwards. The top lifts up and you now have access to the RF modules. To open the bottom an Allen key is required, this section gives access to the AF, computer and voltage regulator modules. See the accompanying diagram.



Put to one side the control box, (which is microprocessor controlled), the junction box, and cabling. The cable with the large multi-way connector on the end I used as a means of supplying the DC supply and providing speaker connections. I removed the remaining wiring from it. Next remove the following boards referring to the layout diagram;

**BF 911** — the branching filter, remember the rig is duplex. The receiver frequency is normally at least 4.5MHz away from the transmitter frequency, and the branching filter consists of several helical filters to stop the TX frequency going into the RX and vice versa. We will of course need to add relay switching and re-tune, see later.

**CL905** — this is the computer interface to the control box, we will need to add manual controls, see later.

**MM901** — this is the memory module associated with CL905. Yes the CL905 is another microcomputer, and I haven't thought of a use for this yet!

**PC904** — if fitted, this unit is used to reduce the power to around 2 watts.

## Hardware Modifications

In the area vacated by the branching filter, you'll need to mount three 12V relays. These are an aerial changeover relay (in place of branching filter), a relay to remove supply to receiver mixer stage when switched to transmit, and a PTT relay to drive transmitter and mute receiver on transmit. I glued mine in position, mounting them so their contacts faced the 'non-RF' side of the set. Wire the coaxial cables taken from the branching filter via the aerial changeover relay contacts, non energised for receive.

Originally the volume and squelch levels were adjusted by the control box microcomputer, as this has now been removed it will be necessary to fit manual controls in their place.

For these, select a suitable location on the 'non-RF' side of the Storno and drill four holes in the front panel to suit an additional on/off switch, volume control, squelch control, and socket to interface to your TNC (I used a 5 pin DIN socket for this).

For the volume and squelch, the original microprocessor offered a DC level to appropriate pins on the audio amplifier (marked U2, AA9014, M905748G1) and squelch (marked U3, SO903, M905752G1) modules. For the manual controls you will need to provide a variable level of 7.5V to 3.6V to pin 10 of the audio amplifier (socket connection J1-4), and a variable level of 3.8V to 2.0V to pin 14 of the squelch module (socket connection J1-16). I used two potentiometers from my junk box, both 22k,

you will need to select the resistors to give these voltage levels. There are also two presets on the audio amplifier which additionally control both volume and squelch. To mute the receiver or loudspeaker on transmit, locate J1 pin 3 (Loudspeaker) or J1 pin 8 (receiver) on the audio amplifier module and ensure one is taken to earth via a spare relay contact.

For the On/Off switch, locate pins 15 and 16 on the front panel multi-way plug and wire the switch contacts between these. If you find this difficult, locate the voltage regulator and fit the switch between pins 6 and 7 of this instead. If you do not want an On/Off switch, simply link it out.

The receiver sensitivity is quoted as being 0.35 uV for 12dB SINAD. If this isn't sensitive enough, you may at this stage like to fit a commercial or home-made receive preamplifier. If so, wire it in series with the miniature coaxial cable that went from the branching filter to the receive mixer (now via a relay contact), ensuring that its 12V supply is removed on transmit. In any case, locate Pin 4 on the receive mixer unit which carries its 12 volt supply. Break the track on the main interconnection board and take this via the same relay contact to 12V, this removes the receiver front end supply on transmit.

On the transmit audio side a preamplifier may be necessary, depending upon your TNC, between the TNC audio output and the set's exciter input. 1V peak-to-peak is required at J2 Pin 9, to provide this I added a simple microphone preamp from the ARRL Handbook. A voltage supply can be found on the row of pins where the IU901 was fitted, Pin 10 is positive, pin 15 is negative. Add also a 10uF capacitor (any polarity) between pin 1 and 2, this is the receive audio.

Wire the PTT input from your connector to the remaining relay, wired so when this PTT line is connected to 0V the relay closes and presents an earth to the TX ON/OFF input on the exciter module. This is J1 pin 29, on the row of pins that originally connected to the computer board (CL 905). Remember to connect a dummy load if you're initially testing the transmitter switching.

Finally locate the Audio Amplifier board AA90016 or AA90017, and connect a wire to the junction of R4 (10k, to be found at the front of the module U2 — AA9014), and C1/C2. Take the wire, via a capacitor around 10uF, to the front panel audio output connection. For normal use you can take the audio, via a capacitor, from the speaker but you will need to attenuate it a great deal, the audio output is 10W so watch your ears! All that now remains is to replace the crystals and realign.

## Crystals

The crystal frequencies are calculated as follows;

*Receiver frequency* = Crystal x 3, + 21.4MHz (IF), + synthesiser (12.8MHz to 15.9875MHz).

*Transmitter frequency* = Crystal x 3, + synthesiser (12.8MHz to 15.9875MHz).

Thus to give 144.600MHz to 144.775MHz I chose to use 36.45416MHz on RX and 43.5875MHz on TX.

Remove the cover of the Transmitter EX911, and remove the unit labelled Y2 X0906, it just pulls out. Take out the crystal and replace with the new one, and replace the unit. Now remove the cover of the receiver frequency generator FG911, remove unit Y1 and replace it's crystal, and again replace the unit.

All modifications are now complete and the unit now only requires realignment.

## Voltage checks

With the supply set to 13.8V, the rig would normally take about 1.5A on receive and 9A on transmit. But with the modules removed, mine took 450mA on receive and 8.35A on transmit with 30W output. To check the voltage regulator, connect your meter between TP1 (JP904) and earth, you should read 5V +/- 0.2V, and on TP2 you should get 9V +/- 0.4V. VR 901 adjusts both the 5V and 9V lines.

## Alignment

First you'll need to set the set's frequency synthesiser to the frequency required, using the front edge Pins 2-1 to pins 2-8. You may alternatively link them on the pins vacated by the computer board CL 905.

The rig is channelised into 256 channels each 12.5kHz apart. The channel section is carried out by altering the frequency of the synthesiser which in turn, if it is in lock, alters the frequency of both the receiver and transmitter. As follows;

Synth Pin No.	Freq
2-8	12.5kHz
2-7	25kHz
2-6	50kHz
2-5	100kHz
2-4	200kHz
2-3	400kHz
2-2	800kHz
2-1	1600kHz

Thus by changing the logic state on the pins listed above, the rig will change by the frequency stated. If you want to use the rig for continuous coverage, you simply require extra logic or maybe switches.

# PMR Conversions in HRT

Over the years there have been many PMR conversions in HRT, see our January 1992 issue for a full list. Photocopies of the articles are available from the Reader Services Dept, ASP, Argus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, £1.50 per article (cheques payable to ASP).

*Back issues for the past 12 months available from:*  
Argus Subscription Services, Ham Radio Today, Queensway House, 2 Queensway, Redhill, Surrey.

I only required it for packet use and therefore preset it to 144.650MHz with wire links.

The frequency synthesiser shouldn't need any alignment at all, however the following receiver and transmitter alignment details are based upon information from the Storno manual, using a analogue 20k/ohms voltmeter and metering points on the 'RF' side of the rig.

## Transmitter

Note that all transmitter adjustments can be carried out with the power output modules *unplugged* or with a dummy load in output socket — remember to connect a suitable 50 ohm load to the set's aerial output socket.

On the transmitter exciter (EX911); Key the transmitter and check that the oscillator frequency is 43.5875MHz, connect a voltmeter between 1 and 10 on metering block and adjust L3 in XO906 for maximum reading. Then adjust L12 for maximum, L13 for minimum, and L14 for maximum, the minimum should be around 0.1V.

Move your voltmeter to points 1 and 9. In the exciter adjust L12, L13 and L14 for maximum, and repeat until there is no further improvement. Connect your meter to points 1 and 7, and adjust L3, L4, L5 and L8 for maximum reading, you should get at least 0.25V. Note that L8 can be in a position where absolute maximum does not appear, if so choose another setting of L8.

Unkey, plug in the transmitter output power module, and you should now be able to read the output power if you connect a power meter in series with your dummy load. The output module does not require any adjustment apart from adjusting R on the PA module to vary the power output.

## Receiver

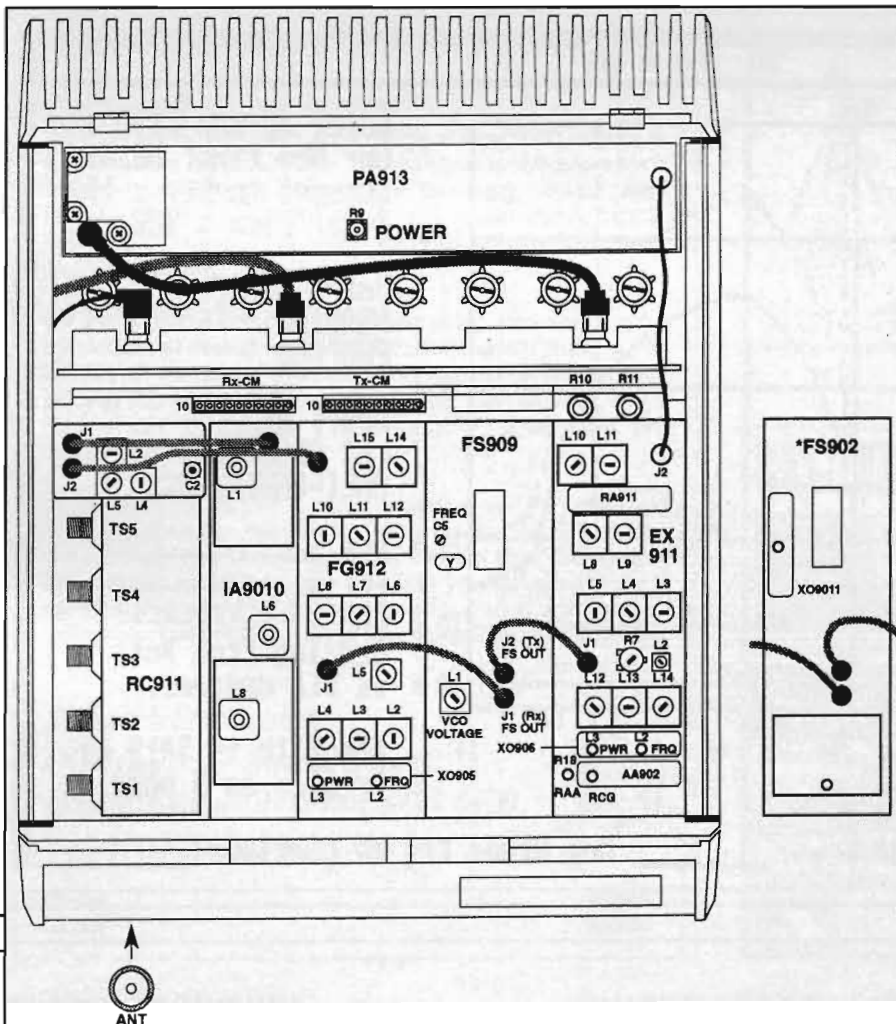
On the frequency generator module FG912, adjust L2 for the frequency required at test point J2. Then connect your meter to points 1 and 6 and adjust L5, L6, L7, L8, L9, L10, L11 and L12 for maximum voltage reading. Now connect your meter between points 1 and 5 and adjust L14 and L15 for maximum reading, also adjust L2, L3 and C2 in the front end module RC911 for maximum reading.

The receiver will be *Very* insensitive before the front end is adjusted. Either tune to a strong local signal with an aerial attached, or connect a signal generator set 100mV output to the aerial input, connect your meter to receiver points 1 and 6 and adjust the slugs (TS1 to TS6), C2 and L4 for maximum meter reading. Decrease the signal input level to fine tune.

There should be no adjustments required on the IF amplifier. Finally, connect a loudspeaker, and with a strong modulated signal being received (a level of 1mV if you have a signal generator adjust L1, L6 and L8. All adjustments are now complete.

## Conclusion

I have found the set to be an excellent rig, it has now been in use 24 hours a day for many months, the massive heat-sink always remains cold. My thanks go to Doug G3AKJ for the use of his signal generator and help with the alignment. Anyone requiring assistance on the Storno or CPM computers as terminals, may contact me Barrie Kissack G3MTD, The Old Saddlers, Church Street, Braunton, Devon, EX33 2EL or via packet @ GB7AKJ (AKJBBS).



# HF Propagation Prediction Software

*Don Field G3XTT looks at PC-based alternatives to the crystal ball*

Forecasting HF radio propagation is very much like weather forecasting. There are many different factors at work, and long-distance paths add to the complexity by, for example, passing through day/night boundaries or through the auroral zone. As in weather forecasting, history can be a guide. When the sunspot count was last at this level, at this time of the year, with the 'A' index (a measure of auroral disturbance due to ionised particles emitted from the sun) the same as it is now, then propagation behaved in a certain way. So we might expect that to happen again. However, as with weather, the number of variables is so large that history rarely repeats itself exactly.

To help the process along, it is possible to buy books of tables which tabulate the more important variables (sunspot number, date and time, etc.) and allow you to make a stab at forecasting MUF (Maximum Usable Frequency)

for the path you are interested in. This is a tedious process, and the advent of computers presents the opportunity to automate some of it. But, just as weather forecasters always want to buy the biggest and best computers, so propagation forecasters want to do the same. Why?

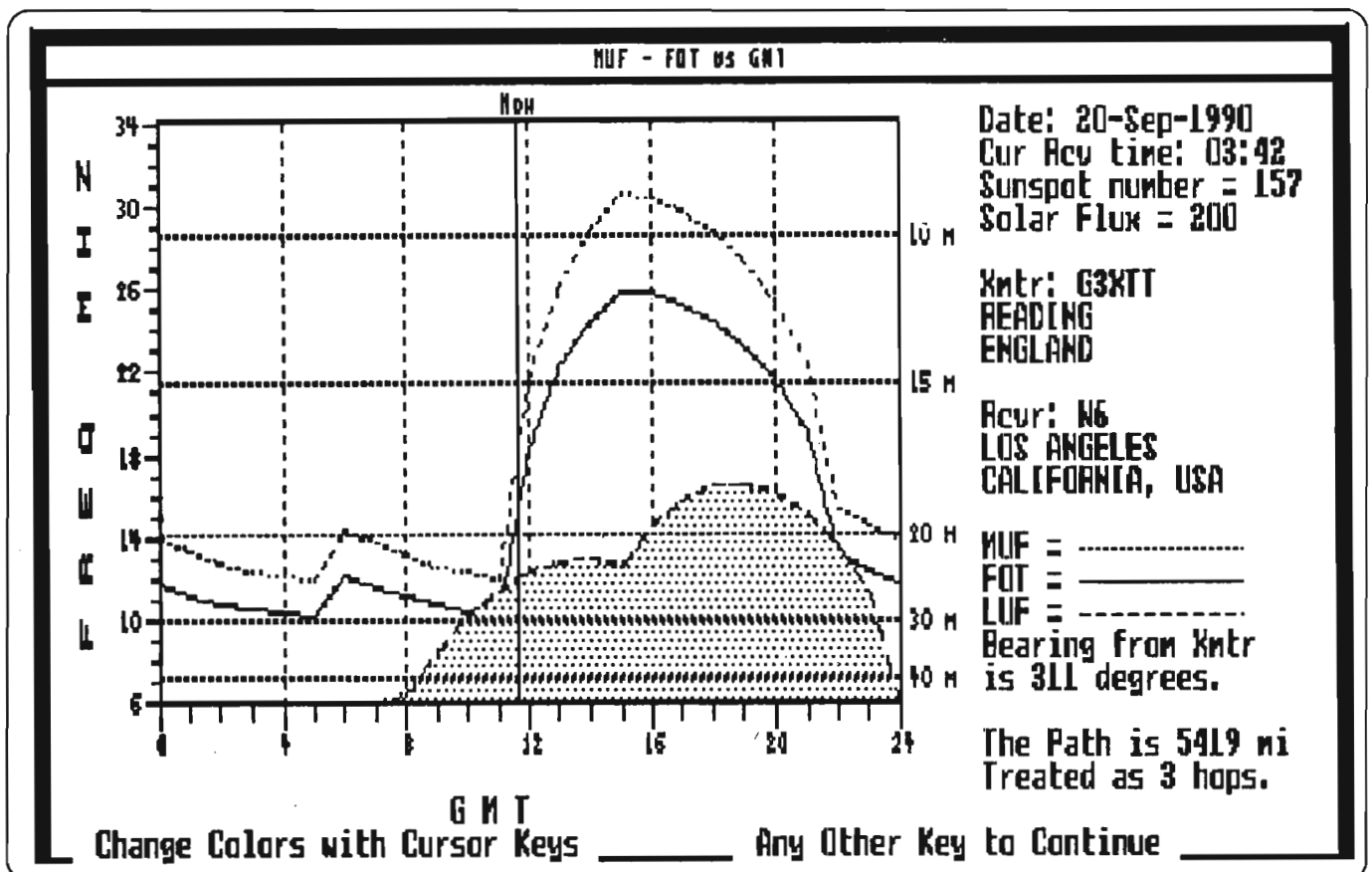
Again, it is to do with the sheer complexity of the task. One of the most popular propagation forecasting programs for many years was *MINIMUMUF*. This program is simple enough to run quickly on even the earliest personal computers, however this is because it simplifies the calculations to the point where a number of compromises have to be made. Essentially, *MINIMUMUF* only looks at the two ends of the path (for example the UK and

Australia) to work out the MUF. It therefore ignores the fact that half way along the path the MUF may be much lower.

As computers have become more powerful it has been possible to introduce more complexity into the calculations to take account of intermediate reflections along the way, and to look at both long and short path propagation. To do this for many different destinations would still take up a lot of computer power. The tables produced for commercial propagation planners are still run on mainframe or minicomputers. But when you are only concerned with one or two destinations, and for example in order to find out the best time and band on which to work a forthcoming DXpedition, then modern PCs are more than up to the task. This is especially so if you have a maths coprocessor installed in the PC to help the calculations along.

When a group of us looked at propa-

## T-MUF



gation prediction software for the 1990 HF Convention, there were very few programs available although others are now beginning to appear. The three programs we reviewed were *TMUF*, *MINIPROP* and *IONCAP*.

Here is what we found, and I am indebted to Paul Evans, G4BKI, who undertook the comparative tests.

## TMUF

*TMUF* unfortunately never got beyond the beta-testing stage, but is an indication of what the future might hold in propagation forecasting software. The user interface is excellent, with pull-down menus, good use of colour, and a selection of graphical presentations of the output, from a great circle map with MUFs plotted worldwide to graphs of MUF and FOT (optimum frequency) hour by hour for a given path. The algorithm used in *TMUF* seems to give rather optimistic predictions, with MUFs some 10-15% above those actually observed in practice. Of course, this raises another issue with propagation prediction. Do you predict for the QRP station with a G5RV, or for the kilowatt station with the big beam? Propagation may be perfectly acceptable to one, when it is marginal to the other.

## IONCAP

*IONCAP* falls at the other extreme of prediction programs available for the PC. This program started life as a mainframe program for government use, and shows its breeding by having what might best be described as a 'user hostile' rather than a 'user friendly' interface! *IONCAP* is available in the public domain, and it includes a program in Basic which enables the user to build a text file containing the base data needed by *IONCAP* to run a series of predictions. Paul G4BKI has rewritten the Basic program in a way which makes it easier to use, adding an MS-DOS batch file which links it to *IONCAP* in a logical way. However, this program is not for the beginner! The output is in a text file as a series of numbers. The reason we looked at *IONCAP*, of course, is that given its heritage, you would expect it to give reasonably good predictions. This turns out to be the case. It is slow to run (there's a lot of number crunching) so that a run for a particular path can take several minutes on an 8MHz PC. But the results appear to be accurate, if slightly optimistic (they would probably be about right for a commercial station), and they do appear to pick up the various changes in propagation you would expect to see during an opening as signal arrival angles change.

MINIPROP (TM) SHORT-PATH PREDICTIONS				09-20-1990	Path Length : 11596 km	
Sunspot Number : 200.0		Flux : 242.9		F Hops : 4P	Radiation Angle : 7 deg	
TERMINAL A : 20.60 N		157.50 W		Hawaiian Islands	Bearing to B : 14.6 deg	
TERMINAL B : 52.20 N		1.00 W		England	Bearing to A : 337.3 deg	
Terminal A Sunrise/Set : 1622/0425 UTC		Terminal B Sunrise/Set : 0652/1803 UTC				
----- QUICK-LOOK SIGNAL LEVELS in dB ABOVE 0.5 uV -----						
UTC	MUF	3.6 MHz	7.1 MHz	14.1 MHz	21.2 MHz	28.3 MHz
0000	17.2			9 a	15 D	
0200	16.8		-4 a	16 a	18 D	
0400	14.9	12 a	23 a	24 B		
0600	14.5	30 a	30 a	26 B		
0800	21.4	9 a	21 a	24 A	22 B	19 D
1000	20.9	-9 a	14 a	21 a	20 C	
1200	20.1		8 a	19 a	20 D	
1400	19.2		4 a	18 a	19 D	
1600	20.5		-8 a	14 a	17 C	
1800	30.8			9 a	15 A	15 B
2000	27.4			6 a	13 A	15 C
2200	22.3			6 a	13 B	15 D
Signal levels not shown if below -10 dB or if predicted availability is zero.						
Availabilities A: 75 - 100% B: 50 - 75% C: 25 - 50% D: 1 - 25%						
a, b, c, d: Same as A-D, with high probability of reduced signal levels.						
(<Z>oom    G: graph    F: print table    L: long path    H: menu						

## MINIPROP 3

### MINIPROP

My program of choice, right now, seems to be *MINIPROP*. This program has been very successful as shareware and is used by a large number of amateurs. Version 3 is no longer shareware, but costs \$54.95 from W6EL software, for this you get a 52 page manual plus user support. Version 3 introduces mode searching, which enables the program to check for different propagation modes and, therefore, be able to give better predictions of signal strength versus frequency. Because this takes a fair amount of time (unless you have a fast PC or maths coprocessor) there is also a Quick-Look prediction mode to check whether there is any likelihood at all of a band opening, before you start doing the heavy calculations.

G4BKI's tests showed *MINIPROP* to be remarkably accurate, even in the Quick-Look mode, and it copes well with polar paths where T-MUF tended to be weak. Output is in tables of numbers plus some very rudimentary graphs. This is a pity in some ways, though it does speed things up as generating graphics is always very compute intensive. Available outputs include MUF, FOT and angle versus time, signal strengths versus time, and an MUF compass.

### Choices

If you want to go beyond *MINIPROP* (which is still a popular program, and is for example packaged into *Swisslog* for near instant predictions during your everyday operating), *MINIPROP* has to be a favoured choice. There are other programs now coming available which claim similar performance, though I

have not had the opportunity to test any of them. *MINIPROP* is very slow on an XT or earlier computer, but this doesn't matter if you are simply checking out the possibilities for propagation for a DXpedition coming up in a day or two. If you have to go away for a coffee while it does the calculations, so what?

Incidentally, in order to run any of these programs you will need suitable input information. *TMUF* and *IONCAP* will both accept call sign prefixes as location information, so you only need to enter the latitude and longitude if you want to be very precise. However, you will need to input solar data. You can always guess at this, but remember that you can get accurate figures from a number of sources and, of course, the predictions you get will only be as accurate as the data you put in.

Finally, as well as the programs which I have been describing, there are a number of other programs which are useful in propagation prediction. These centre around the calculation of sunrise and sunset time for grey-line predictions (low frequency propagation is enhanced when signals travel along the terminator - the daylight/darkness boundary). Many programs will make this calculation. Some, such as *DX Edge* and *GEO-CLOCK* will plot the terminator on a map of the world, so that you can see it move across the screen of your computer. The grey line is wider away from the equator than at the equator (twilight lasts longer in higher latitudes) and the better programs will tell you not only sunset and sunrise but also the start and end of twilight. The program I personally prefer in this respect is one which comes as part of a suite of software to complement ON4UN's book on LF DXing.

# SCANNERS

## AR3000A Review

It's been several years since the 'original' AR-3000 receiver was launched, a marvel of compact engineering in its time. In my mind there's still been nothing to beat it in its size, and I'd still love to own one if I could afford one! AOR have now given their flagship receiver a slight 'facelift' together with a boost in performance, with their recent launch of the AR-3000A. So guess who's fingers started itching when he knew there was one on the way?

### Appearances

Outwardly, it looks very similar indeed to the earlier AR-3000, retaining many of the features of its predecessor including the staggering frequency coverage of 100kHz-2036MHz. You can use the receiver to listen into CW, USB, LSB, AM, Narrow FM and Wide FM, each individually selectable. The AR-3000A also lets you select any 'step' increment you like in 50Hz steps between 50Hz and 999.95kHz. So you can, for example, choose 9kHz steps for the Medium Wave broadcast band, 50Hz for 'fine tuning' on the HF amateur and utility bands, 1kHz or 5kHz for HF broadcast band listening, 12.5kHz on VHF/UHF, and so on.

### Tuning

A free-running rotary knob lets you tune around manually, and small push buttons next to this let you speed up the rotary tuning rate by a factor of ten, or slow it down by a factor of five, to give you even more control. The usual 'Up/Down' buttons, positioned next to the tuning knob, give you an alternative tuning method as well as provid-

ing a scan initiation if you keep one of them pressed down for a second or so. You can usefully program a 'repeater split' into the set, so that when tuning around you can quickly switch between the input and output frequencies of split-frequency base or talkthrough stations as found on VHF and UHF.

A single BNC aerial connector on the rear panel is used for the entire frequency range, and a short telescopic whip comes with the set to get you on the air quickly. To guard against problems caused by megastrong signals upsetting the set's front end with an external aerial, you can switch an internal aerial attenuator in using a keypad function. If you're using a super-long outdoor wire aerial for HF then you can also switch the internal HF section preamp out by changing the positions of two internal switches. If you're short of space for an array of aerials covering such a wide frequency range, AOR can even supply a 1.5m long wideband active aerial, the WA5000, cover-

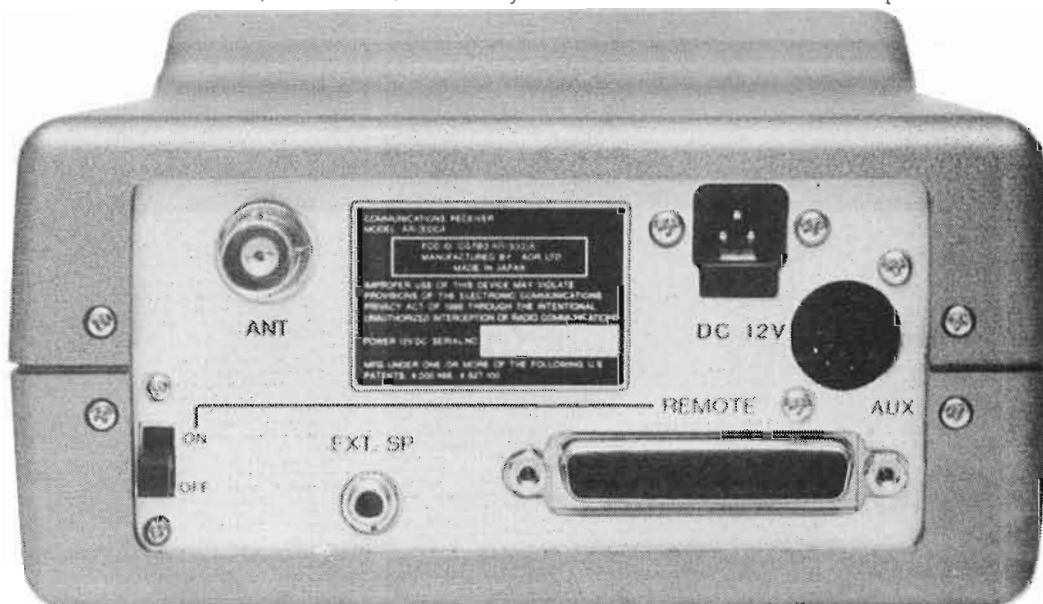
ing 30kHz-2000MHz (!). We've plan to feature a separate review of this aerial together with AOR's new DA3000 wideband discone in next month's issue.

The set is quite small at 138mm (W) x 80mm (H) x 200mm (D). It's designed for operation from a 12V supply, so with an optional mobile mounting bracket you can easily fit it into your car. A DC power lead is supplied, and together with a plug-in mains power unit for base use. A well-written manual, prepared by AOR (UK) for UK use, comes with the set, this giving practical operating examples together with a brief appendix of air band, marine, and TV audio frequencies.

### Searching and Memories

One of the major improvements, in my mind at least, is that of the much faster scanning rate of the set, this now being up to 50 channels per second. You can do all the usual things such as search through your programmed frequency ranges for signals, store channels into the 400 memories arranged into 4 banks of 100 channels each, engage a 'priority watch' for each bank, this even having a programmable selection time interval, and so on.

All your programmed memory and search information is backed up by an internal lithium battery, but if you really need to, you can erase all these from the front panel





## LABORATORY RESULTS:



by pressing a couple of buttons whilst switching the set on.

As well as 'memory lockout' for skipping channels when scanning, up to 100 individual frequencies may be selected in each of the four search banks, for the scanner to ignore, when you're searching across a given range. This is useful for automatically passing the many 'constant' signals you may find, even down to those annoying carriers generated by the computer in the next room or house.

### Remote Control

You can connect an external tape recorder to the AR-3000A's accessory socket, and an internal transistor switch driven by the set's squelch circuit lets you control the motor on your tape recorder. Hence you can leave your set switched on, with your tape recorder being enabled only when the set's squelch raises. An optional recorder lead is available (CR400) if you don't fancy making up your own.

Although the set doesn't have a 'timer' mode as such for automatic program recording, you can use the set's internal clock with its 'alarm' facility, where it switches on at a given time at a preset volume, switching off 60 minutes later. A 'sleep' timer can also be used to switch the set off after a predetermined length of time between 1 and 120 minutes. An external speaker socket is fitted on the rear panel, this cutting out the internally fitted speaker at the lower front of the set, and a headphone output giving a reduced audio level is provided on the front panel.

### Sensitivity;

Input signal level required to give 12dB SINAD;

Freq.	CW/SSB	AM	FMN	FMW
100kHz	1.04	2.26	1.22	—
500kHz	0.32	1.01	0.53	—
1MHz	0.21	0.60	0.29	—
2MHz	0.18	0.47	0.22	—
4MHz	0.15	0.38	0.18	—
6MHz	0.11	0.36	0.14	—
10MHz	0.13	0.41	0.19	—
20MHz	0.12	0.34	0.16	0.52
30MHz	0.13	0.37	0.17	0.56
50MHz	0.15	0.43	0.20	0.65
100MHz	0.18	0.53	0.25	0.78
145MHz	0.17	0.48	0.24	0.73
250MHz	0.16	0.46	0.22	0.69
435MHz	0.18	0.51	0.25	0.71
700MHz	0.25	0.59	0.26	0.72
1300MHz	0.18	—	0.17	0.41
1700MHz	0.25	—	0.23	0.67

If you'd like to extend your scanning horizons, then you can also let your PC take control of the set's functions for you, through the set's RS-232 connector. A slide switch on the rear panel controls this, so that when the 'remote' mode is selected only the set's on/off switch and volume/squelch controls are enabled. Through your computer or terminal you can duplicate the front panel controls as well as getting 'S-meter' level, dial or memory channel contents and the like, from the set. By running AOR's optional ACEPAC-3A software on your PC, as well as remotely controlled the set, you can monitor band activity with a display of percentage squelch opening time against frequency, even produce a graphical 'sweep output' of activity against frequency. Take a look at our test of the ACEPAC-3 program for the AR-3000, in the January 1992 issue of Scanners International, for an idea of the flexibility you can achieve.

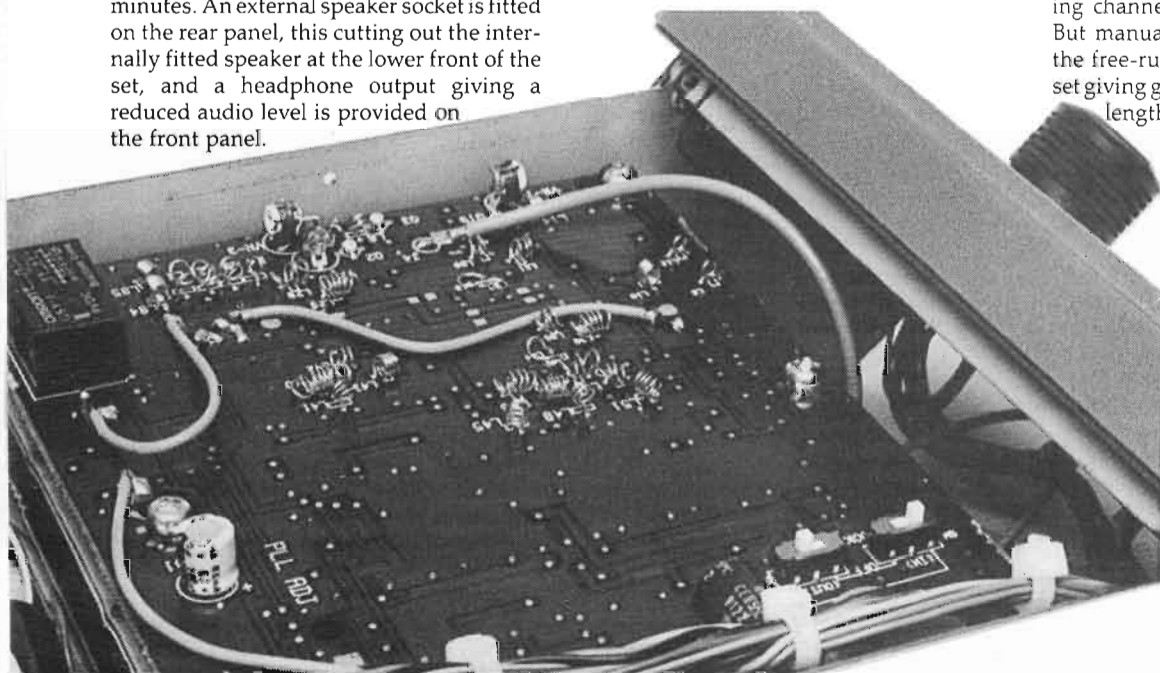
### On The Air

The supplied instruction book gave clear details on the set's use. Following a read of this I was quickly up and running, listening to my semi-local amateur 2m repeater with

the set's short telescopic whip. After programming some of my favourite frequencies, I then tried the set's 'search' mode to see what else was about over its wide frequency coverage. I found it very easy to manually store the many active frequencies I found into memory, the set automatically selecting the next channel for me each time. I did however find that I was sometimes programming multiples of the same frequency into subsequent memories, so I had to be careful!

The 'frequency pass' was easy to program when in search mode, just a two-button press. I found this function was very useful, I wish my own scanner had this facility! Scanning through both the memories within a given band, and across a programmed search range, was fast, very fast. I was pleased to be able to control the 'pause' time on an active frequency, which could be set to anything between 1 and 60 seconds to suit what I was scanning across, to give me a chance to hear what was happening before deciding whether to manually 'halt' the scan or not.

I sometimes found that I accidentally touched the free-running tuning knob, with the annoying result of the set either switching channel or just carrying on scanning. But manually tuning around on HF using the free-running knob was great, with the set giving good results even with just a short length of wire plugged into the aerial socket. Connecting an external long wire of course brought in many more signals, although I never found I needed to switch the internal preamp out. When changing between different bands and tuning steps, I found it handy to store the 'centre frequencies' of these into memory channels. I then used these as a



'band/mode' select, a simple press of the front panel 'dial' button then let me tune away from these, very handy! As well as 'normal' tuning in the usual steps, I found it useful to be able to program the set to tune in my programmed steps but with whatever offset I liked, for example a 5kHz or 1.25kHz offset with 10kHz steps for European and UK 26/27MHz frequencies.

The sensitivity was excellent, especially so on the frequencies above 1000MHz. I found I could hear my local 1297MHz repeater just as well on the AR-3000A as on a dedicated transceiver for the band, and although I didn't try it 'on air' I'm sure reception of 1691MHz geostationary weather satellites would also be superb. However on VHF I did sometime find I suffered from problems caused by other strong local signals in the same band mixing together, due to receiver overload. I suppose you can't have everything!

Finally, connecting my computer, operated purely in a 'dumb terminal' mode, to the RS-232 connector let me remotely enter frequencies and the like at the touch of a keyboard. I was surprised how simple this was to do, in a few days I'd probably have started to write a simple program for it!

#### Adjacent Channel Selectivity, VHF;

Measured on 145MHz 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;

+12.5kHz;	40.5dB
-12.5kHz;	43.5dB
+25kHz;	50.5dB
-25kHz;	54.5dB

#### SSB Selectivity, HF;

Measured on 10MHz USB, single signal;

-3dB	1.9kHz
-6dB	2.6kHz
-40dB	3.6kHz
-50dB	3.9kHz
-60dB	4.4kHz

#### Blocking;

Measured on 145MHz NFM as 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;

+100kHz;	67.0dB
+1MHz;	79.0dB
+10MHz;	94.5dB

#### Intermodulation Rejection;

Measured on 145MHz NFM as increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

25/50kHz spacing;	41.5dB
50/100kHz spacing;	41.0dB

## Insides

Opening the receiver shows a box packed with tiny electronics, arranged on several RF boards plus a control and keypad board. Fifteen switched RF bandpass filters are used before the GASFET RF amplifiers, to give out-of-band rejection combined with good on-channel sensitivity. This should also allow, for instance, good reception of VHF when a local mega-strong UHF signal is present. A triple conversion superhet circuit is used (with quintuple conversion on WFM), and a more efficient microprocessor than the set's earlier cousin has been used to

give the much faster scan and search speeds as well as the extra features.

## Conclusions

The lab results confirmed the good sensitivity of the set, the intermodulation figures also showing that I'd not been imagining the occasional problem I found on-air, no doubt the set's attenuator would be useful here. Nonetheless for its size, its array of reception modes, and incredible tuning range, I still feel it's a marvel, one that I'd love to own! The AR-3000A is currently priced at £765, and my thanks go to AOR (UK) for the loan of the review equipment.

#### S-Meter Linearity

Measured on 145MHz NFM;

Reading	Input Signal	Rel. Level
S1	0.65uV pd	-29.7dB
S2	0.94uV pd	-26.5dB
S3	1.43uV pd	-22.8dB
S4	2.11uV pd	-19.5dB
S5	3.13uV pd	-16.1dB
S6/7	5.42uV pd	-11.3dB
S9	19.9uV pd	0dB Ref.
S9+10	53.2uV pd	+8.6dB
S9+20	255uV pd	+22.2dB

# Book Review

## Short Wave Communications

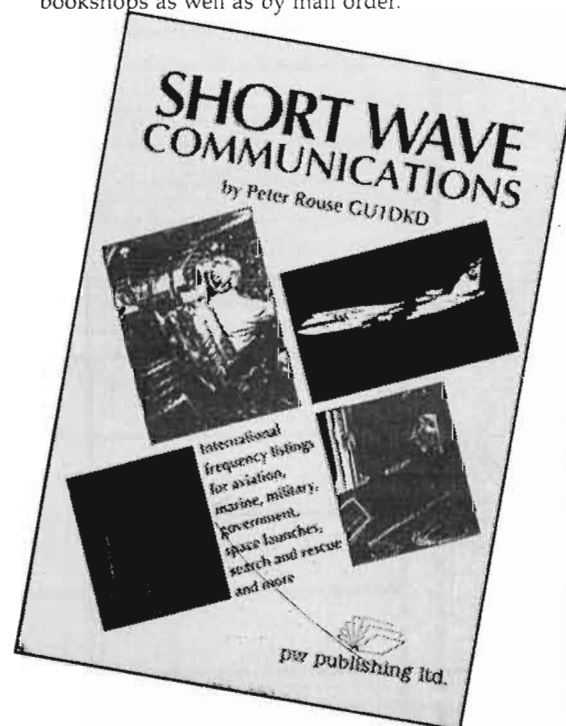
by Peter Rouse GU1DKD

From the keyboard of *Scanners International* contributor Peter Rouse comes his latest book, aimed at the many new, as well as 'old hand', listeners to HF. Short wave listeners often just use their receivers to tune into broadcast stations, but there's a lot more that goes on over the short wave spectrum! You'll find conversations between air traffic controllers and intercontinental aircraft, between coastal stations and ocean going liners, maybe even an 'SOS' transmission and the resulting rescue operations.

But it's another matter knowing exactly what frequencies to tap into your receiver to hear these! Until now, many publications have been aimed at the amateur bands listener or the broadcast listener, or maybe the 'CW and data' utility specialist. However Peter's book, as well as giving an introduction to short wave and a guide to choosing a receiver, including sources of supply, also gives a comprehensive listing of frequencies used by speech stations, usually transmitting in English. *Scanners International* readers may for example be interested to note the HF 'Marine Band' *Frequency Finder* in the November 91 issue was compiled by Peter. We're told his lists in the book are not simply 'cribbed' from others, but are often the result of many hours spent

listening on the bands. In chatting with Peter, we know this is often the case!

'Short Wave Communications', ISBN 1 874110 00 X, 187 pages softback, is priced at £8.95 and is available from several bookshops as well as by mail order.



# Novice Notes

Rechargeable batteries are now commonplace. They provide a source of power which is portable and very convenient. As such they are widely used within amateur radio circle for variety of portable receivers and transceivers. Although several types of rechargeable battery are known, the sort which is used virtually universally for portable electronic equipment is the NiCad.

## Characteristics

In many respects a NiCad appears to be very similar to the standard zinc carbon or alkaline type of batteries, which are widely available in the shops for powering everything from transistor radios to torches and motor driven toys. First of all they are nominally the same size. NiCads are available in all the standard sizes — C, D, AA, AAA etc., and can be physically fitted in as a direct replacement. However NiCads are sometimes very slightly larger and if the normal cells are a tight fit then it may be worth checking that the new NiCads will fit before buying them!

Apart from the size, the voltage which they produce is also nearly the same. Normally a zinc carbon or alkaline cell will give very nearly 1.5V when new. A NiCad will give slightly less at 1.2V, but this is often not a problem in many instances. However one difference occurs in the discharge characteristic. In a standard cell the voltage will fall as power is removed from the cell. In the case of a NiCad it retains its voltage until it is nearly discharged, and then its voltage falls off quite rapidly.

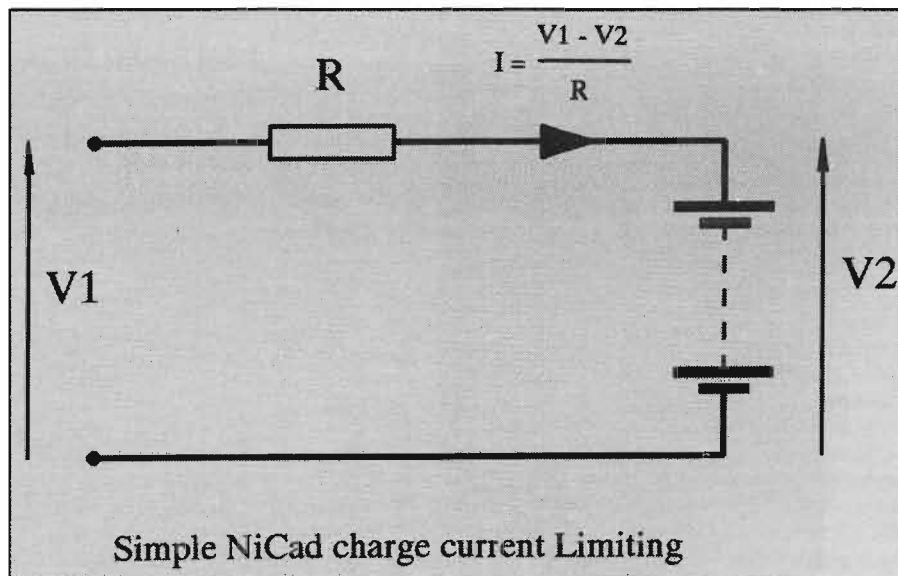
One other point to note about NiCads is that they will hold less charge than a standard cell, and it will be necessary to change a NiCad more often. This can be particularly important if long periods of use are envisaged and no charging capability is available.

NiCads have a very low internal resistance and can provide very large currents. This can be noticed in many instances. One example is that flash guns which can take both normal and rechargeable cells will be ready for operation much quicker if NiCads are used.

## Do's and Don'ts

If treated properly, a NiCad should be able to give good service over several hundred charge and discharge cycles. But to achieve this sort of life the cells must be treated well and not abused.

First of all they must *never* have a



*Ian Poole G3YWX with  
advice on NiCads*

short circuit placed across them. As NiCads have a low internal resistance they can give a *very* high current, placing a short circuit across them can be quite dangerous.

The extent to which a NiCad should be discharged is also quite important. If at all possible they should not be discharged any further after the voltage across them reaches 1.0V. Fortunately once they have reached this voltage virtually all their charge has gone and there is little point in trying to use them anyway.

Care must also be taken to ensure that a NiCad cell is never reverse charged. The most common way for this to happen is when a battery (consisting of several cells in series) is completely discharged. As all the cells will hold a slightly different amount of charge, those which are discharged first will become reverse charged by the others. In order to avoid this, batteries like the PP3 (RX22) should *never* be completely discharged. (*Tech Ed's note — this also applies to handheld transceiver NiCad packs, which should never, ever, be deliberately completely 'flattened' as some misguided 'experts' occasionally try to tell us*). If it were ever necessary to discharge a set of individual cells then

this should be done for each cell individually. An instance of this would be to let you have a known amount of charge in the cells before giving them a full charge.

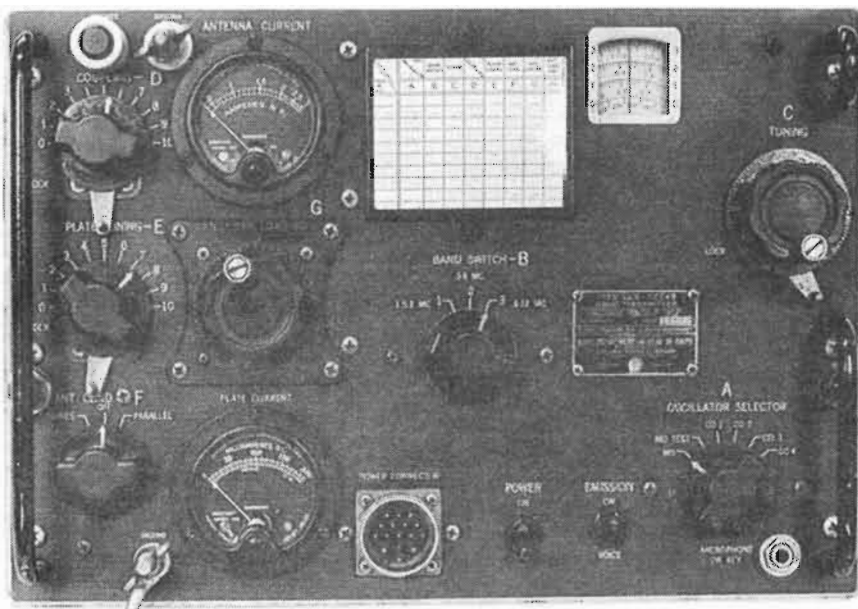
It is also necessary to charge the cells correctly, by using a constant current source. A simple current limiting resistor may be used for this, its value calculated using Ohms law. The charge rate and time is also important. Normally this is stated on the cell itself, and generally it is around C/10 where C is the full amount of charge which can be stored in the cell in Amp hours. It is also important not to charge the cells for too long. A moderate amount of overcharging does not cause much noticeable degradation of the cells, however if this is done for an extended period then it can cause the output voltage to be reduced once the cell is in operation. Fortunately this effect can sometimes be reduced if the cell is given a few complete discharge/charge cycles. It is however perfectly OK to 'trickle charge' them at less than the full rate of charge.

Temperature also has quite an effect on NiCads, if at all possible they should be used at around room temperature. If they are cold they will lose a lot of their capacity — possibly 50% or more at zero degrees C, but they do recover once they have warmed up.

## Summary

NiCads are an ideal source of power for portable applications. However as they are more expensive to buy than conventional batteries it is worth taking a few extra precautions to ensure that the best is obtained from them.

# In Praise of Excellence



In the history of radio communications there can be few companies whose names are, and always have been, an integral part of the scene. One such name is that of Collins Radio Company, who more than any other company epitomised engineering excellence at all levels. Collins did not follow the herd, they simply designed *everything* to be the best that technology could provide, and where standard techniques or components would not satisfy the Collins design team, they designed their own components and techniques to do the job.

I cannot claim to have any detailed knowledge of the history of the Collins Radio Company, my contacts with their equipment have always been through amateur radio, both in the military radios produced during World War II, and extensively used and modified by a generation of radio amateurs, and in their post war equipment designed and developed specifically for the radio amateur. It can truly be said, however, that any radio amateur who could say 'I'm using Collins equipment' was judged (and rightly so in my opinion) to have the very best that money could buy.

The 'very best that money could buy' is not an idle phrase when applied to Collins, because true excellence is never cheap. Fortunately for many amateurs in this country, Collins, in common with most American manufacturers during World War II, were drafted into making military radio systems, and these eventually appeared in reasonable

quantities on the surplus market after the end of the war. Thus the eager amateur could get his hands on such goodies as the 'TCS' series equipment, or the ART-13 HF transmitter, both made by Collins to military specification.

Not that even the surplus items were particularly cheap, if you take general inflation into account the AR88 would equate to costing £880 and the 'TCS' a staggering £2000. Perhaps today's prices for radio equipment are not so far out of line as we think? By 1948, their advertisements in the ARRL Handbook showed the 75A receiver and matching 32V transmitter, together with the 30K-1 half kilowatt AM/CW transmitter and 310A exciter. The 75A series receivers were without doubt well in advance of anything else on the market, and in the 75A-4 the Collins lead was maintained. It is interesting to remember this was the first receiver to employ 'Pass Band Tuning', allowing the operator to effectively move the IF filter around a received signal without retuning the receiver.

The mechanical engineering in Collins amateur equipment was delightful, and anyone who has looked inside a Collins receiver or transceiver whilst twiddling the front panel preselector knob will know what I mean. To see the genius which went into the engineering of the tuning slug rack is still one of the pleasures in life (coming a close second to a good bottle of Chateau Margaux).

The genius didn't end with the 75A-

*John Wilson G3PCY  
praises Collins' engineering  
and details the KWM-380*

4, Collins stunned everyone with the introduction in 1957 of the KWM-1, the world's first mobile SSB HF transceiver.



Collins KWM-1

At a time when most amateur stations were constructed in tall racks, the KWM-1 came as a real surprise measuring only 355mm x 255mm x 165mm, and weighing only 6.8kg. To put it into context, that is smaller than a TS-940 or an FT-102, and lighter than a TS-440 or an IC-740. The KWM-1 ran a pair of 6146 tubes in the PA, producing then as now in excess of 100W, and covered the frequency range from 14 to 30MHz. Not very much you may say, but the KWM-1 could operate *anywhere* between 14 and 30MHz, and was thus equally at home in commercial systems.

Typical of the Collins approach was the PA tuning network. We have all become accustomed to seeing two controls marked 'Tune' and 'Load', but in the KWM-2, these actually turned roller coaster variable inductors, with the result that the transceiver could handle a wide range of load impedances without fuss. I can speak with affection about the KWM-1 because I am lucky enough to own one, and I use it regularly, in fact during the Falklands to-do in 1982, it was all I used to keep in touch with friends who went with the Task Force. Not bad for a geriatric 30 year old rig, let alone the geriatric old operator, and no I will not sell you my KWM-1.

The range of Collins equipment goes on and on, with many type numbers familiar to radio amateurs, the 75S series of receivers, and the matching 32S transmitters, the KWM-2 and 2A which took over from the KWM-1, and the commercial 51J series with the 51J-4 which had a full mechanical filter pack fitted.

For the military, Collins produced the R-390 and 390A which had mechanical digital frequency readout and a somewhat heavy tuning action. You can always recognise the owner of a '390 by the fact that his right wrist is thicker than his left, and he will have a nervous rotating twitch of the right arm.

But where is the company now? In 1974, Collins became Rockwell-Collins with no more uniquely amateur radio transceivers from them.

And so we come to the point of this feature which is to take a close look at what was in effect the last transceiver from Collins to be made generally available to the radio amateur market, the KWM-380.

## The KWM-380

In the late 1970s there were rumours of a totally new HF transceiver from Collins, a transceiver which would be far in advance of anything currently available, and Collins fans waited with eager anticipation to see what would come out of Cedar Rapids. What appeared was certainly revolutionary, because the KWM-380 general specification was not matched by anyone for several years, and in some respects the KWM-380 is still ahead (but one expects Collins equipment to have a long life).

When released in the UK at the beginning of 1981, the KWM-380 seemed expensive, at around four times the price of the current top of the range products from Trio, Yaesu, and Icom, but this was not too unexpected because Collins equipment has always been at this kind of relative price premium. The importer then, as now, was Radio Shack in North London (and I don't mean Tandy) and when in conversation with them I was offered the chance of having a KWM-380 for an extended period of trial, I naturally jumped at the chance. I wanted to find out just what the KWM-380 was like, not only in absolute terms of performance but in having that almost indefinable 'Collins feel' which has been a feature of all their equipment. I was not disappointed, and the rest of this article will try to tell you why I still believe that Collins radios are so satisfying to own, to use, and to enjoy.

When you receive a KWM-380, the first thing which strikes you is the sheer size of the carton. Don't expect a friendly wave from the Securicor man as he staggers up the drive with a heavy box measuring some 660mm x 740mm x 380mm, and weighing around 25kg. Perhaps it's better to collect it yourself and ensure that the contents are treated with the respect they undoubtedly deserve. Unpacking the carton eventually reveals a very substantial transceiver which is immediately distinguished from the run of the mill offerings from the Orient by its lack of knobs — but who needs them when it's a Collins?

## First Impressions

The first impression of the KWM-380 when you get it into position on your Collins KWM-380



operating desk is that it 'looks different', that is to say it is not cast in the same mould as all the Japanese transceivers with their black or dark grey panels. No, the KWM-380 is refreshingly different, with its coffee coloured outer casing, and off-white front panel. The panel itself looks remarkably uncluttered, and indeed it is, having only seven rotary controls (two of them are dual concentric) to handle all the functions of this remarkable transceiver. Two sets of six push buttons complete the decoration of the panel, and you can see from the photographs how stylish the transceiver appears as a result of the Collins approach.

Hidden behind a dark filter across the top of the panel are the S-meter and a 7 digit frequency display. These are virtually invisible with the set switched off, but they certainly stand out when you turn it on. The frequency display is a full blooded easy-to-read display with red digits 2cm high, meaning you can glance at the transceiver from the other side of the room and see straight away what frequency is on the readout. In the usual way the backlit S-meter reads signal strength on receive and acts as a multi-function meter on transmit, allowing the operator to check ALC level, supply voltage, forward RF power, and reflected RF power.

Having seven digits in the frequency display gives the readout 10Hz resolution, and the synthesiser in the transceiver tunes in 10Hz steps. The tuning is so smooth that it is virtually impossible to believe that you are using a synthesised receiver, and tuning through a carrier produces a pure note in the same way that a classic high performance VFO would perform. Of course, if you try to tune in 10Hz steps from 500kHz to 30MHz, it's going to take you a long time (see the remarks about '390 owners'), so Collins adopt the delightfully simple approach of giving the operator complete control over the tuning rate. The six push buttons under the frequency display can be used to select MHz, in which case the main tuning knob tunes in 1MHz steps giving 10MHz per revolution, in 1kHz steps giving 200kHz per revolution, in 100Hz steps giving 20kHz per revolution, and in 10Hz steps giving 2kHz per revolution. Thus the operator can choose any tuning rate he wishes, get to a new frequency in extremely rapid fashion, and then revert to the lovely slow tuning rate for fine tuning. The other two push buttons in this bank of six are used for frequency lock, in other words disabling the tuning control, and 'SYNC', which synchronises the frequency of the idle VFO to that of the active VFO being used.

Mention of the 'SYNC' button brings me to the twin synthesiser used in

the KWM-380. Operation is simplicity itself, there are in effect two VFOs provided, and each VFO can be tuned to any frequency between 500kHz and 30MHz. You can use VFO 'A' for transmit and receive, or VFO 'B' in the same way, but you can also receive 'A' and transmit 'B', or reverse that, i.e., receive 'B', transmit 'A' using a simple four position rotary switch. The operator can therefore use any frequency split between transmit and receive, but can instantly put both VFOs on the same frequency using the 'SYNC' button.

The other bank of six push buttons are labelled 'MOX', which is a manual transmit/receive switch, 'VOX' which engages the smooth voice operated receive/transmit system, 'NB' to switch on the noise blanking system if the optional board is fitted, 'PROC' switches on the transmit speech processor system if the optional board is fitted, 'AGC' which switches the receiver AGC on and off — that's right, a receiver which allows the keen CW operator to dispense with AGC and revert to full manual gain control, and finally 'SLOW', which changes the hang time of the receiver AGC.

The AGC system is a delight, and uses the Collins principle of fast attack, steady hold, then rapid release after a fixed period, either fast or slow depending on the setting of the 'SLOW' switch. The RF Gain control for the receiver acts as a 'pedestal' for the AGC system, and in use on SSB or CW, the operator can back off the RF Gain to the point where all background noise is suppressed, leaving the signal to which you wanted to listen standing out of the now silent background. Another Collins classic, and most impressive in use.

Remaining controls on the front panel are the 'Mic/Carrier' level, the AF gain control concentric with the RF gain (sensibly), the 'MODE' switch, and the 'SELECTIVITY' switch. These last two are worthy of a little more explanation. The 'MODE' switch has four positions, CW, LSB, USB, and AM RCV, all of which seems straightforward, but not so. When I first used the KWM-380 to receive SSB, I turned the MODE switch from LSB to USB and thought 'Aha, it's not working', because there was no change in the incoming signal. After trying to decide why the transceiver didn't work the way I thought it should, I retreated to the handbook and found that the mode switch selection of upper or lower sideband was for use in the transmit mode only, and in fact had no function on receive. 'Why is that?' I hear you cry. Well, if you recall what I said earlier about the Collins system of pass band tuning in receivers, you will not be surprised to learn that in the KWM-380, Collins use the pass band tuning facility to enormous advantage.

## Passband Tuning

Although the electronics is complex, the passband tuning operates very easily as far as the operator is concerned. If the frequency readout tells you that it is on 14.200MHz, that will represent the true frequency. To receive an upper sideband signal, the IF passband is placed so that signals from 14.200MHz to 14.203MHz are received, that is, an upper sideband signal with a carrier frequency of 14.200MHz. To receive a lower sideband signal, the IF passband is placed so that signals from 14.197MHz to 14.200MHz are received, that is, a lower sideband signal with a carrier frequency of 14.200MHz. The shifting of the IF passband is done by simply turning the centre knob of the 'SELECTIVITY' control, and this allows you to move the IF passband right across the incoming signal from +3kHz to -3kHz relative to the centre frequency, and thus select not only which sideband you want, but also use the passband tuning to eliminate adjacent channel noise and nasties. The passband tuning system operates on CW as well, and with whatever filter you have chosen for the IF, so you can slide around the bottom end of 40m with a narrow filter and pick 'em out one by one. Brilliant.

Four little controls peep shyly out from alongside the main frequency display, and once again the Collins details show. Two of the four are labelled 'CW' and 'SSB', and are above and below the word 'DELAY'. This refers to VOX delay, and uniquely you have independent adjustment of the transmit/receive delay at the end of a transmission. This may seem unnecessary, but most operators prefer a longer hang time on SSB than they do on CW, and provision of independent adjustment means that you can adjust the delays to suit yourself and then forget about it. On lesser equipment you are faced with twiddling a knob every time you change modes, and often the knob is hidden either on the rear panel or under a lift-up lid somewhere on the body of the transceiver. The other two controls of the four are labelled 'VOX' and 'ANTI', these being easily available should you wish to set them correctly, but discreet enough not to be a nuisance.

The operation on SSB and CW using the VOX system is another delight, and the KWM-380 switches easily into transmit at the first syllable or the first feather touch on the key. It comes back on to receive with equal ease, with no popping and banging in the audio, and with no discernible effects on the transmitted signal. The only noise you hear is the slight 'tick' of a relay from inside the unit. CW keying is nigh-on perfect with no traces of sharp edges on the keyed

waveform, and no sign of key clicks.

The rear panel of the KWM-380 carries all the connectors you would reasonably expect such as the key jack, aerial connector, audio input and output, linear control and ALC, PTT, transverter RF drive and so on. The unit which I tested also had remote control facilities provided via a multi-pin connector on the rear panel. I can't think of a facility which has not been included, and all this makes the KWM-380 typical of Collins' thought and experience.

Mechanically the transceiver is a delight. It's heavy, as I said before, but in contrast to so many flimsy looking offerings the KWM-380 is built to last for ever. I note in the handbook that Collins even go to the lengths of sending the power transformer separately in some overseas markets, because you 'ain't seen a transformer like this in a long time. Remember (those of you who are old enough) the days when transformers sat quietly at the bottom of a rack, never emitting a single noise and never, never getting warm. That's what the KWM-380 transformer is like. The heat sink on the rear panel is beautifully finished, with not a sharp edge in sight, and the overall paint surface seems destined to stand up to any abuse.

If you were hoping for a detailed set of measurements showing third order intercept points, or the onset of second mixer blocking, or the level of the 99th harmonic when on transmit, I'm sorry to disappoint you. This is a description of a piece of classic radio equipment, and rather like Rolls-Royce, the performance of the KWM-380 is better than you will ever need in real life. This is equipment for the person with a maturity of outlook and a balanced view of the hobby, not for the uninitiated.

## Memories

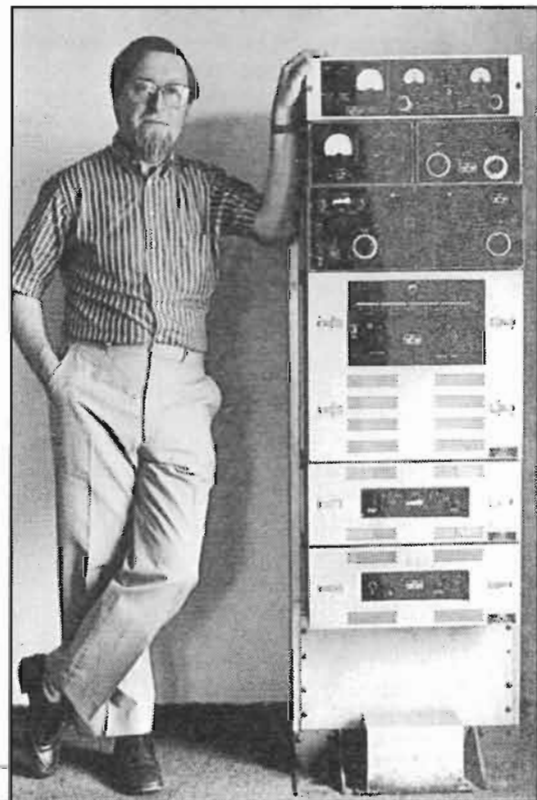
I started writing this short article with my knowledge of Collins equipment based largely on memory, and since one always seems to remember the good and forget the bad, I realised that I may be in for a slight disappointment when I came face to face with the facts. This was not the case, and my short but entirely enjoyable time looking at the KWM-380 has served only to reinforce my belief that there really is something very special about Collins engineering. Collins have always had the courage of their engineering convictions, and have never been afraid to step off in a new direction even when conventional wisdom suggested otherwise. When every major receiver manufacturer in America was making bigger and heavier radios, such as Hammarlund with the SP-600, RCA with the ill-fated AR8516L, National with the NC-300, and

Hallicrafters with the SX-101, Collins went down the road to smaller, lighter equipment, and obtained stability and accuracy by re-thinking the whole way in which receivers worked, and their thinking was not only proved to be correct, it was also copied by everyone else, sadly too late to save National, Hallicrafters, and Hammarlund from financial disaster.

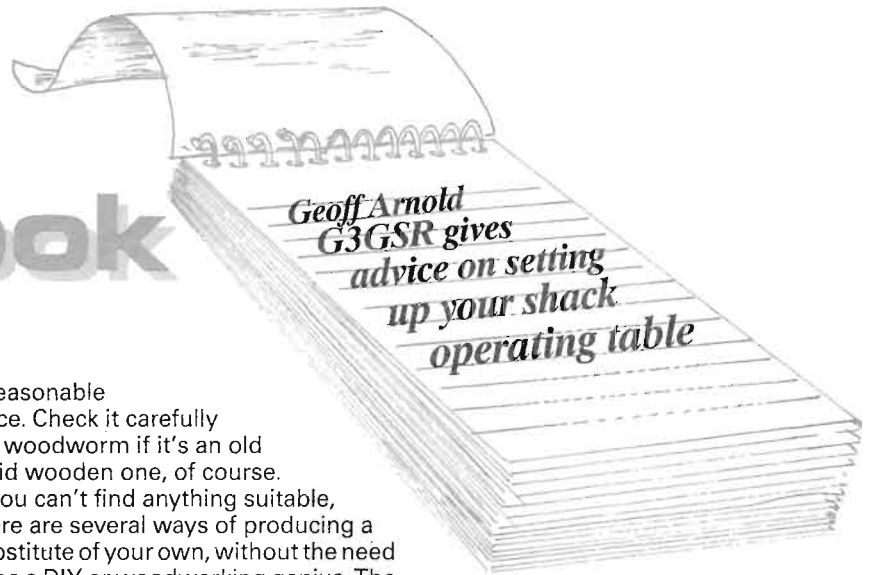
Thank goodness Collins survived by leading the pack, and all I can say is that the KWM-380 is a fine example of the best of Collins engineering. It may not have multitudes of coloured buttons, it may not have a thousand memory channels, it may not have synthesised Oriental voices to tell you that you are on upper sideband, but my goodness it's a welcome change. If you are lucky enough to own a KWM-380, keep it. If you are looking for a transceiver and can find a KWM-380, buy it to keep.

Finally, if you think that I am a Collins admirer, take a look at the last photograph which shows what Collins were up to in the military field in the late 1950 — early 1960 period. If you wanted a fully synthesised HF transceiver with a pair of 4CX-250Bs in the final, with independent sideband, with almost ultimate stability, this was it. This is a KWT-6 which was very generously donated to my collection by Cyril Clews, and apart from the fact that it takes six men to lift it, it's not a bad rig. If ever you hear me hopping up 80m in 1kHz increments, with the roar of a blower in the background, bear with me because it will be this rig I am using (and it's built exactly as Collins always built 'em).

Collins KWT-6



# From My Notebook



This month I am deserting amps, volts, ohms and so on, to take a look at the place where you pursue your hobby. I'm assuming that your main activity is operating, and I shall be talking about the 'operating table'. I'm sorry if that phrase evokes an image of a hovering surgeon's knife. In fact, much of what I shall say applies equally to a radio experimenter's workbench and the test equipment which he has on it.

First, where are you going to set up your station? There's a wide variety of places that radio enthusiasts have put to good use. It doesn't have to be large, and indeed there's a very true saying about clutter expanding to fill the space available to it. I've seen some very neat and efficient amateur stations built into a cupboard under the stairs, or a small built-in wardrobe. A roll-top desk or bureau used to be a favourite for a station that can be hidden away when not in use, but such desirable pieces of furniture are becoming ever rarer, and are now more likely to appear at a frightening valuation on the *Antiques Road Show* than at a reasonable price in a second-hand furniture shop!

Should there be young children around the house, it's essential for safety reasons that you can turn off the power and shut your equipment away somehow. If you can't take over a spare bedroom or the like, then with a little straightforward adaptation, one of the wardrobe kits available from stores like MFI can be a simple and relatively inexpensive way round this problem. This can allow you to have all your equipment set up and ready for use the moment the cupboard doors are opened, and look just like a normal piece of household furniture when not in use. You'll need to add a few shelves sturdy enough to support your equipment, and some form of drop-down flap to use as a table, but that's not too difficult a task. In any 'boxed-in' situation, remember to allow enough space around equipment to allow heat to escape.

If you're lucky enough to have a spare room that you can commandeer, you've still got to find a suitable bench or table, but at least there's a lot more scope here. A visit to a local office furniture supplier dealing in second-hand furniture can often turn up a large desk at

a reasonable price. Check it carefully for woodworm if it's an old solid wooden one, of course. If you can't find anything suitable, there are several ways of producing a substitute of your own, without the need to be a DIY or woodworking genius. The basis of all of these is to lay a substantial piece of board across the tops of two supports. But what sort of board, and what sort of supports?

## Support

Let's talk about the supports first. The prime requirement is that they should be the right height. Even in these days of ergonomic design and standardisation, there's still some argument on what the right height is, but most new office desks are in the region of 725mm. You can of course cut supports from sheets of plywood or chipboard, but you are then faced with having to fix them rigidly to the top if the whole arrangement is not to collapse sideways. No problem if you're a dab-hand at carpentry - see the RSGB and ARRL handbooks for ideas on build-it-yourself operating desks and consoles. If you find it difficult to saw a straight line, though, a better solution is to use a strong cupboard or nest of drawers under each end of the top.

Almost 20 years ago, I bought a couple of multi-drawer steel cabinets, of the sort intended for storing stationery, etc., in offices. They were a clearance line at a Habitat store, being sold off cheaply because they were painted bright blue, obviously not a popular colour. At the time, I assured my wife that I'd repaint them in a less garish shade, but we soon became used to it. They have 10 drawers - very useful for storage - and stand about 670mm high, which is ideal for resting a substantial top on. I use them to this day.

Another solution, especially useful if you have lots of papers and thin books to store, is a couple of two-drawer filing cabinets, which are also just the right height. The snag here is price. Second-hand two-drawer filing cabinets are just about as rare as the proverbial hens-

teeth, and new ones are expensive - you're unlikely to see any change out of £100 a time at best. Chests of drawers intended for domestic use are another possibility, providing you can find something of the right height. My advice if you're planning to build an operating table is to keep a good look-out when going shopping, even in the most unlikely places. You'll also sometimes come across useful bits and pieces in sales of furniture and fittings from closed-down shops and offices. Don't forget to take a tape-measure with you, and a note of the maximum size you can accommodate at your chosen spot.

## Top

Moving on now to the board for the top, there's a much wider selection available. Plastic-faced chipboard - the sort you can buy in various widths and in lengths of either 2m (sometimes) or 2.4m in any DIY store - is not really suitable, for several reasons. First, the plastic used is melamine, which does not stand up well to being used as a work-surface. Second, the board is only 15mm thick and not strong enough to span a knee-hole space without sagging under any reasonable sort of load, though obviously you can fix additional support underneath to stiffen it up. Third, the maximum width available is around 600mm. If you operate mobile equipment in the shack it's not too bad, but when you realise that quite a modest sized HF rig will measure around 375mm from front to back, then allow 75mm or so for the connectors and cables behind it, you will see that you'll have a maximum of 150mm clear table in front of it for your microphone, Morse key, notepad and logbook. With one of the beefier rigs, you could find the control knobs hanging over the front edge of the table.

you gain a little if your operating table is not backed up against the wall as most are, as you can let the connections overhang the back, but you've still got to keep the rig's rear feet safely on the table.

Kitchen worktop, available in 1m, 2m and 3m lengths from the DIY stores, is reasonably priced, with the advantage of a top surface finished in a hard-wearing plastic laminate. Also it usually has a nice rolled edge at the front to save cutting into your arms as they rest on the top. Its high-density chipboard core is thicker — there are three or four different thicknesses depending on quality and price — but any will support quite a load over a clear span of a metre or more without sagging. Unfortunately, it's even narrower than the melamine-faced board, with a standard width of 600mm. Wider stuff is available, intended for breakfast-bars, but it will cost you an arm and a leg. I have used kitchen worktop extensively for desks and operating tables, but I usually build it out with an extra strip of timber behind. This works, but it adds a lot of complication to an otherwise simple job.

## Open Door

Perhaps the ultimate solution to the question of DIY table-tops is to use a door. Doors come in various sizes from around 2m by 750mm upwards, and can often be bought cheaply from demolition contractors' yards, where you may find both old-fashioned panelled doors and modern flush doors. The old panelled variety are generally stronger, but have the disadvantage that you have to face at least one side with a sheet of plywood (unless that was already done by the previous owner) to give a flush working surface. The modern flush doors, despite consisting of an interior of glued-up cardboard strips with a narrow wooden frame surround, sandwiched between two sheets of ply or hardboard, are nevertheless surprisingly strong. If you're likely to drop heavy objects on their corners on to the table-top (not recommended for thousand pound-plus rigs!) it's as well to provide some extra protection by laying a sheet of hardboard over the top surface. When the hardboard eventually gets 'tatty' you can renew it quite cheaply.

New doors can be rather expensive, but one suggestion if you have no luck at a demolition contractor's is to go and talk sweetly to the storeman at a builder's merchant or joinery depot. They often have a damaged door tucked away somewhere, one that's had a slight knock or gash on one face so that it's still quite sound but totally unsaleable for its normal purpose. I picked one up some time back for around a quarter of the nor-

mal retail price, and it served me well for years.

If your operating table is up against the wall, it's as well to give extra support and stability by securing it to a wood batten screwed to the wall. If, on the other hand, it is free-standing, you'll need to find some other way of making sure the top can't tip over when all your radio gear is lined up along the back edge. Expensive, that!

## Shelves

A shelf over the operating table is useful for stowing ancillary units, linear amplifiers, aerial tuning units, SWR meters, aerial switches, speech processors, electronic keyers and so on, but not recommended for receivers or transceivers unless you operate exclusively on a channelised system such as 2m or 70cm FM. Your arm will soon begin to ache as you search the bands if the tuning control is raised much above bench level.

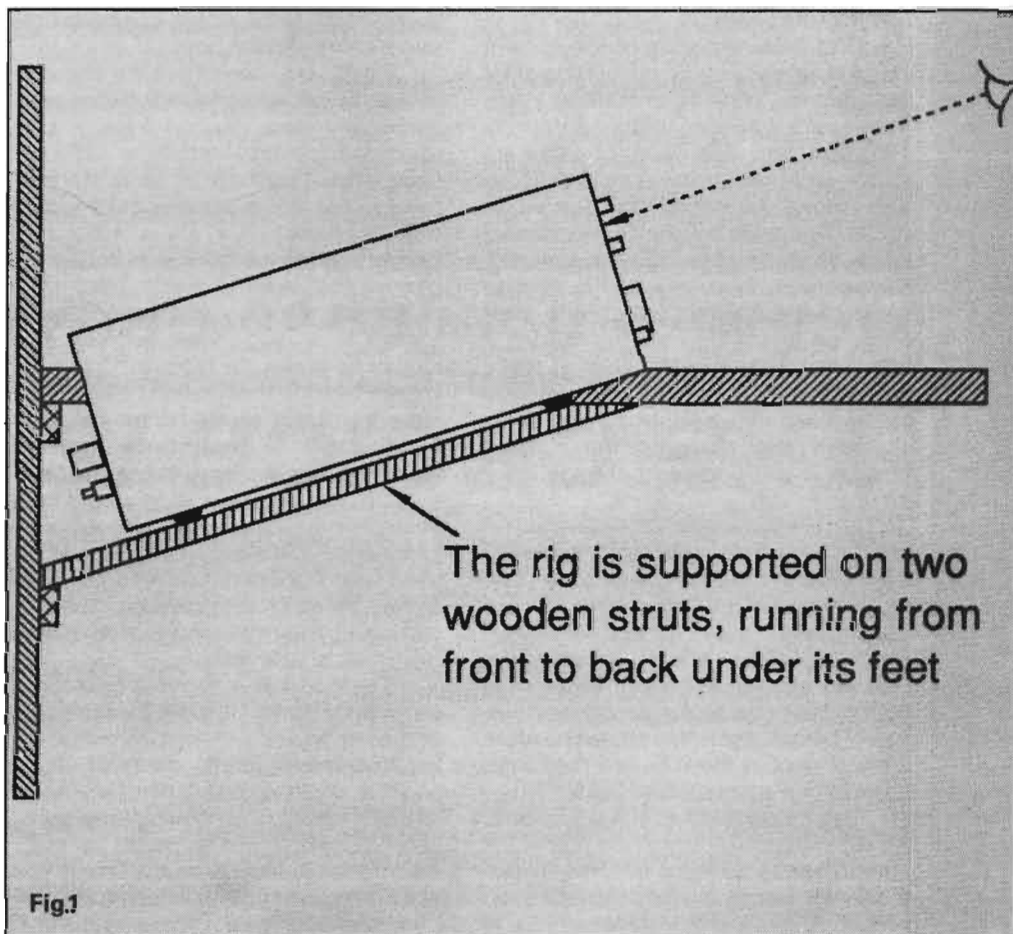
If your table backs onto a wall, you can fix the shelf to the wall. Strong adjustable shelving systems such as Spur are ideal. If your table is away from the wall, a 'bridge' shelf supported on uprights at each end (and perhaps in between as well) standing on the back of the table top will do the job. Melamine-faced chipboard makes shelves that are

easy to keep clean, but needs supporting at intervals of not more than 500mm unless strengthened with a substantial wooden rail glued and screwed underneath it. If you're building shelves using veneered chipboard, check that the ends of the board were cut square by the manufacturer — in theory they should be, but occasionally you get one that isn't, which can make an awful mess of your carpentry if you don't notice it!

## Equipment Consoles

If you study photographs of professional radio receiving positions, you will notice that the receiver often has its rear end recessed into the table-top, so that the panel faces the operator 'square-on' (Fig. 1). This is done for a combination of reasons. It reduces parallax errors in reading a scale-and-pointer frequency dial, but can be just as important in getting a good viewing angle with modern digital read-outs. It puts the tuning knob at something like 50-75mm above the table, which means you can rest the heel of your hand on the table top whilst searching the bands. It also allows you to see the markings round the remainder of the control knobs more easily.

Where more equipment is required to be available to the operator, this idea is extended into a desk-top console.





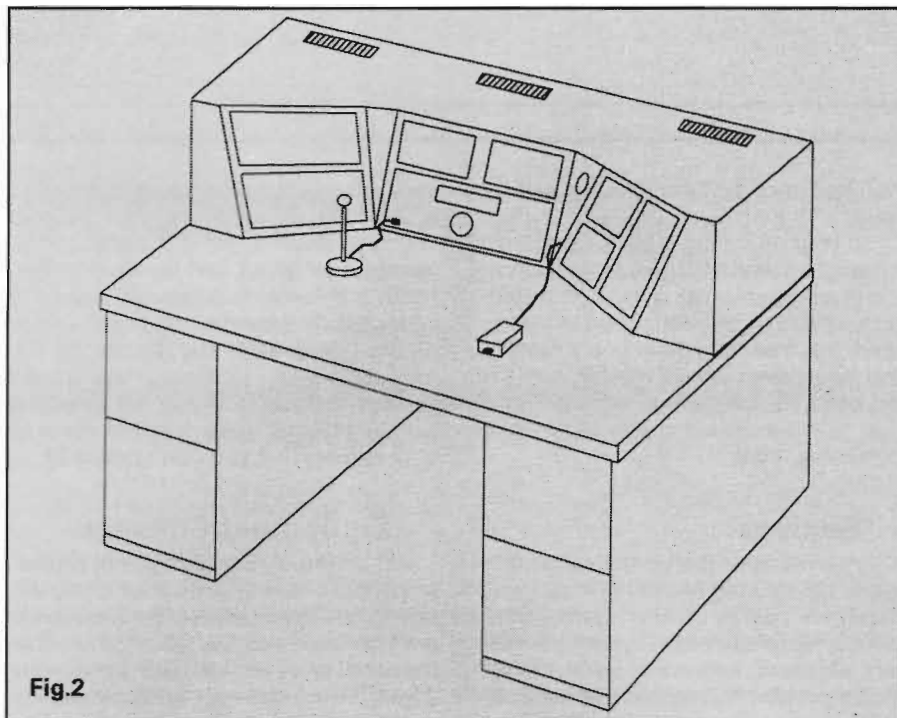


Fig. 2

Sometimes the ends of the console are curved or angled so that it 'wraps around', bringing the panels to face the operator horizontally as well as vertically and putting the controls within easy reach (Fig. 2). You'll see a similar arrangement used for VDU operating consoles in money or commodity exchanges and the like, pictured in TV news bulletins. This makes a very comfortable operating position, but any DIY fanatic thinking of building such an arrangement for their home station should be aware of some of the snags.

First, virtually none of the current range of amateur equipment is designed for rack or console mounting, with panels of a standard width and depth. Therefore you will need to make up some sort of a surround or mask to fill the gap around the panel. With the multiplicity of controls fighting for front panel space on some of today's transceivers, the designers have resorted to putting some of the controls under little trapdoors on top of the cabinet, making it impracticable to box the rig in. If that's not a feature of your transceiver, you will still be faced with making up a new panel surround and changing the support bearers if you decide to change it for another model.

Second, you need to consider ventilation. That's nothing like the problem it used to be in the days before solid-state equipment, but it's still important where transmitters or transceivers are involved. However you design your console, you must allow for air to enter at the bottom and rise freely past the equipment before escaping through some form of vent at the top. You may even need to fit a small electric fan.

Third, you need to have access to wiring and connections at the rear of the equipment. In an ideal console design there are doors or removable panels behind it, but if the installation has to

back onto a wall, that isn't possible. You can, of course, make all the cables long enough to be connected or disconnected with the equipment withdrawn from its housing, but then you've got to trust to luck that nothing will get kinked or trapped when the equipment is pushed back in. Also, it's impossible to get a good short earth connection. One solution is to design the console with an open bottom, as in Fig. 1, so that you can lie on your back on the floor beneath it and reach up to make the connections at the rear of the equipment. The open bottom aids ventilation, too.

Finally, you need to make arrangements for connections to services such as headphones, loudspeakers, microphones, keys, etc. Headphone jacks are usually fitted on the front panel of transceivers, but this is actually not an ideal site. It's a good rule of operating position design that the leads for keys and headphones should not cross the front edge of the table. This means that sockets for Morse keys and desk microphones should be above the table-top, but sockets for headphones should be under the table-top, fixed near the front edge of the table but to one side of the operator. That way, the leads are less likely to get tangled up or pulled on — especially where your chair has arms to it. Headphones with coiled leads are not so bad when used with front panel sockets, but they still tend to catch your pencil and papers and sweep them onto the floor when you lean back in your chair.

The loudspeaker on your receiver or transceiver is most likely in the top panel of the set, so you will need an extension loudspeaker fitted into the front of the console, or sitting on top of it. Select one of the so-called 'communications' speakers having an audio response specially tailored for speech reproduction if you use the receiver just for listening to voice transmissions, or a wide-range unit if

you sometimes listen to music too.

## The Dreaded Pythagoras

I talked earlier about the space problem when accommodating a large piece of equipment plus microphones, keys, logbooks, etc., on the operating table. One big drawback of putting the equipment at an angle, regardless of whether it's recessed into the table top or set off to one side, is that its front-to-back dimension is increased.

Say that you have a rig that measures 500mm deep (i.e. front to back), 400mm wide and 200mm tall, and you recess it into the table so that the top of the back panel is just level with the table surface. Its effective depth increases, according to Pythagoras' Theorem, to 538mm, the diagonal of a rectangle measuring 500 by 200mm. In other words, you've added 38mm to the depth. In fact, you'll find that you don't need to recess the back of the rig quite that much to put its front panel at right angles to your line of sight, so the actual effective depth is very slightly less.

A variation of this idea, which was at one time much favoured by the Post Office in its radio stations, was to recess the receiver into the table-top but to tip it over still further, so that the front panel became almost horizontal. If the receiver was deep but not very tall, this had the advantage that its depth became a near-vertical measurement and was swallowed up under the table, whilst the height became a near-horizontal measurement, taking up much less of the depth of the table-top. It had the disadvantage that the operator had to lean forward over the table to see the tuning scale, and also a large part of the labelling of the other controls was likely to be obscured by the knobs.

If you were to sit the rig flat on the table-top but off to one side of you, at an angle so that the front panel was facing you, the depth could become as much as the diagonal of a rectangle 500mm by 400mm, which is 640mm. If you both angle the rig to one side *and* recess it, the depth (from one front bottom corner to the back top corner on the opposite side) could be as much as 670mm. The formula to find this is very simple; you calculate the squares of the depth, width and height, add them together and then find the square root of the sum.

Incidentally, that last dimension, which in geometry rejoices in the name of 'the diagonal of a parallelepiped', is quite useful in another radio application — calculating the maximum length of dipole or long-wire aerial you can squeeze in from one corner of a garden to the opposite corner, by raising one end higher than the other.

# QRP CORNER

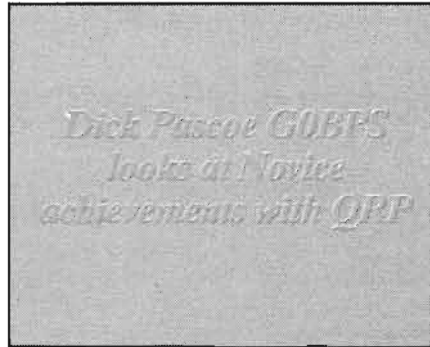
I was pleased to play host for a few days, to one of the new Novice licensees, Richard, 2E0AAK. He was one of the first in our area to gain his HF Novice licence, and after a few months he finds it all almost too easy. Even limited to his low power he gets plenty of contacts, generating a pile-up almost every time he goes on the air. His latest achievement was working into Kuwait City, all this on SSB too, his twin sister Rachael (2E0AAP) prefers CW.

After listening to Richard operating, it became clear to me that his training through the Novice course had been very good. This showed as he demonstrated unconsciously how to carry out an almost perfect QSO. No jargon, correct call signs given, and an exchange in English, no 'radioese'. I should mention that Richard and Rachael are 12 years old!

## Letters and Calls

From the letters I receive from around the world, one of the main points of interest is that almost all writers build their own equipment. Is this just a natural facet of this part of the hobby or is it that we amateurs are tending to just buy our equipment these days. But without getting into the 'black box' versus 'homebrew' argument, it seems to have become the norm for most low power enthusiasts to go for home construction.

The plethora of circuits that appear in the amateur press for complex, all singing-all dancing one kilowatt transceivers make me wonder where we are going wrong. My simple three transistor transmitter will still put out a signal, and can be built in about 15 minutes. It was designed by George Burt GM3OXX, and is a firm favourite with the G-QRP club.



Most builders will have heard of this set, called the 'OXO', a very simple transmitter that anyone can build.

A letter from France the other day made me look a little more carefully at the international QRP scene. I was amazed to see that our own English QRP club has a membership list that encompasses almost every country in the world, some with their own membership agent in that country. One of these agents is Peter PE0MHO, who is an almost exclusive 50MHz freak. A frantic phone call disturbed me early one morning, it was Peter saying he had at last worked all continents QRP and with SSB! Quite an achievement, so well done Peter. Have any UK operators done this, or getting close?

Another VHF QRP operator is Dave G0DJJA, from up in Wakefield. He prefers 2m CW and was pleased to work into France, Holland and Germany with just

3W from an old Icom IC202. These old Icoms are still well thought of in QRP circles, ideal for driving transverters too! The point that Dave made was that he has tried for years to work into the continent, and only made it by beaming north east, so 'Thank you kind Aurora'.

## Rallies

The rally season is well under way again and I was pleased to see the RSGB decided to change the date of their National Exhibition to the end of May. It has been a great shame that this marvellous show has clashed with the larger show at Dayton, so avid transatlantic-hopping rally goers will be even more pleased they'll be able to 'do' both.

This month once again brings a cry for help. It's mostly the same people who man the G-QRP Club stands at rallies, but help is always needed. It's not really helpful to just turn up and offer your services, a quick call beforehand ensures that the stand will be manned throughout the show, without too many or too few at any one time.

I've already mentioned the Yeovil QRP convention to be held on Sunday 10th May, this is an excellent gathering for the QRP enthusiast. Pop along to the Preston Centre, in Monks Dale, Yeovil. Entrance is £1.50 to include a lucky draw. This is not a rally as such, it is a small gathering with a few traders with items of interest to builders. No black boxes or computers either.

A rather short column this time, pressure of work has made me spend much more time at the keys on other things. So that's it for this month, News and views to me please via HRT or to 3, Limes Road Folkestone or via GB7SEK. 72 de Dick

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# VHF/UHF Message

50MHz openings to the East and West took a dive in mid January, but on the 26th there was a return F2 opening to VS6 (Hong Kong) at 0930GMT, and later to XX9. Sporadic E was prevalent during the month with many short openings on 50MHz to CN8, YU, OE, SM, ZB, 9H, I, OK, and DL. Solar flux figures also took a dive during the month, but again towards late January the flux levels were back in the 200s. Given these figures and the recent early opening to the Far East (not noticed in January before) I personally think we will see more openings yet to come.

## Beacon News and 'Down Under' Distance Records

News from Steve VK3OT is that all of the VK distance records set up in cycle 21 have been broken! VK2FLR who had just set up the VK2 distance record with GJ4ICD in October 1991 broke the record books again by working Joel CU/N6AMG on the Azores. Eric VK5LP has been awarded the short path record for his contact with P43AS on Aruba (a familiar call to UK operators) thanks to WIA for this news. Another well known call is VK6PA who now has worked 42 countries on six but only has 23 confirmed. Other news from Steve VK3OT is that VK3SIX is now on 50.053MHz CW, power is 100W to a 9 element yagi at 40m above ground level.

Also on the subject of 6m beacons, a new one has been reported being received in Finland; DX1HB in Manilla on 50.008MHz was S5 to S9 for over two hours.

## A Pleasing Start to 1992

It's unusual to see large anti-cyclones during the month of January, usually down here in GJ we get blasted by force 8 gales, and easterly winds from the USSR bringing ice and freezing rain. However, for the past three weeks anti-cyclones have been continually dominating the scene, the best of these (radio-wise) was the peak on the 14th to the 16th when pressure dropped just one millibar from 1039 and stabilised. The first indications of good tropo in GJ is that our microwave TV link goes hay-wire, which is always a good sign!

## 144MHz wide open

The evening of the 14th brought Ela G6HKM 2m signals from HB9RSO (JN36), HB9RCJ (JN37), and the HB9

## Geoff Brown GJ4ICD reports on the excellent tropo conditions on 144MHz and 432MHz

beacon, all very strong. On the 15th things really got going, again Ela had many QSOs with OK, OE, HB9, and DL, some of these QSOs were well over 1000km. Some choice DX was OK1DDO (JO60), OK1UBR (JN69), OK1DVN/P (JN78) — I also worked this station at S9+, OE5VFM (JN67), OE5HSN (JN68), plus many more, but the total number of squares worked for the day was 29! Ela also heard HB9QQ working G stations whilst having her evening meal, this was copied on a Trio 9130 and indoor halo. In GJ, DL0PR on 144.910MHz was S9+, as was GB3ANG, and pages of DLs were worked over to the Polish border.

Later in the month good tropo returned to 144MHz with the 30th being the best judging by reports received. Again checking the barograph, there seemed to be a slight drop of around 2 millibars, pressure was very high at around 1045 millibars. Again Ela G6HKM had a ball, DL6NVC/P (JO73) was her best DX to the East, and OZ1BJF



The famous Gunter Hoch DL6WU, 'The Antenna Man'

(JO75LB) was worked on Bornholm Isle.

Dave G0DJA in Wakefield, Yorkshire reports on hearing three Auroras during the month, these were on the 3rd, 11th, and 27th. During the event on the 27th Dave was calling CQ with only 3W and a 9 element yagi, when he was answered by LA1BEA who gave him a report of 589. This was truly a nice tropo duct and not aurora. Dave had other contacts on the band, during the month GM4ZUK/P in Grampian was worked with his usual 3W.

## 432MHz comes back to life

Activity during the autumn is usually the best time for this band, however January brought some fantastic openings to the continent, and not before time. Ela G6HKM reports good openings on the 11th, 13th, 14th, 15/16th, and 30th. On the 11th Ela heard SP2DDV (JO93) calling CQ on the key. On the 13th, ON, HB9, and DLs were worked, the 15/16th were certainly the best, OE5XBL (JN68) was worked for a new square, others worked were LX1JX, HB9s, and lots of DLs.

I was active for once on this band as 50MHz propagation had died, it was nice to see so much activity on 70cm. The 15th was good and GU3EJL on Alderney worked a DL in JO64, this is quite a rare square. The Angus beacon was end-stopping down here, as was GB3MLY, but I fear this latter beacon is sited too high up the TV tower as I called and called with no replies. By 1500 GMT the SK6UHI beacon on 432.925MHz had showed up at S5, and SM6ESG (JO67) came in at S9, this was a new one for me after all these years of being on 70cm!

Later in the day beacons came in from all directions, HB9F on 432.984MHz at S9 giving its info as 3573m ASL. DL0SG (JN68) on 432.975MHz was reported in the south of England at S9+. HB9MIN blasted the south of England at S9+ asking for 23cm activity. Later that evening Y21TC (JO63) came romping into GJ at S9+, this being another new one for me. More beacons were heard in DL, one such report was DB0VJ on 432.995MHz in JN67, which was S9 in Cornwall.

Stan GU3EJL went on to work some choice DX later that evening, he reports working lots of OEs, OKs and an HA (wow, real DX!). By lunchtime on the 16th, propagation had died, but it returned around the 30th. Once again Ela G6HKM held her own with OZ1BJF (JO75), SP3RBF (JO71), and many DLs and PA0s.

Down here in Jersey things were really good, GB3MA the UHF repeater in Lancashire was S9+, GB3MLY on 432.910MHz was S9+40dB all day long with little or no activity on the band. GB3ANG was also S9++ again with no takers after hours of calling. It strikes me as very strange, if so many people are out of work, as is stated, then what do they do during the day? Y21TC (JO63) was pounding the UK all evening, and DF8LC (JO53) was also giving UK S-meters a hard time. Other nice DX signals reported were DC7MH (JO62), and OZ1BJF (JO75).

On the 31st conditions were still good, south coast stations were reporting the SM beacon at S9+. G3NVO worked SP3RBF (*I wish I could hear SP!*) and SM6ESG (JO67) was in along the UK east and south coasts, lots of OZs were also worked in the south of England. It seems that the band of the month must have been 432MHz, the activity was fantastic for this usually quiet band, well done to all.

### Six takes the back seat!

There were a few brief openings during the month, but conditions generally failed expectations. The southerly path seemed to be coming back into play, with ZS6 stations being reported by a few people in the south of the UK. Weak openings to the USA east coast also transpired along with a few spotty openings to central America.

On the 26th, VS6BG was 599 into Jersey, and so was XX9JN in Macau which was a very big shock to the system. The 28th brought RA3TES who worked into the UK, but I understand he had no permit and thus cannot be counted as DXCC at present. Again Ela G6HKM had her share of DX, on the 29th she worked Mike UL7GCC/P in MN83 square for a new country and square. Ela also heard P43FM several times but has yet to crack the pile ups, she also upgraded her 50MHz RSGB countries DX award to 75 countries confirmed, and was delighted to see that it was endorsed #1.

Richard G4CVI followed your scribe in the pile-up for UL7GCC/P on the 29th, and became the first G to work Mike. Mike also worked CU1EZ in the Azores for a distance of over 7300km, your's truly heard both sides of the QSO which was quite unusual.

Early February saw a large increase in the solar flux levels. These peaked over 300 units, a few flares took place and there were a few small auroras. Neil G0JHC (Lancashire) reported hearing the Lerwick beacon, and on the 1st February he worked 4X1IF #99, and a UK first with OD5SK #100 (well done Neil). On the 5th Feb conditions returned to the



EMEsers on a visit to Jersey to see Geoff, F6BSJ (left) and F8OP (right), both QRV on 144MHz and 50MHz

Far East, early that morning KG6UH/DU1 was into the UK as was VS6, JA, and VK2, 4 and 6, so things are looking brighter we hope.

Dave OZ3SDL phoned to say that no EA permits will be issued prior to June 1992. Dave also faxed this info through from the Spanish PTT. It may be mid-year before we hear Poland on 'six', many negotiations have yet to take place regarding aerials and power levels, but it is certain that Poland will appear this year. SP3CUG is ready to go on 'six' as soon as permits are issued.

The UK Six Metre Group still has two 'special achievement plaques' left, one is for the first SWL who can submit proof of 100 countries confirmed on 'six', and the other plaque is for the first class B licensee who can do the same (Ela, get those cards in!). Further information can be obtained from G3WOS, Old White Lodge, 183 Sycamore Rd, Farnborough, Hants GU14 6RF.

4U1UN has recently been QRV on 50MHz, if you were lucky to work him then the QSL route is via W8CZLN.

### DX on 23cm

I am sure that some excellent DX was worked on 23cm during January, however not much feedback has been received. I was continually asked during 70cm QSOs 'do you have 23cm?'. Well the answer was no, but by the time you read this article I should be QRV again using an FT736, and maybe a cavity amplifier. Ela G6HKM reports good activity on the 11th with JO33, JO43, JO23 squares, and John G3XDY in JO02. The 13th was also reasonable with ON4YZ (JO20), FC1EZQ (JN27), and DB2VY

(JN39) for another new square. Finally Ela heard OE5XBL on the 15th at 51, but couldn't manage a QSO due to her low power level. (*Maybe we should tell readers where they can buy triple cavities for 23cm complete with fitted 2C39As at £60 a time Geoff! — Tech Ed.*)

### Other News

On another front, some UK dealers seem to be selling a German based QRA locator map of Europe. Please beware if you are thinking of purchasing this product as I have found many mistakes on it. For instance the 5B4 beacon in Cyprus has also been located in the USSR in locator square KO60, when it is really in KM64, there are also several squares with wrong numbers in them.

As the column was just being finished a massive opening occurred on the 8th Feb to the Far East, VK2/3/4/5/6/8, KG6DX KG6UH/DU1, and 4X1IF were all worked into the British Isles, signals were very strong and I am very sure that some VK distance records may well have been broken, more news next month.

Shamir, OD5SK is now qrv on 50MHz, he had his first taste of six on 1/2/92 with a very good opening into GM, GI, OY, and lots of G's in the north of England.

Large openings are also occurring on 50MHz to VE, W1/2/3/4/8 around late afternoon, were has all this propagation come from?

That's it for this month, thank you to everyone who phoned or wrote with reports and info, please keep it coming to; G. Brown GJ4ICD, TV Shop, Belmont Rd, St Helier, Jersey, Channel Islands, JE2 4SA, Tel. 0534 77067 daytime (switched to fax at night), or 0860 740727.

# Packet Radio

## —Roundup—

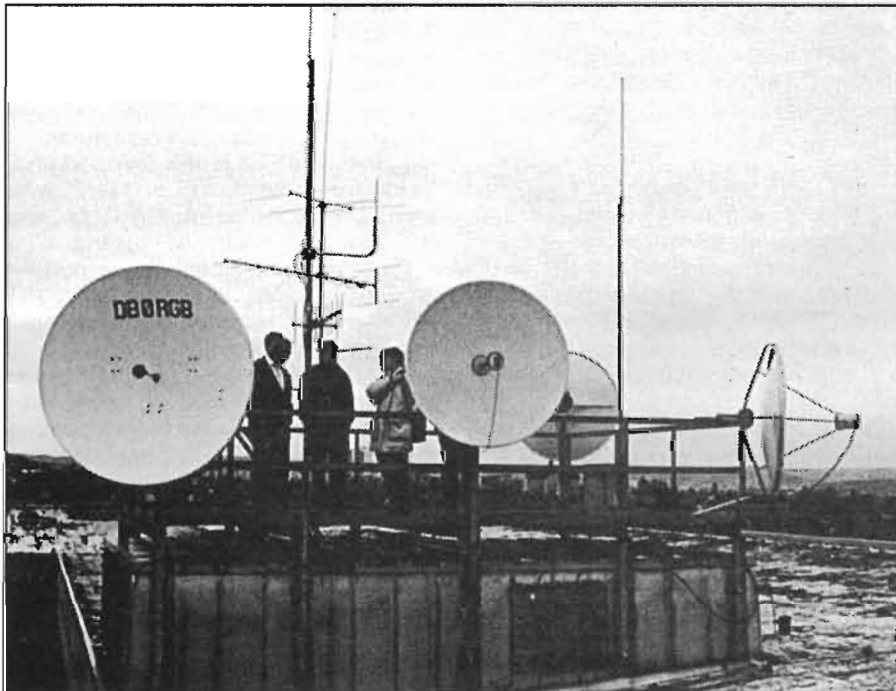


Phew! Immediately following HRT's exclusive review of the Minipak system in the March 92 issue of this magazine, the UK distributors were in touch to say they've been inundated with requests! I had the pleasure of replying 'So have I!' In case you missed it, this is an £80 system which uses the supplied and UK-licensed 'Baycom' software on your PC, together with a supplied, self-contained modem, housed within the 9-pin RS-232 connector which plugs into the back of your PC, a lead from this connecting straight to your transceiver.

### Minipak software upgrades from Baycom

The Baycom team in Germany must have their work cut out, as they've been busy getting together various enhancements for the program. Denis G0KIU, who acts as the UK Baycom 'translator' of the German text into English, has just dropped me a comprehensive amount

**The Baycom team do things in style with their DB0RGB 'supernode', including 3cm and 23cm links, with one 23cm 9600 baud port linking to Munich over 160km away! John G8BPQ (right) is seen here admiring the aerial system**



*Our packet SysOp G4HCL receives messages by the score*

of information on Version 1.50. In this he says the following additional features are now available on Baycom V1.50; *All 8 Ports can be written to separate files.*

*Software DCD  
Integrated Screen Blanker  
36 lots of 10 line Standard Texts possible  
Ctext and L2Text  
Possible to use COM3 and COM4 (usually)  
Priority of keyboard interrupts lowered  
New command, XMITOCK which disables the PTT  
Commands DIR and CAT without shell-ing to DOS  
Mouse can be used  
Password file and control corrected.*

Denis has been running V1.50 now on his PPC512 for several weeks with no problems, allowing him to test each command which no doubt made his translation work that bit easier. He adds that the 'On-line' help file is now in two versions, consisting of the full one with all the German Node information etc. stored, occupying around 145kBytes, plus a 96kByte UK Version. A further slight 'bug fix' version of V1.50 will probably have been issued by the time you read this.

I've been told that Baycom software upgrades, complete with printed manual, will be available to UK amateurs



**The 'business' end of the Baycom DB0RGB node**

for a nominal charge of £5.00. The cheque is to be made payable to 'Baycom' rather than the UK distributors, this ensures the team receive due recompense for their efforts. Contact Siskin Electronics (0703 207587) or Denis G0KIU @ GB7BAD for details.

When they're not putting all this together, it looks like treating amateurs to hospitality is the German Baycom team's nature. I've heard this from several UK amateurs, indeed Denis has asked me to mention the fact that the BayCom Team are a magnificent load of gentlemen. He and his XYL stayed with DG3RBU's parents last June and they and the team really made them welcome, Johannes's younger brother taking them on the finest conducted tour they've ever had. Two of the team even took them for a cruise on the Danube, ending at a monastery that sold marvellous beer!

### Baycom Expansion Card

In between these times, the team have also designed a PC plug-in expansion card for packet, this having on-board 1200/2400, 300/1200 and 9600 Baud modems. I'm told the 9600 baud modem is a variation by DF9IC of the G3RUH type, and can be pushed up to 38,400 Baud for high-speed use (I've used modified G3RUH modems at 56,000 Baud, and Mike G8TIC has performed tests at 64,000 Baud).

# CB CITIZENS' BAND

CITIZEN'S BAND is the only British CB magazine and covers a wide range of topics of interest to the newcomer and the experienced user. In each issue the latest equipment is reviewed, useful practical projects are detailed and all the national and international band news is featured. Of particular interest to overseas readers are the QSL pages, articles on shortwave listening, and reports on UHF CB.

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As I write this, the UK Baycom distributors, who have just returned from Germany this weekend, have told me an *exclusive* review sample of this board will be with HRT in time for the next issue. Watch this space!

Baycom V1.50 Software caters for this card, in fact it caters for 16 Channels if anyone can afford all those rigs! Denis GOKIU has translated the manual for a driver for this, written by an ex-East German 22 year old, that allows SP to run on the ordinary BayCom modems. Denis should also have available what he describes as a 'magnificent' PMS program that will run on a TNC at the moment, but should be on BayCom Modems shortly. The program writer has also adapted it to give multi-access to an inbuilt PMS with BPO Nodes incorporated, once again this from a young man in his early 20's.

### New DigiProm MB.XA

For users of the Commodore 64 and 128 machines, the latest packet software from JSM, DigiProm MB.XA is now available (the DigiProm system was reviewed some time ago in HRT). If you'd like a copy of this software, send a formatted 5.25in disk with the correct return postage and disk mailer to Paul Timmins

GONDV, 60 Bramwell Street, Netherthorpe, Sheffield, South Yorkshire, S3 7PA. Remember to add whether you want a C64 or a C128 version, and Paul mentions that any disks arriving without the correct postage or return mailer will be kept until further instructions are received.

### Network News

Following my description of the 'State DCD' board a couple of issues ago, I received a call from GM0DRU saying that the 2m LEWS21 node in the Outer Hebrides, which is co-sited with the GB3IG repeater, will soon have one of these added inside its Tiny- 2 TNC to improve communication over the long RF path to the mainland. Although GM0DRU isn't on packet (yet), you can get further information on LEWS21 from the SysOp GM3JIJ @ GB7AOR.

At the southern end of the country things have also been moving to improve links. The Isle of Wight 23cm node is due for installation next weekend, and will hopefully be in operation by the time you read this. This should bring about a much needed improvement to the east-west linking along the central south coast. A further Packet-Cluster has also come into operation in the south, this being GB7JCJ in Dorset.

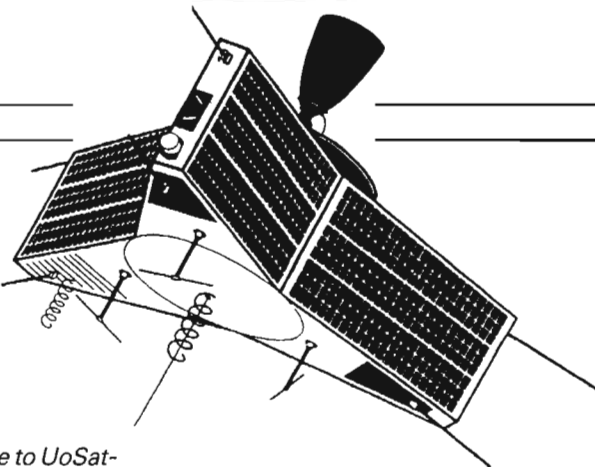
This currently links into the network through GB7DXC, providing an additional help to DXers in what was a 'hole' in the southern cluster coverage. Any offers for a cluster around the south-east?

### CTRL-Z, End of Message

I recently received a letter and SAE from an amateur new to packet asking me for a listing of 'the program' to run packet on his PC, as he'd bought a TNC but no software and couldn't find anything in various packet books. In 'Packet Radio Roundup' as well as new software I often mention various software sources, including the Public Domain and Shareware Library (0892 663298) who supply an enormous amount for a nominal copying fee. Fortunately the reader told me which TNC and computer he ran, and was probably surprised to receive a 'bumper filled' disk from me in return!

With a final reminder to northern SysOps that the SYSOP 13 Packet Conference takes place on the 5th April (get your skates on), I'll get back to the TNC keyboard. Please keep the news coming, to P.O. Box 73, Eastleigh, Hants. SO5 5WG, Tel. 0703 262105 evenings up to 8.30pm, or via. packet, let's hear what *you're* doing. 73 from Chris G4HCL @ GB7XJZ

# Satellite Rendezvous



**AMSAT info on space-age communication, collated by Richard Limebear G3RWL**

## UoSAT-3 users move to UoSAT-OSCAR-22

Because of the shortage of memory on UO-14 and the relative glut of memory on UO-22, some time ago UoS told us they could soon make some changes to amateur operation. Well it happened!

Jeff Ward G0/K8KA tells us; SatelLife, the organisation which paid for most of UoSAT-5, had planned to operate the satellite predominantly on non-amateur frequencies. Operation of the CCD camera on the amateur downlink was to be a 'secondary' activity of UoSAT-5. After launch, this plan ran into two difficulties. The UoSAT-5 CCD camera proved very successful, and amateurs around the world have been downloading images of the Earth. Images are taken several times a week, each having over 300 kbytes of data. Furthermore, UoSAT-5's high power amplifier which produced excellent output on the amateur frequencies, did not work reliably on the non-amateur frequencies. So the following steps were taken by the UoS team; 1) All non-amateur traffic, both SatelLife and VITA, will be carried on UoSAT-3, which will cease to transmit on its amateur downlink.

2) All amateur traffic will move to UoSAT-OSCAR-22, and UoSAT-OSCAR-22 will operate as a dedicated amateur radio satellite transmitting constantly on its amateur downlink.

Of course, there is a price to pay for this transition. Most notably, the conflict between CCD users who want to download large CCD image files and 'BBS' users who just want to get their mail. The UoS team are looking into on-board JPEG compression for the images, and this potential disadvantage will be balanced by the advantages of 512 kBytes of program memory permitting 800 message capacity, two amateur radio uplinks (145.900MHz and 145.975MHz), and no downlink frequency switching (permanently on 435.120MHz).

So there we are, UoSAT-3 is essentially 'no longer there' as far as amateur operation is concerned, but instead we've got the exclusive use of UoSAT-5.

## Oscar 13

Weighing up the opinions of concerned users as a result of the recent request for comment, and the technical options imposed by flight software and power production, the AO-13 command team will invoke the following experimental schedule on a trial basis for the period Mar 16 to Jun 08; Mode-JL: ON four days per week, Monday, Wednesday, Friday, and Saturday UTC from MA 100-150. J OFF 120-135 Mode B; ON at all other times. Mode S; ON every orbit MA 120-135, the beacon on 'L' days, the transponder on 'B' days.

The aggregate amount of time allocated is 200 MA counts/week compared with an average of 227 at present. However the usable time is considerably increased because for northern hemisphere stations the squint angle is never worse than 15 degrees. This corresponds to an off-pointing loss of no more than 1.8 dB. So a minimum EIRP of only 1.5kW RHCP will always realise modest SSB communications. That's a 25W 'brick' to an 18 dB gain aerial, which isn't difficult. So let's give this experiment a try. If it works, then good. If it doesn't we can easily go back to the old arrangements.

Up to date information about AO-13 operations is always available on the beacons, which you'll find on 145.812MHz or 435.658MHz in CW, RTTY and 400 bps PSK. Constructive feedback about operations is always welcome by the active command stations.

## Oscar 10

Graham VK5AGR believes that AO-10 is still using the omnis on both the uplink and downlink so the best squint angle is 90 degrees plus or minus 15 degrees. Also, when the range is less than 20,000 km. the signals are quite strong. Graham provided the following ALON/ALAT predictions for AO-10;

Date	ALON	ALAT
11 Apr	308.0	13.9
09 May	304.8	13.4
06 Jun	301.7	12.8
27 Jun	299.3	12.2

As reported here in the past, Oscar 10 is currently available for Mode B operation when it is view, but please do not attempt to use it if you hear the beacon or the transponder signals FMing.

## Russian Satellites

DB2OS reported recently that due to a ground controller strike at a large satellite tracking facility in the Russian Republic, only AO-21's CW beacon (145.948MHz) can be heard at the present time. The unusual circumstances surrounding this situation are not difficult to understand when one considers that AO-21 is flying 'piggy-back' aboard a geological research satellite.

### OSCAR-13 Calendar until June;

Date	Event	Modes
1992 Mar 16 [Mon]	180/0 Schedule	B (JL) S
1992 Jun 08 [Mon]	180/0 schedule	t.b.a.

Based on feedback to the AO-13 Command Team, the following AO-13 schedule will be put in place:

Mode-B : MA 000 to MA 100	Mode-JL ON Mon, Wed
Mode-JL : MA 100 to MA 120	Fri and Sat UTC only
Mode-LS : MA 120 to MA 135	S Beacon on 'L' days
Mode-JL : MA 135 to MA 150	S Transp on 'B' days
Mode-B : MA 150 to MA 256	
Omnis : MA 240 to MA 030	BLON/BLAT 180/0

It appears that ground controllers have refused to perform any commanding until a payment plan is worked out between the Ministry of Geology and Sciences, AMSAT-U, and AMSAT-DL. In the past, the Soviet Military paid for the operation of the tracking facility no matter if the satellite was used for civilian or military purposes. With the current political upheaval, the Soviet Military is now no longer involved with civilian satellites and has therefore ceased paying the salaries of the ground controllers for commanding civilian satellites. Negotiations are underway and AO-21 users are asked for their forbearance while this frustrating problem is worked out.

## MicroSats

The AO-16 Command Team tell us they're pleased to announce the resumption of S-Band transmitter operation after a lengthy wait. Favourable sun angles now permit the S-Band transmitter (2401.14MHz, 1200bps BPSK) to be activated as part of the Wednesday Experimenter's Day activities.

Since the power level of the Raised Cosine transmitter must be reduced during periods of S-Band operation to maintain a positive power margin, users will notice a 'weaker' 70cm downlink signal than they have been used to over the past few months.

While Experimenter's Day operations on AO-16 are scheduled to be conducted weekly, users are reminded that these operations may be shortened or cancelled to allow uploading of spacecraft software. Watch bulletins on the BBS and/or in the telemetry text frame for changes to the schedule.

Up to now, Experimenters Days have been distinguished mainly by the use of the Raised Cosine downlink and (when the power budget permitted) the S-band downlink. Experimenters Days are now also designated QRP days.

The receivers are quite sensitive. Tests have shown that an EIRP of about 20W is more than adequate to hear ground stations reliably. Unfortunately many Microsat users have fallen into the habit of using their AO-13 stations with about 1000W EIRP! This has the effect of 'freezing out' users with minimal stations consisting of 25W radios and omni directional antennas, since they can't compete successfully with the 'Big Rigs'. Many of these minimal stations are being set up by newcomers to the Microsats or to satellites in general. In order to encourage the use of minimal stations, to prove such stations can be used with great reliability, and to give newcomers with small stations a fair shot at the BBS, *all users* are asked to limit their uplink power to 20W EIRP during Experimen

ters Days on AO-16. If you are using your AO-10/13 beams, this means you must crank your power back to about as low as it will probably go, no more than 2W. And don't forget to turn off your amplifier! While there is no way to enforce this one-day-a-week limit on uplink power, the Command Team hopes all Microsat users will comply in the spirit of amateur radio.

DOVE has now returned to the 2m downlink frequency of 145.825MHz. Using the painstaking method of listening to the S-Band downlink for the chirpy 'ACKs' and 'NAKs', N4HY has successfully loaded all the necessary software to get the basic housekeeping system working. It took 12 tries over a 2 month period to complete the upload. Now that the initial load is completed, the second phase will be to install a 'push-to-talk' software loader which will

make DOVE appear as a 2m terrestrial packet station to ground controllers so that the software uploading can be done on 2m. DOVE's signal should sound quite loud since its RF output is set to about 5W.

Those of you looking at the telemetry may note that the two RF power output channels show little or no power out while the status line shows maximum power out (FF). This is because in its present mode, i.e., the transmitter coming on only when a packet is to be sent, the telemetry is being gathered while the transmitter is off.

## 2-Line Keplerian Elements

NASA have changed the check-summing algorithm in the 2-line element sets.

### 2-Line Keplers

#### OSCAR 10

1	14129U	83 58	B	92022.23314193	-.00000072	00000-0	99998-4 0	7932
2	14129	26.0458		102.6682 6082608	312.2601	10.1329	2.05909224	36754

#### UoSAT 2

1	14781U	84 21	B	92023.59731543	.00001714	00000-0	30697-3 0	1633
2	14781	97.8720		65.1525 0011399	183.2450	176.8667	14.68017405	421774

#### AO-13

1	19216U	88 51	B	92019.51747436	-.00000112	00000-0	00000+0 0	3346
2	19216	56.6342		47.8769 7278385	275.7250	12.9207	2.09709303	27593

#### UO-14

1	20437U	90 5	B	92021.21676325	.00000374	00000-0	16209-3 0	4952
2	20437	98.6490		104.2484 0010591	248.3203	111.6854	14.29452645	104132

#### PACSAT

1	20439U	90 5	D	92023.68952365	.00000627	00000-0	26106-3 0	3933
2	20439	98.6568		107.1912 0010043	243.5033	116.5119	14.29530123	104493

#### DO-17

1	20440U	90 5	E	92022.18494199	.00000750	00000-0	30846-3 0	3938
2	20440	98.6575		105.7850 0010682	248.4587	111.5454	14.29640372	104287

#### WO-18

1	20441U	90 5	F	92023.76043529	.00000606	00000-0	25213-3 0	3922
2	20441	98.6568		107.3395 0010762	243.4417	116.5662	14.29652281	104517

#### LO-19

1	20442U	90 5	G	92022.18310220	.00000681	00000-0	28105-3 0	3930
2	20442	98.6572		105.9217 0011390	248.2726	111.7241	14.29732346	104295

#### FO-20

1	20480U	90 13	C	92014.83021608	.00000019	00000-0	71050-4 0	2902
2	20480	99.0604		322.1087 0540542	182.0931	177.7899	12.83199781	90704

#### INFORMTR-1 AO21

1	21087U			92023.17292731	.00000140	00000-0	13551-3 0	2194
2	21087	82.9428		70.9822 0036456	8.1367	352.0371	13.74448005	49246

#### UO-22

1	21575U	91 50	B	92021.73442941	.00000961	00000-0	34193-3 0	982
2	21575	98.5252		98.7126 0008144	29.1690	330.9937	14.36427839	27088

#### RS-10/11

1	18129U	87 54	A	92022.68090196	.00000175	00000-0	18085-3 0	167
2	18129	82.9257		256.6476 0010789	302.5148	57.4970	13.72249989	229694

#### Cosmos 2123 RS1213

1	21089U	91 7	A	92021.82431852	.00000175	00000-0	17458-3 0	1919
2	21089	82.9256		302.0200 0030909	32.5969	327.7084	13.73959752	48167

#### Mir

1	16609U	86 17	A	92023.10031843	.00038080	00000-0	40050-3 0	183
2	16609	51.6037		262.0156 0001764	319.3098	40.7917	15.63920917	339476



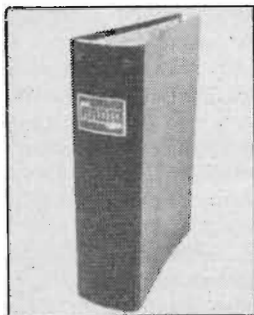
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The plus sign used to count as 2, it's now zero. Users of the program 2LIN2KEP.BAS should delete lines 250 and 310 (IF CS\$='+' etc.). Users of IT should obtain ITPATCH1.ZIP, and Sat-scan and other users should attack the 2-liners with a word-processor and change all plus signs to spaces. ITPATCH1.ZIP is available from the Amsat-UK office; please send a formatted disk (either size) and postage/packing and your *InstanTrack* serial number.

For those who solely use the AMSAT-NA elements, these will *not* have the '+' signs. However, those who download from the Celestial BBS, or take the Amsat (UK) elements from Packet will need to change.

There is a bug in several tracking programs which will prevent Auto-updating of Keplerian Elements from a 2-line format input file when the day value is less than 100. This bug only showed up after the first of the year when the NASA EPOCH value began to have a blank in the hundreds position of the day number. Updates from an AMSAT format file are not affected. For example the AMSAT format would be 91012.345678 while the equivalent 2-line format would be 91 23.45678. So if your software gets upset with the new year's

elements look for this first and insert a zero instead of the blank; I always change the packet elements to remove this problem.

While on the subject of software, some of the older programs require a sidereal correction which changes each year. The number for 1992 is 0.27477847 (the number for 1991 was 0.27544157).

## Race to the Moon

An international scientific 'solar sail' expedition and race to the Moon is planned for 1994, with participants from the United States, Europe, and Japan presently working to complete their spacecraft for launch on an Ariane 4 rocket. All three satellites will use sails having areas of 400 square metres, and will use solar radiation pressure against the sail for propulsion. The first spacecraft to return an image of the Moon's far side wins the competition. In addition, the spacecraft sponsored by AMSAT-NA and the World Space Foundation, will have interplanetary capability, and will proceed to Mars if its lunar encounter goes well.

The imaging payload carried on the Amsat-NA spacecraft will be based on the colour CCD camera carried on WEBERSAT-OSCAR-18. A beacon trans-

mitter is proposed for operation on 145.825MHz, the same frequency used by UoSAT-OSCAR-11 and DOVE-OSCAR-17. Communication links with the spacecraft will probably use Mode S, with 1.2GHz uplinks and 2.4 GHz downlinks.

## AMSAT-UK News

Ron G3AAJ is compiling a manual of upgrades to FT-736 and DSP-12 modems, if you have any input please send it to him so that your information may be shared by all. Ron would appreciate this on IBM format disk if possible, and in turn will issue a technical file on all information received (*another good reason for joining AMSAT-UK if you use an FT-736!* — Tech Ed). If you came and said 'hello' at the London or Sandown shows then thanks, and remember to put the AMSAT-UK Colloquium dates of 30th July to 2nd August in your diary! Booking forms will soon be available, but in the meantime please don't contact the University of Surrey staff about this — they've got enough to do looking after the satellites!

For further information about Amsat-UK contact: AMSAT-UK, c/o Ron Broadbent, G3AAJ, 94 Herongate Rd, London, E12 5EQ. Big SAE gets membership info, SWLs are welcome.

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