PRACTICAL WIRELESS

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NEW LOOK

JANUARY 2020

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BUILDING AN ICON

Making the Lovell Telescope

Yaesu FT-3DE Dual-Band Transceiver

Practical Wireless REVIEW

This exciting new handheld put to the test.

Online propagation prediction software

Some of the tools available to make your own predictions

Gemini DX1200 solid state linear amplifier

Details inside, plus all the other latest products on our news pages

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As Christmas approaches, it is time to wish all readers a very Happy Christmas. Now entering our 47th year, it is a reminder of how technology has advanced. In 2020 we will bring you even more advanced gear. The IC-705 and the K4 are already announced. What else? Time will tell.
Wishing you all a very happy Christmas and New Year

Peter Waters G3OJV

ELECRAFT — Brought to you by W&S!

Elecraft K4 SDR Transceiver

The new K4 transceiver steps forward into the world of SDR. Not new territory for Elecraft, of course, for both their KX3 and KX3 feature SDR. However, the K4 will now set a new standard of performance by which others will be judged. Again nothing new for for Elecraft, who have been at the top of the performance list of analogue designs.

Contesters, DXers and DXpeditions rely on the performance and reliability of Elecraft. This will continue with the K4. A design that now adds dual receive, and dual spectrum display. You won't need extra filters but you can add auto ATU, Diversity Reception, a Superhet front end for ultimate receiver performance, and to come a dual 2m and 70cm 15W module. Deposits now being taken.

The New AX1 Antenna System

The AX1 antenna was designed by Wayne N6KR, co-founder of Elecraft. Whilst designed with the KX2 and KX3 in mind, it will equally appeal to all QRP operators. Handling up to 30W and covering 20, 17 and 15m, this telescopic whip fits easily into a pocket. Each antenna also includes a counterpoise wire. Additional accessories are also available as below.

£109.95

- Bands: 20 - 17 - 15m
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AXT1 Tripod Adaptor **£29.95**

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The AXE1 is a 40m add on coil that sits above the base of the AX1 and below the whip. This brings the system up to 4 bands, whilst retaining the pocket size of the system. The coil is 15cm long and because of its high 'Q' an ATU is needed. (KXAT2 or KXAT3).

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Elecraft K3S 100W, 160m

Performance at the top end of the Sherwood Engineering list. Its compact form and light weight make it at home on a DXpedition or on your operating desk. It's Elecraft's answer to those who want top end analogue performance.

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UK Elecraft Carries Exclusive 2-Year Warranty

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600W up to 10:1 1kW up to 3:1. Can be used with any transceiver or amplifier.

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A great companion for the K3 series. It gives you a live view from 2kHz to 200kHz ollus waterfall.

Kit: **£819.95** Built: **£849.95**

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The KX2 offers a LOT MORE!

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Mic & paddle key are optional extras

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Elecraft KX3 160 - 6m, 15W

There is something very special about the KX3. It out-performs any similar transceiver and almost all of the base stations. You can run it at 100mW or increase to any power up to 15W (a bit less above 20m). You can add 2m or 4m, Add a narrow roofing filter or auto ATU. No other rig can match it.

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IC-7610

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The IC-9700 brings together the three popular VHF bands and puts them into one very high tech. box. The large screen, packed with information, will be a welcome addition and copies their HF range in presentation and flexibility. Top of the feature list is SDR employed on both 2m and 70cms, with all the benefits that go with this. And there is no extra charge for the 23cms down converter which will be the icing on the cake for many. The recent trade demonstration showed us just what a great radio this is. Call us today for a quote. **£1795.95**

Other Transceivers

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ID-4100E	2m / 70cm D-Star & FM Mobile	£295.95

Icom Outdoor Radio

D-51E Plus
22m & 70cm

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- Access Mode
- Terminal Mode
- AM & FM Receive

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..... **£1199.95 with cashback £1054.95**

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Keylines

61

64

I'm writing this while back in the Gambia, this time for the CQWW CW Contest at the end of November. I started coming to West Africa with the Voodoo Contest Group in November 1999 and quickly realised that it's a great location for these international contests. There is a good sea path to North and South America, Europe is directly north and the proximity to the equator means that the ionosphere gets more solar radiation than more northerly latitudes, something that's especially helpful at times of low solar activity. Most important though, it beats putting contest antennas up in the inevitably cold, wet and windy autumn weather in the UK!

I did wonder whether I would struggle to put *PW* to bed from here – the internet was somewhat variable on previous visits. However, I was recommended to buy a 4G router (available locally, along with 30 days of unlimited data) and I'm finding that speeds are pretty much as at home in the UK. Africa and many other parts of the world have benefited enormously from mobile telephony, whereas wired telephony was always a challenge – not least because overhead copper wires were too tempting to would-be thieves. But nowadays, mobile phones are used for everything, including small payments and money transfers. Yes, wireless technology is everywhere nowadays.

Activity from Home

I have also been a bit more active from home following the house move. A modest effort on 80m SSB in the CQWW Phone contest at the end of October, followed by swapping the 80m vertical for a 160m inverted-L antenna in the hope of working some of the autumn DXpeditions on topband, which has always been my favourite amateur band. I started by playing on 1.8MHz FT8 and, in the first 24 hours, worked A65 (UAE), UN (Kazakhstan), 5T (Mauritania), the USA and lots of Europeans. But what was most interesting was to see activity from a number of UK stations that I don't associate with 160m DXing. Topband DXing has never lent itself to SSB operation (signals are generally weak and Morse gets through much more effectively) but that has pretty much locked out those who don't use CW. However,

they can now enjoy the DX to be found on the band, and learn about its propagation and other characteristics, by operating on FT8. The same is true of the 10MHz band, where phone operation is discouraged by international agreement because the allocation is so narrow.

Beginner Licence

I commented last month on a proposal for a Beginner licence, put forward by **John Regnault G4SWX**. Our VHF columnist **Tim Kirby G4VXE** also covers the proposal this month, in somewhat more detail. I would be very interested in feedback from *PW* readers. Is this an innovation that you support and, indeed, may have valued yourself on coming into the hobby? Or is it a step too far, when we already have a three-tier licence structure? After all, many of us (myself included!) had only one option – to take the Radio Amateurs Exam (and a Morse test, if we wanted access to the HF bands). Tim's concern is primarily related to activity on our VHF and above bands – is the problem simply that the cat escaped the bag well and truly when Class B licensees were given access to HF? The topic is certainly worthy of a (reasoned, as against emotional!) debate.

Let me finish by wishing every reader and contributor Seasons Greetings. I always appreciate feedback from what I like to think of as the *PW* family. Here's to a great 2020.

Don Field
Editor, *Practical Wireless* Magazine

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Newsdesk

Have you got something to tell our readers about? If so, then email **practicalwireless@warnersgroup.co.uk**

Radio News

CDXC NEWS: CDXC The UK DX Foundation has announced the date of the 2020 Convention, AGM and annual dinner. This will be May 2nd 2020. Following the success of last year's event, it will be held at the same venue, the Link Hotel Loughborough. Non-members and partners are welcome to attend and there will be a partners' programme.

The programme will include four great DX and technical talks headed by Dave K3EL who is leading next February's DXpedition to South Orkney, together with a social dinner in the evening. The full programme will appear in the January edition of the CDXC Digest and on the CDXC website.

The cost of the full package (talks plus dinner) is £42 and a day ticket for the talks is £10. Booking is via the CDXC website There is no charge for CDXC members to attend the AGM, which will be held in the morning. Accommodation can be booked direct with the Link Hotel at the same B&B rates as last year.

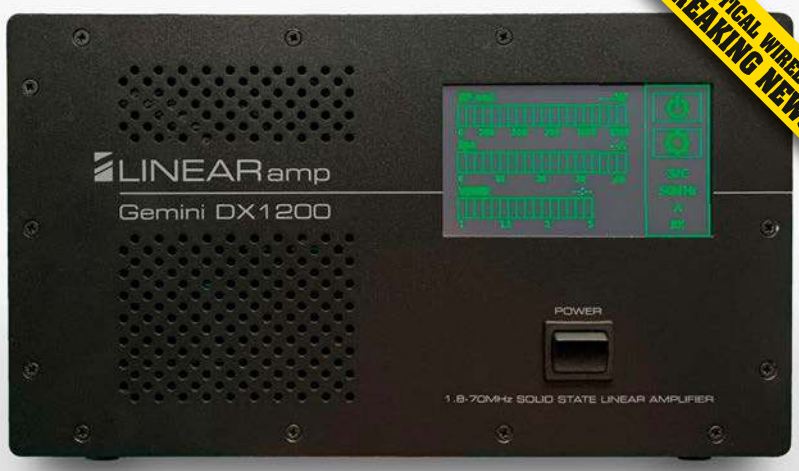
The CDXC committee is also delighted to announce a donation £2,000 ($2600) on behalf of its members for significant hardware upgrades to Club Log – the DXers' invaluable online tool. This is in addition to the £500 ($650) CDXC donates each year to support Club Log running costs. This hardware upgrade will improve resiliency, enhance performance and facilitate further innovation.

Club Log is the brainchild of Michael G7VJR and is now supported by a team of volunteers worldwide. Today Club Log hosts 590 million QSOs and caters for 69,000 active users. Michael G7VJR said "Wow, amazing! Totally amazing – thank you thank you! This takes the budget for the hardware easily to the level where I can get the next step of CPUs, which I'd not expected would be possible. I can also get the redundant main storage card option, which will improve the overall resilience (and day to day performance) as well!"

More information on CDXC is available on the website (below) or from Chairman Chris Duckling G3SVL, e-mail: Chris@G3SVL.com

www.cdxc.org.uk

PRACTICAL WIRELESS BREAKING NEWS



Gemini DX1200 Announced

The new Gemini DX1200 solid state linear amplifier from The DX Shop Limited is a high output, compact and quiet amplifier giving 1.2kW on 1.8-30MHz and 1kW on 50MHz. It will also give 400W on 70MHz making it an ideal companion to transceivers such as the IC-7300, TS-890 and FTdx101. The dual-LDMOS design helps the DX1200 to achieve full output with excellent IMD performance.

It features fully automatic band selection (no CAT needed), three antenna sockets, full colour touchscreen display and full QSK operation with its vacuum relay switched output circuit. Very low noise operation is achieved with a high efficiency heatsink and ultra-quiet temperature-controlled fans. Measuring just 278w x 157h x 380d and weighing 15kg, the DX1200 is priced at £2499.00 inc. VAT and will be available from January.

www.thedxshop.com

KW DAYS, JANUARY 4TH & 5TH: The first weekend in January is now well established as a time that KW owners put their classic radios and accessories on the air. This relaxed operating weekend marks the anniversary of the iconic company's founding in 1956 by Major Roly Shears G8KW and Ken Ellis G5KW.

Every year the number of restored and re-discovered KWs grows thanks to the active support group KW-Radios@groups.io some of whose contributors worked for the company. UK and overseas stations will be using the non-WARC bands, SSB 1.977, 3.775, 7.177 and 14.277MHz, AM and CW on the VMARS frequencies ±QRM. Multi-op station GB8KW will be active from Cray Valley Radio Society from Friday January 3rd and will be welcoming visitors. Every year since the event began more shed/attic finds come to light and it's hoped that more of them will be restored in time to be operational. CVRS member Guy Roberts G0UKN maintains the international list of known KW equipment and is hoping to record more details/serials and provenance of gear during the weekend.

UK Clubs are encouraged to get involved as it's an ideal opportunity for a Winter get-together, to reminisce or demonstrate to newer licensees the black art of 'netting, dipping and loading'! Does someone in your club own a KW?

PRACTICAL WIRELESS BREAKING NEWS

New Mast from SOTABEAMS

Portable specialist SOTABEAMS has launched a new carbon-fibre portable telescopic mast. The Carbon-6 has an extended length of 6m (19.6ft) but weighs just 300g (10.6 ounces). Its packed length is only 43cm (17in) meaning it can be taken pretty much anywhere.
The Carbon-6 has been designed for light-duty operations and is best suited for supporting the centre of end-fed wire antenna in inverted-vee fashion. It is likely that this will be a popular choice for the portable operator who undertakes more 'extreme' forms of travel or just wants to travel light!
https://tinyurl.com/rcyyd5r

Radio News

JOTA NEWS: Essex Ham supported what they believe to be the largest Jamboree on the Air (JOTA) event in Essex. An estimated 200 Beavers, Cubs and Scouts took part in the two-day event at the Belchamps Scout Activity Centre. The busy event included a 2m and HF station for greetings messages with the callsign GB1BEL, the chance for the youngsters to design QSL cards and send them via SSTV, a Raspberry Pi SDR and the popular 'Your Name in Morse' demo. Also at the event, vintage military radio equipment, Morse code oscillators, a radio hunt using PMR 446, a Zello station linked to other Scout groups and aircraft tracking. On the Saturday, the ISS had a scheduled contact with an Italian school, giving youngsters at Belchamps the chance to get outside with two handheld beam antennas, play 'hunt the ISS' and hear a live downlink.
The event was organised by Scout leader Derek Hagan M0SCE, who was interviewed by a team from the BBC local radio station who were using the event's location as a clue in their Essex Quest show.

Members of the Worksop Amateur Radio Society set up a JOTA station for Members of Bassetlaw Scout District and Whitwell Cub Scouts. This is the eighth year that the Society has been involved with JOTA having been introduced to it by local Scout Leader and Member Paul M0PJA.
This year's event was superbly organised by Sue M6XAK, who introduced two new activities into the mix. The first was a snail practice Morse key. This project is made available by the RSGB and designed by Trevor Hughes G4WKJ. It can be found at:
https://tinyurl.com/svo6vff
Under the watchful eyes of Sue M6XAK and Carol 2E0XCA all the young people who wanted to were able to build one of these kits and take it home to enjoy. For the more adventurous young people and some leaders and parents, they had a Morse Practice Oscillator to build on Bread Board. The youngsters were able to make a QSO or two and pass a greeting message under the expert tutorledge and watchful eye of Martin M0ZMF.
The Cornish Radio Amateur Club, based in Redruth, Cornwall, also participated in JOTA, from the headquarters of the 1st Lanner Hill Scouts in Lanner, Redruth, with the callsign GB1LH. Unfortunately, the 40m noise level was extremely bad but to pre-empt possible problems, four members were waiting in the wings for staged contacts on 10m, making sure all 19 Scouts had a turn speaking into the microphone.
Rick G4PGD had prepared a video presentation on amateur radio and sorted out the CW station. Trevor M0WDO put the Scouts to work assembling an extremely good modern copy of an old ca.1920's Art Deco crystal radio receiver with a base made from a lunch box.
The Southport and District Amateur Radio Club (SADARC) was approached to support local Scouts in JOTA. Although initiated by the 48th Southport Air Scouts, Scouts from various Southport Scout Groups would attend. After discussions with Scout leaders and site visits it was decided that the station would consist of areas able to support 80, 40, 20 and 2m operations with the addition of digital modes and a Skype connection. On the day there were up to 39 Scouts and Scout leaders in attendance with support from ten club members and members of Merseyside RAYNET. During the weekend the Scouts were involved with the setting up of the antennas and equipment. They were also introduced to Morse Code and the Phonetic Alphabet. There was also the chance to use some DF equipment that the Scouts had obtained and some handheld PMR radios.

EXERCISE BLUE HAM LATEST: For the final time in 2019, EXERCISE BLUE HAM 19-3 was run using the 5MHz (60m) shared band from 14 different locations around the UK, many of the stations being manned by Air Cadets during the event with two Sea Cadet Units joining in. As this exercise has grown in popularity over the years the regular amateur operators have provided many portable stations and made the effort to get out and enjoy some fresh air and at times wet and windy weather. Over the weekend most exchanges were on voice but there were some using PSK31 and Olivia 16/500.
All of the Cadets gained a great deal of operating time during the exercise. One cadet said, "Great exercise this year, enjoyed by every Cadet at my unit that participated in it over the two days. This is our first year taking part as a Squadron as we have just set up our brand-new HF radio equipment; what an experience for us".
Here is a taste of some of the feedback from radio amateurs: "I enjoyed working the cadet stations today on 5MHz with their excellent operating standards. I have made a successful Olivia QSO with MRE84 already on 5366.5kHz, so very good to see some data activity. Blue Ham very busy this year". Steve G4HPE.

Worksop Amateur Radio Society

Having seen and tested the Online Exams at the National Hamfest, members of Worksop Amateur Radio Society were keen to try out the new system. The first set of exams were run on October 19th, with assistance from RSGB President Dave Wilson M0OBW. While the system requires an internet connection, a mobile hotspot is quite sufficient.
The Society has its own building and is based at 59-61 West Street, Worksop, Nottinghamshire. The Society does not just do radio but also covers Raspberry PI, Arduino, Electronics and Construction (Radios, Electronic circuits, Antennas etc). It is a very active club with over 160 members, and the club is open on Tuesday and Thursday Nights. The photo shows Carol 2E0XCA, Dave M0OBW, Andy 2E0SUK one of the successful exam candidates and Donna M7DON, exam Invigilator

Radio News

FARNBOROUGH CONTEST GROUP EXPLORE IMPERIAL WAR MUSEUM DUXFORD : In October members of Farnborough Contest Group made a visit to the Imperial War Museum at Duxford. For any group of radio amateurs this is a fascinating day out and well worth the visit.
The Farnborough Group are a relatively small group with an average age of over 70 years.
On arrival they started at the active amateur radio station GB2IWM, which is staffed by knowledgeable volunteers. It comprises a working R107 with matching wireless set No. 12 transmitter plus a separate set-up of an R1155 with matching T1154 transmitter and a selection of Morse keys. The equipment is arranged to

demonstrate the operator's position in an operational Lancaster bomber and all equipment is in full working order.
The museum has a wide and varied collection of aircraft, including a complete Vulcan and an Avro Lancaster. You can look around the interior of Concord 003. There is also a beautiful Mosquito and TSR2. Sally B, not the real Memphis Belle, but nevertheless a B17 was sitting out on the apron. Separate hangers are dedicated to civilian and US aircraft, including the spectacular and imposing B52. Most of the group could remember when these aircraft were flying. There is also a complete Anderson air raid shelter on display.
When the walking became too much, they used the museum's electric transport vehicle that runs between the different display hangers.
The staff were always on hand offering friendly, helpful advice, nothing being much trouble.
The Farnborough group found it a most thought provoking and worthwhile experience.
www.iwm.org.uk/visits/iwm-duxford

NEW QRP MEMBERSHIP SECRETARY: The G-QRP Club has a new Membership Secretary who will be handling renewals from January 1st 2020. Daphne Neal G7ENA has taken over from Tony Fishpool G4WIF, who had done a very efficient job for over a decade. Tony has helped smooth the handover and will continue to run the Club's website and e-mail group, which is in the process of migrating from Yahoo to IO groups.
Full details of Who's Who in the G-QRP Club and contact details can be found at:
GQRP.com/who.htm

RAF WADDINGTON ARC: RAF Waddington Amateur Radio Club was formed in 1988 operating from the RAF base. In 1999 the club moved to the Pyewipe Inn on the outskirts of Lincoln. The current membership stands at 70 and the facilities include a fully equipped shack, kitchen and radio room with an extensive antenna farm. A full calendar of talks and Special Event Stations take place throughout the year. Free tuition is given to members wishing to pass the licence exams.
A small number of members enter contests and nationally the club does well. However, nothing is taken too seriously. Pictured is Bob G3VCA dressed suitably for top band ably assisted by Santa, also known as Don M0CES.
The club meets at the Pyewipe Inn, LN1 2BG, on a Friday evening and all are welcome. Membership is just £10 per year.

Yaesu FT-3DE 144/432MHz Dual-Band Transceiver

Tim Kirby G4VXE gets to try out a new Yaesu handheld that offers an awful lot in a compact package.

Tim Kirby G4VXE,
longworthtim@gmail.com

In the July 2016 issue of *PW*, we reviewed the predecessor to the FT-3DE, the FT-2DE as part of our first series on System Fusion. It was a handheld I really liked and it wasn't until earlier this year that I had the chance to own one. I should have known that something was about to happen because shortly after I'd bought my FT-2DE, their price dropped, always a sign that a new product is on the way! Sure enough, the FT-3DE was announced shortly afterwards and thanks to our friends at **Martin Lynch & Sons,** we have one to review.

As usual, I'll start with noting what Yaesu have to say about the FT-3DE. Their description appears in the sidebar. As you can see, this little rig has a lot to offer.

Unpacking and Familiarisation

I'd looked forward to the arrival of the FT-3DE. My FT-2DE is a handheld I enjoy using for C4FM (System Fusion), FM and APRS operation, so I was curious to see what had changed. The first impression, on unpacking was the slightly smaller size of the FT-3DE. It's just a bit shorter (easier to fit in a pocket!), but the most striking thing on powering up was the colour touchscreen. Although it didn't bother me on the FT-2DE, some people felt the mono LCD screen was slow and poor quality. Not entirely fair, perhaps, but the FT-3DE's screen is definitely better quality and much sharper to read.

First Impressions

Because there's no Fusion repeater around West Oxfordshire, my first test of the FT-3DE was to hook it up to my computer running the Wires-X software and use it in Personal Digital Node configuration to connect to the GB3SP repeater in Pembrokeshire. **Martin GW3XJQ** was on hand to give me an audio report and confirm that it sounded good. The initial test in PDN mode was in Direct Mode, where you use the rig essentially as a speaker/microphone connected to the computer by the optional SCU-19 cable, which I already had for use with the FT-2DE. Later, I tested the rig in Access Point mode, with the FT-3DE connected to the computer by the same cable but, this time, the rig transmits on a frequency of your choosing, so you'll need another Fusion-enabled rig to access it. I used my FT-2DE as the end user radio. This too worked fine and Martin GW3XJQ was on hand again (thank you!) to give another report.

I also tried the FT-3DE accessing the America Link 'room' using my ZUMspot hotspot. This worked well and I enjoyed a couple of contacts around the world in C4FM digital quality, with the callsign of the station transmitting being displayed on the FT-3DE's screen. Because the FT-3DE has an internal GPS, if the station you are listening to is transmitting a GPS position, the FT-3DE can show a distance and bearing of that station, which can be quite interesting.

If you have a Fusion repeater close to you, or other stations with C4FM capability nearby, you will be able to make

use of the two digital voice modes DN (voice and data) and VW (high quality audio). As we've observed before in other Fusion reviews, the VW mode is fairly comparable to fully quieting FM in terms of speech quality. You can also take advantage of the Automatic Mode Select (AMS), which allows the rig to switch automatically between FM and C4FM transmissions. This happens very quickly and is a useful feature.

GPS performance is good and I found the GPS would lock up fast, even with the rig inside the house – somewhat quicker, I felt, than the FT-2DE's GPS. The Smart Navigation feature allows you to set waypoints (as you would on a 'traditional GPS') and navigate between them.

With the supplied rubber duck antenna and the rig inside the house, I found I was able to hear the GB3WH 145MHz FM repeater, some 15 miles away from me, with a little noise. Sensitivity seemed about the same as with the FT-2DE and indeed, other handheld radios I have around the place. The rig's sensitivity on 70cm seems at least as good as expected and I was able to monitor the GB3TD repeater near Swindon quite comfortably, with the rig inside the house. I found FM (analogue) performance good, with received and transmitted audio quality reports being good.

Bluetooth

The FT-3DE comes with a Bluetooth module installed as standard. Yaesu produce a Bluetooth headset (SSM-BT10) but say that other commercially available headsets may work. I didn't have a proper Bluetooth headset available to test, but I did have a £10 set of Bluetooth headphones. I tried pairing the two and to my surprise, it worked, with receive audio coming out of the headphones. Transmit audio was available too, although I'd say it was not of a quality to be proud of (the problem being in my cheap headset, of course!). You probably won't need me to tell you that if you are planning to use a non-Yaesu Bluetooth headset, it is touch-and-go as to whether it will work because Bluetooth implementations seem to be surprisingly different. I asked a friend who is able to use an Anytone AT-878 Plus with the Bluetooth system in his Kia automobile whether the FT-3DE worked in the same way, but it did not appear to.

Club Activity Monitor

Something new to Yaesu with the FT-3DE is the Club Activity Monitor (CAM). With this feature, you can assign particular memory channels to a group (I created a Swindon group with the GB3WH and GB3TD repeaters as part of that group and a Reading group with the GB3RD, GB3AW and GB3BN repeaters). You can be listening on another channel, switch on the CAM and then you will see a display of the channels in the group you have selected. So, for example, assuming I've selected 'Swindon', there is a graphical display of two bars, one for GB3WH and one for GB3TD. When one of those channels becomes active, you'll see that displayed on your screen. Editing the names of the channels and so on is a bit of a faff from the rig's keyboard, no doubt easier from programming software. The feature is neat. I liked it as a very visual method of scanning. I wonder if firmware upgrades for other Yaesu rigs will include it in future. I'd actually assumed, reading about the feature, that it would be for C4FM channels only, but it works just fine for analogue too.

Incidentally, the CAM feature and some others, are described in the FT-3DE Advance (sic) Manual, which you can download from the Files section for the FT-3DE on the Yaesu website: **https://tinyurl.com/y55q5gws**

There are various other optional manuals available to download, including ones for WIRES-X, Group Monitor (GM)

and APRS, which you may wish to look at, depending on your interests.

The bandscope feature is somewhat similar, allowing you to graphically display where signals are found on the band – useful perhaps if you are new to an area. You can determine how many channels are checked – 19, 39 or 79.

Wideband Receiver

The FT-3DE has a wideband receiver, capable of 0.5-999.5MHz. It comes with some pre-stored memory channels; the US weather channels (not much use to us in the UK), International Marine Channels (useful depending on how close to the sea you are!) and some international shortwave frequencies. With the rubber duck antenna, I did not notice any of the shortwave frequencies booming in during the day but, of course, conditions are not terribly good and with a small antenna you should not expect too much.

One of the things I liked when I tried the FT-3DE's little relative, the FT-70DR was the airband reception, which I thought was exceptional. The FT-3DE is similar and I was very pleased with the performance on the civil airband. The only minor disappointment in this regard (in common with many other rigs) was that although the military airband frequencies can be selected, you cannot select AM mode.

Automatic Packet Reporting System (APRS)

One of the things I like about the FT-2 and the FT-3 models is their ability to 'do' APRS. I enjoy popping the handheld in a rucksack or a pocket on a walk and seeing what packets it picks up. If I get to a hilltop or other good location, I'll launch a couple of beacon packets containing the GPS position and then, when I get home, I can see how far away I was heard, using the aprs.fi website. The APRS frequency for 1200 baud packet in Europe is 144.800MHz (144.390MHz for any North American readers!). You can also use the APRS features to listen to, and indeed, transmit, the digipeater on the International Space Station and a couple of other APRS-enabled satellites. For that, you'll need to tune to 145.825MHz. For satellite use, you might need to try a slightly more 'gainy' antenna than the supplied 'rubber duck' for reliable use, but you'll almost certainly be able to get your signal digipeated, just using the antenna provided.

Battery Life

Battery life seemed pretty good, although I felt that the colour screen probably drained the battery quicker than the FT-2 does, as you'd expect. Certainly, I didn't have any problem with battery life, but I don't think it's of the 'charge once and forget for a while' type. You'll probably need to expect to charge it every day or so, depending on how much you transmit, use the GPS and so on.

Interchangeable accessories

I was pleased to find that the accessories are interchangeable between the FT-2 and FT-3 models, so I was able to use my FT-2 charger (although of course, one is supplied with the FT-3DE), the SCU-19 cable and, should you have one, the camera microphone. Batteries too, are interchangeable, which is good news if you have bought spares.

Overall

I enjoyed the FT-3DE. If you have a local Fusion repeater or have a digital hotspot, it could be a useful handheld for you. The ability to connect directly to the Yaesu WIRES-X network with the Personal Digital Node facility will expand your horizons. The capability to transmit and receive APRS packets is a useful and interesting one too. The quality of the colour touch screen is excellent and represents quite an improvement on the previous FT-2DE model. Transmitted and received audio was good in both analogue and digital modes.

This is obviously a high value handheld, compared with the many cheaper mostly Chinese units available, so you will probably only be interested in buying it if you are expecting to use the digital and APRS facilities of the unit. If you are wanting to use those facilities, I do not think you will be disappointed with the FT-3DE.

Our thanks to **Martin Lynch and Sons** for the loan of the review unit. It costs £379.95 (including VAT). See the ML&S website for details on how to order: HamRadio.co.uk/FT3DE

Manufacturer's Description

*The new **Yaesu FT-3DE** is the worthy successor to the FT-1DE and FT-2DE. It provides reliable 5W RF power output in compact design and lightweight form factor (2.44 x 3.94 x 1.28in). Battery power-saving settings are available for each frequency band with TX output power level (5/2.5/1/0.3W) individually selectable. Even with the compact body, you will enjoy loud and clear C4FM voice quality from 700mW of audio power. Real Dual Band Operations (V+V, U+U, V+U, U+V) are available with two independent receivers. And the FT-3DR supports simultaneous C4FM digital monitoring for both the A and B bands (C4FM/C4FM standby).*

The FT-3DE is designed with a crisp high-resolution 320 x 240 dot matrix full colour TFT LCD display, which clearly highlights the frequency of the operational bands. Utilising the Touch Sensitive Screen function of the display, three one-touch-panel keys at the bottom of the display are used for changing the mode, direct frequency entry and various settings from the function menu display with ease of use in mind. With its highly visible full colour display, the new high-resolution Band Scope function enables users to monitor up to 79 channels centred around the current VFO frequency in real time. Number of channels scanned is selectable from 19, 39 or 79 channels. The already popular Automatic Mode Select (AMS), Digital Group ID (DG-ID) operation, and Smart Navigation function are continued with the new FT3DE.

The FT-3DE fully supports the WiRES-X Portable Digital Node Function as well. In the same way as some other current C4FM transceivers, users can easily set up a portable digital node with the new FT-3DE and the optional SCU-39 cable kit and enjoy the WiRES-X internet communication.

CAM (Club Channel Activity Monitor) function is one of the new advanced features of the FT3DE. Up to ten groups with five channels per group each, of frequently used memory channels can be registered, and while receiving on the current channel, the signal strength of this channel and past peaks of the other channels in the group can be displayed and monitored. With a single touch of a channel bargraph, it becomes the active operating channel and the FT-3DE users may immediately start communicating with other club members on that channel.

The built-in *Bluetooth® unit can provide the Hands-Free Operation using the optional SSM-BT10 headset or a commercially-available product. SSM-BT10 is equipped with the PTT button and supports the voice activated transmission (VOX) function.*

Other refinements include: Wide-range receive coverage with reception from 0.5MHz – 999.99MHz [less cellular] (A Band)/ 108MHz – 580MHz (B Band). Built-in high-sensitivity 66-channel GPS receiver: 1200/9600bps APRS Data modem: 2200mAh High-Capacity Li-ion Battery Pack (SBR-14LI) as standard: Voice Recording Function for the received and transmitting voice and audio data, which can be saved as an audio file on the micro-SD card: simultaneous AM/FM broadcast Reception while monitoring two frequency channels: micro-SD Card Slot.

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Mt Athos Operation Accredited

Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

Steve Telenius-Lowe PJ4DX highlights a forthcoming DXpedition and reports on the accreditation of SV2RSG/A.

A Happy New Year to all readers of *HF Highlights* and may 2020 be a DX-filled year for you. To start the year, a good one to look for will be ZC4UW from the UK Sovereign Base Areas on Cyprus. The **Cambridge University Wireless Society G6UW** is celebrating its 100th anniversary in 2020 and a group from the Society will be active from this semi-rare DXCC entity between January 2nd and 7th. The team will be active with 400W on 1.8 to 28MHz (though little propagation is expected above 21MHz, and 5MHz operation is unlikely as they are limited to 15W EIRP). Antennas will be verticals and the main modes will be CW and SSB: the group will not use FT8 or FT4. Logs will be uploaded to *Club Log* and LoTW – if you want a paper QSL please use the *Club Log* OQRS (don't send any cards direct or via the bureau). See:
zc4uw.com

Mt Athos

Since **Monk Apollo SV2ASP/A Fig. 1**, passed away last May (see *HF Highlights* July 2019) there has been little activity from the DXCC entity of Mt Athos. **Monk Iakovos SV2RSG** has occasionally been active from the monastery of Koutloumousíou but until recently contacts with him have not counted for DXCC. However, on November 7th he was informed by the ARRL that, if he signs SV2RSG/A from Mt Athos, contacts will now be accepted. QSL direct: Iakovos says that QSLs will be sent in the first week of the month after the arrival of your card.
qrz.com/db/sv2rsg

2020 Solar Forecast

We're all impatient for solar cycle 25 to start in earnest (at least I am). The first sunspots of the new cycle were seen in 2019 but that doesn't mean we'll see an improvement in conditions any time soon. According to Australia's Space Weather Services, the 'T Index' (SWS's measure of how good or bad HF propagation is likely to be) is predicted to be at a value of –17 this month, deteriorating even further to –20 in May (the nadir of this cycle) and won't be at a level above –17 again until November 2020. Conditions should then start to pick up during 2021.
sws.bom.gov.au/HF_Systems/6/4/1

October-November Activity

This month's column covers the period from October 11th to November 10th. Most of the more interesting activations were in October with VP6R (Pitcairn), 5K0K (San Andres & Providencia), D68CCC (Comoros), 5T2KW/5T5PA, **Fig. 2**, Mauritania), and others, on the air. Not all were easy to work from the UK, though several appeared in our correspondents' logs this month (see 'Around the Bands').

October also saw the CQWW DX Phone contest, which always provides plenty of activity. I was lucky enough to be invited to be a guest operator at PJ4K, a new American-owned contest station here on Bonaire. The station is still under construction. There are three 43m (140ft) towers and more antennas are going up all the time, **Fig. 3**. CQWW often appears to create its own propagation but even so I was astonished at just how good conditions were on 21MHz. Apparently 'dead' much of the time, PJ4K made 3492 QSOs with 132 DXCC entities on 21MHz alone, though the station's stack of three phased 4-element Yagis certainly helped!

Readers' News

Victor Brand G3JNB found conditions in mid-October poor so *"it was time to drop down to QRP and enjoy what was on offer, including RK9LWO (Asiatic Russia) on 40m and S01WS on 30m. Then, just for the day on 22nd, the DX bands erupted and I worked 5K0K (San Andres) on 17m where I also copied a weak VP6R (Pitcairn)."* Victor said that D68CCC was the only signal audible on 17m on the evening of the 25th: *"Booming in here, they were soon in the log; minutes later they vanished! Then on the following Sunday, whilst the CQWW SSB contest raged above me, I found them again on 15m, lonely and calling CQ, and I suspect they were quite glad to hear from me!"* Victor reported that VP6R was unheard again until 30th, *"when they were unexpectedly strong on 18069kHz but unworkable and eventually faded out... However, 40m did yield Comoros yet again at 2220UTC after considerable perseverance in the pile-up!"*

Fig. 1: QSL from the late Monk Apollo SV2ASP/A on Mt Athos. Fig. 2: Johannes 5T5PA at his home station. In October he and Evert 5T2KW operated portable from the remote Cap Blanc area, to great effect (photo: qrz.com). Fig. 3: Two of the three towers at PJ4K: left 10m 5-ele and 40m 2-ele, right 15m 3 x 4-eles and 20m 4-ele Yagis. Fig. 4: Tim G4DBL operating as ZB2BU/P, with a little help from his friends. Fig. 5: The PA/OS8D/P station on the North Sea coast in the Netherlands. Fig. 6: Award celebrating the 18th birthday of HRH Princess Elisabeth of Belgium.

Unfortunately, VP6R never did make it into the G3JNB log, although on 31st *"early that evening, **Robert T6AA** in Kabul came back on 40m to my first call."*

Reg Williams G0OOF was pleased to report *"a good month"* with some good contacts before, during and after the CQWW contest. *"Outside the contest I was pleased to work two expeditions, 5K0K (San Andres & Providencia) and D68CCC (Comoros), both on 17m... 17m has been a great band to work just using a wire dipole not too high above ground producing QSOs with South Africa, Belize, Liberia and St Pierre & Miquelon plus others. The one that got away was VP6R. Maybe next time. The CQWW contest was very enjoyable. Good band openings each day on 20, 15 and 10m. A good number of Caribbean islands and South American countries worked on 20 and 15m... I was particularly pleased to work a couple of USA east coast stations on 80m and Bonaire stations* [PJ4NG and PJ4K – *Ed*] *on other bands.... All in all a good month."*

Owen Williams G0PHY sent in his report earlier than usual as he and his wife were off to Singapore and New Zealand. *"Not many contacts this month, a lot of time*


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spent listening for VP6R, unsuccessfully as it happened. However, contacts were made with D68CCC on 14 and 18MHz (18MHz being a new band slot).”

During Jamboree On The Air, Gibraltar Amateur Radio Society members **John King ZB2JK, Kevin Hewitt ZB2GI** and club regular **Mike Wilson G4GOU** operated ZB2FFG from the Wellington Front Fortification, home of the 1st/4th (Marquis of Milford Haven’s Own) Gibraltar Scout Group. Kevin reported that poor conditions and a high noise level made operating difficult but they managed contacts with Scout groups in Luxembourg and the Netherlands. During the month Kevin also operated as ZB2BU/P from the Top of the Rock, where he was joined by John ZB2JK and **Tim G4DBL** , **Fig. 4**, who was visiting Gibraltar.

Carl Mason GW0VSW wrote that *“It seems it takes yet another contest to open up a few bands. I tried the CQWW weekend to work some SSB stations running the Xiegu G90 at 4W (I forgot to select 5W!) and a combination of a newly-installed inverted-V G5RV and my indoor ‘Crown’ loop wire antenna. It was good to see just how well the low power would do with the bands in such poor shape... I am not often to be found using SSB and was pleased to make 48 DX entities after two days hard graft but disappointed to only work 202 stations... As usual, the following day there was little to be heard on any band! It will be interesting to see the final contest results and what others were able to achieve with a maximum power of just 5W.”*

Chris Colclough G1VDP uses all modes at 100W from a Kenwood TS-590S to an MW0JZE Hexbeam and 30/40m dipoles. He commented, *“It was amazing the difference between central UK and coastal stations in being able to work VP6R, the Pitcairn expedition, as I only heard them on a couple of occasions at the start and end of the expedition. Yes, I managed to get them on 40 and 17m FT8 but it would have been nice to have had a CW or SSB contact with them to say I had actually worked them, but it still seems to be my bogey DXCC entity. In comparison, the D68CCC expedition seemed to have a pipeline direct to the UK and I managed to work them on 20 through to 10m on all modes – with the exception of 20m on any digi modes... Most of the FT8 contacts have come from me calling CQ, and there is one huge thrill when a rare(ish) DX station calls you.”*

Tony Usher G4HZW said *“I spent most of my available time on 10m with the occasional foray onto 40m. The higher bands have been poor except during the weekend of October 26 and 27th with ‘contest conditions’ prevailing during the CQWW contest and I fired up the TS-830 to work some SSB as a pleasant change from FT8.”* On 10m Tony made *“just 26 FT8/FT4 contacts this period [but] 60 on SSB during CQWW.”*

Terry Martin M0CLH wrote *“At last, some autumnally-enhanced propagation! Some decent DX in this period, including VP6R as an ATNO* [All-Time New One] *for me and T6AA on a couple of bands for a new mode and a number of other welcome slots. Even a couple of them on 10m! Haven’t yet heard YJ (Vanuatu) or FO/M (Marquesas) but we live in hope. Again, I am appalled at the number of occurrences of deliberate QRM over DXpeditions which have cost a lot of money and effort to organise and deliver. I cannot understand the mentality (or lack of it) of people who engage in such activity... Hoping for a few more sunspots from the new cycle.”*

On November 2nd **Etienne Vrebos OS8D/ON8DN** wrote that he *“made some PA/OS8D/P activities today* (**Fig. 5**)*, exceptionally blue sky between weeks of rain, and 10°C but very windy at North Sea beaches in Holland, surrounded by saltwater 360°. Beautiful QSOs all over Europe on 20m only with my Yaesu FT-891 at 50W and my small vertical antenna, but really performing well. Surprise this morning at 1040UTC:* ***KP4EYT*** *with a 59+ and*

5

***Heriberto** told me 59 too! I couldn't believe my ears, he told me it was 0640UTC in his town. Most of my reports were 59+ from Moscow to south Portugal, from Tallinn to Sicily."* During the month Etienne made sufficient contacts with OR18 stations celebrating the 18th birthday of HRH Princess Elisabeth of Belgium to qualify for the special event's Gold award, **Fig. 6**. or0yal.uba.be

Around the Bands

Since this is the start of a new year it would seem a good time to introduce a small change in this section. The bands will now be referred to in MHz rather than metres. Loggings of European stations made from Europe are generally not listed in order to save valuable column inches though there'll always be exceptions, such as those rare DXCCs (Mt Athos, Franz Josef Land etc) or IOTAs, DXpeditions to places such as the Isle of Man or Market Reef, some special event stations and the like. But 'regular' French, German, Italian, European Russian and similar stations won't be listed because they can be worked any time, even with QRP.

When sending in reports it would help if your loggings are sorted firstly by band (from 1.8 to 28MHz), then by mode (SSB, CW, FT8, others) and finally by alphabetical callsign (and not chronologically). All formats are welcomed, provided I'm able to extract the text.

Reg G0OOF 3.5MHz SSB: CN3A, CR3DX, N5DX. **7MHz SSB:** 7X3WPL, A73A, D4C, V26B, V47T, W3LPL. **14MHz SSB:** A73A, D4C, ED9E, FY5KE, NP2P, P40T, PJ2T, PJ4K, PJ4NG, PZ5K, V26B, V47T, ZF1A. **18MHz SSB:** 5K0K, 9K2HS, D68CCC, FP/KV1J, V31JW, ZS1OPB. **21MHz SSB:** 6W1RY, 8P5A, A73A, HI3LT, KP3Z, P40T, PJ2T, PJ4K, PZ5K, V26B, V47T, V55A, ZD7FT, ZP5AA.

Owen G0PHY 14MHz SSB: 4U2U, 8P5A, D68CCC, V26B. **18MHz SSB:** D68CCC.

Kevin ZB2GI/P and the GARS club call ZB2BU/P worked **14MHz SSB:** 9Z4ZB, AA8DC, CT9ABA, KP4RMS, N4ZY, PY7CPC, VE1RY, VO1AW, W1YY/7, ZP5DBC.

Carl GW0VSW 3.5MHz SSB: EF8R. **7MHz SSB:** EF8R. **14MHz SSB:** CR3DX, ED8H, ED9E. **14MHz CW:** KP2/NY3B. **18MHz CW:** 4U25B. **21MHz SSB:** CR3DX, IH9P, TC0F. **28MHz SSB:** P33W, D4C.

Chris G1VDP 3.5MHz CW: 5T2KW. **7MHz SSB:** OR0YAL (plus many OR18 stations), PE33EUDXF. **7MHz FT8:** T6AA, VP6R. **10MHz CW:** OR18TLS. **14MHz SSB:** D68CCC, JW6VDA. **14MHz CW:** D68CCC, PJ2/KB7Q, TI7/KL9A. **14MHz FT8:** 5K0K, 9G2HO, AE1N, JA1GRM, RU0LL, TI7/KC5HWB, VE1DBM, YB1RUS. **18MHz SSB:** A41CK, D68CCC. **18MHz CW:** 5J500L, D68CCC, VP2VEM. **18MHz RTTY:** D68CCC. **18MHz FT8:** 9X2AW, AE4CC, BV1EK, D68CCC, HK6JCF, JA4LKB, OD5VN, PY2PRB, R9YQ, TA3AHJ, V31MA, VA3TTB, VP6R. **21MHz SSB:** D68CCC. **21MHz CW:** 5R8UI, D68CCC, XQ6CF. **21MHz FT8:** D68CCC, JA3KVT, PU4ISA, RU9YP. **24MHz SSB:** D68CCC. **24MHz CW:** D68CCC. **24MHz FT8:** D68CCC. **28MHz SSB:** D68CCC. **28MHz CW:** D68CCC. **28MHz FT8:** D68CCC.

Tony G4HZW 7MHz SSB: D4C, PJ4K, VO1GCR. **7MHz FT8 / FT4:** 4Z4DX, 8P2K, D44TWO, PJ2LJG, TF3VS, UA9TK, VK1MA, VO1VO, KA6U/VY2, XP2A, YV5JLO, ZL2OK plus *"all contiguous W call areas including W6DR (CA), N7VDS (NV)."* **28MHz SSB:** D4C, FR4QT, P33W, SV9GPV, V55A. **28MHz FT8:** 5T5PA, CE LU and PY, W5E, ZS5PD, ZS6AYE.

6

Terry M0CLH 7MHz SSB: OR18LVN. **7MHz FT8:** A62A, BI8DHZ, RX9DJ, T6AA. **10MHz CW:** OX7AM, T6AA. **10MHz FT8:** UN7IT, VP6R. **14MHz SSB:** SV9/SV0IG, VE3EJ. **14MHz CW:** A71A, N3F. **14MHz RTTY:** FS/F4EQE, HC1MD/2, N0BUI, VP5/KD3TB, YC1OVY. **18MHz CW:** D68CCC, VP2VEM. **18MHz FT8:** 7Z1AL, AE0DC, CO3JR, HI7MC, HK3C, LU4JHF, VP6R, XV1X. **21MHz CW:** 5K0K, D68CCC. **21MHz FT8:** FH/DL9HAL, FR1GV, J28PJ, KD2CYU, LU2DAJ, PU1JSV, V51MA, YB2BNN, ZS2EZ. **24MHz FT8:** CN8AM. **28MHz FT8:** 3B8CW, D68CCC.

Etienne OS8D / ON8DN: 7MHz SSB: 5T5PA, VP6R. **14MHz SSB:** D68CCC, E20WXA, HS0ZLV, KP4EYT, RU0LM, UK8IAR, ZB3Y, ZF2WW. **18MHz SSB:** 5H3MB, 9K2OD, D68CCC, OX7AM, S79W. **21MHz SSB:** CN44MS, CX8TC, D4C, FY5KE, PJ2/ON4ANN, PJ4K, T6A, V55A, YW1K.

Signing Off

Thanks to all contributors. Please send all input for this column to teleniuslowe@gmail.com by the 11th of each month – photographs of your station or activity would be particularly welcome. For the March issue the deadline is January 11th. 73, Steve PJ4DX.

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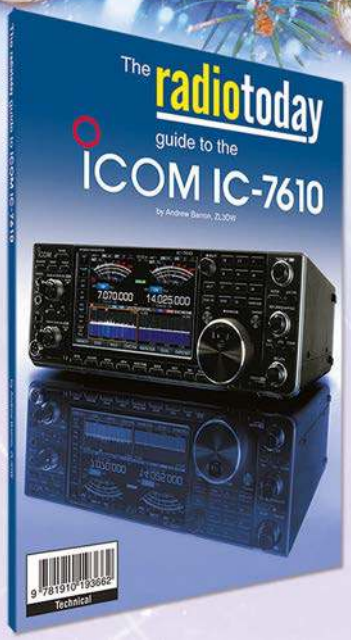

radiotoday guide to the Icom IC-7300

By Andrew Barron, ZL3DW

The Icom IC-7300 radio is one of the best-selling radios of recent years but, as an owner or potential buyer, are you aware of all the features it has and how to achieve the potential of the radio? The *Radio Today guide to the Icom IC-7300* sets out to provide exactly what you want.

This book highlights the myriad of options available. The *Radio Today guide to the Icom IC-7300* doesn't duplicate the manuals that describe each button, function, and control but is a "how to do it" book with easy to follow step by step instructions. The Icom IC-7300 has many settings and controls to learn. The inclusion of the 'panadapter' or 'band-scope' marks out the radio as being excellent value but there is a lot more. The radio has VOX (voice operated transmit switching), a built-in antenna tuner, coverage of the 6m (50MHz) and 4m (70MHz) amateur radio bands. And it has a voice keyer, RTTY and CW keyer memories, and an RTTY decoder.

The *Radio Today guide to the Icom IC-7300* provides invaluable reading for every owner or potential purchaser.

Size 176x240mm, 160 Pages
ISBN: 9781 9101 9373 0
Price £12.99

radiotoday guide to the Icom IC-7610

By Andrew Barron, ZL3DW

Within a few short months the Icom IC-7610 radio, became a 'best seller'. This SDR - based radio has simply become the measure by which other radios are being judged. Andrew Barron, ZL3DW, an acknowledged SDR expert, sets out in this book to highlight the myriad of options available to users.

On opening the box of the Icom IC-7610, you may be surprised by how many settings and controls there are. This should not deter you as this is where this book comes in. From the first steps with the panadapter display and its 'FIX' spectrum display mode, this book guides you. The biggest advantage that the IC-7610 offers over its rivals at a similar price level is the two completely independent receivers, so Andrew explains the changes this makes to the way you operate the radio. The touchscreen controls are explained so you get to know the radio through using it and through delving into every control and menu setting.

The IC-7610 is a truly exceptional radio and if you are interested in purchasing one, this guide provides invaluable reading.

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radiotoday guide to the Icom IC-9700

By Andrew Barron, ZL3DW

The *Radio Today guide to the Icom IC-9700* is the third in this series of books aimed at getting the most out of your radio. Written in the same style as the other books in the series, you get a practical guide that helps you get the most out of this radio and what is possible with the ground-breaking Icom IC-9700.

The Icom IC-9700 is the first full power, multi-mode, VHF/UHF amateur radio transceiver to be based on SDR technology. It is a transceiver for VHF and UHF DX operation, working satellites, EME and repeater operation, supporting both traditional FM repeaters and D-Star digital. This book highlights the myriad of options available to users, many of which have never been available on VHF/UHF transceivers before. As usual, this book does not duplicate the manuals that describe each button, function, and control but is a "how to do it" book with easy to follow step by step instructions.

All of the great new features included in the IC-9700 can make it quite a complicated radio to configure and operate, but the *Radio Today guide to the Icom IC-9700* covers every control and menu setting.

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The Ham Air 2m Half-Wave Vertical Inflatable Antenna

Tim Kirby G4VXE reviews a 2m antenna that is a little out of the ordinary!

Tim Kirby G4VXE
longworthtim@gmail.com

Sometimes, things just grab your attention! Scrolling through Twitter one day, I spotted some tweets from Air Antennas (@AntennaAir) about an inflatable antenna for the 2m band. I was intrigued and decided to find out more.

The man behind the antenna is **Tom Morris GM3HHN**, **Fig. 1**, who has been professionally involved in the design and sale of antennas for many years, mostly for the 2G, 3G, 4G and now 5G markets. Tom writes, "*I came up with the inflatable Ham antenna, about four years ago. As a QRP and SOTA fan, I wanted a suitable antenna that could work as a base, portable etc, but be able to carry it in a rucksack, with very little effort*!"

What does Tom say about the antenna? "*A professionally made, robust, fully portable and waterproof inflatable antenna, for the amateur bands. A 144-148MHz version, Perfect for Base, SOTA, Emergency Comms and just good old backpacking fun! Hang it from a tree, a pole, or fix it to a fence etc, supplied with an overhang flap at the top, as well as eyelets to string it up anywhere!*"

On Arrival

The antenna arrived, well-packaged in a neat pouch with the antenna folded up inside, **Fig. 2**. To put in a rucksack or in the boot of the car, it's perfect because the pouch is really compact as well as being a bit squashy, which always helps with the packing process. The pouch is secured by a strong Velcro strip. The antenna is terminated in a PL-259 connector connected to the antenna by RG-174 coax.

The RG-174 enters the bottom of the inflatable antenna, which is, of course, sealed. So, in the unlikely event that there was a problem with the coax, I am not sure how easy it would be to re-terminate the antenna. The inflatable sleeve containing the antenna unfurls to a length of around 5ft.

SPECIFICATION AS PROVIDED:

Design: ..... Half-wave
Tx: ..... 144 to 148MHz
Rx: ..... 118 to 174MHz
Gain 3dB
Power handling 75W
Length: 5ft
VSWR <1.5 @ 145.500MHz
Cable Supplied to PL259, 6m
Very Lightweight
Fireproof material

At the top of the antenna there is a flap that you can use to hang the antenna on a small pole or mast. There are also a couple of eyelets that you can tie a loop of wire or string through, which you can use to hang the antenna from a branch, hook or whatever's convenient.

At the base of the antenna there's a red tube, which you can use to inflate the antenna. The valve looks suspiciously like the same sort of valve you'd use to inflate and deflate a life jacket. Give a couple of puffs into the valve to inflate the antenna and when you're ready to deflate it, pop a finger into the end of the valve and the air will come out – you'll probably want to press down on the sleeve of the antenna to make sure you've got as much of the air out as possible so that you can pack and fold it back into the carrying pouch.

Also, at the base of the antenna there are a couple of Velcro straps that you might use to secure the antenna in position. Having said that, I found that I couldn't get enough air into the antenna to make it rigid enough such that the antenna didn't fold back over on itself under its own weight. I talked to Tom about this and he confirmed that he generally hangs the antenna rather than using the Velcro straps, but you might use them as an additional support.

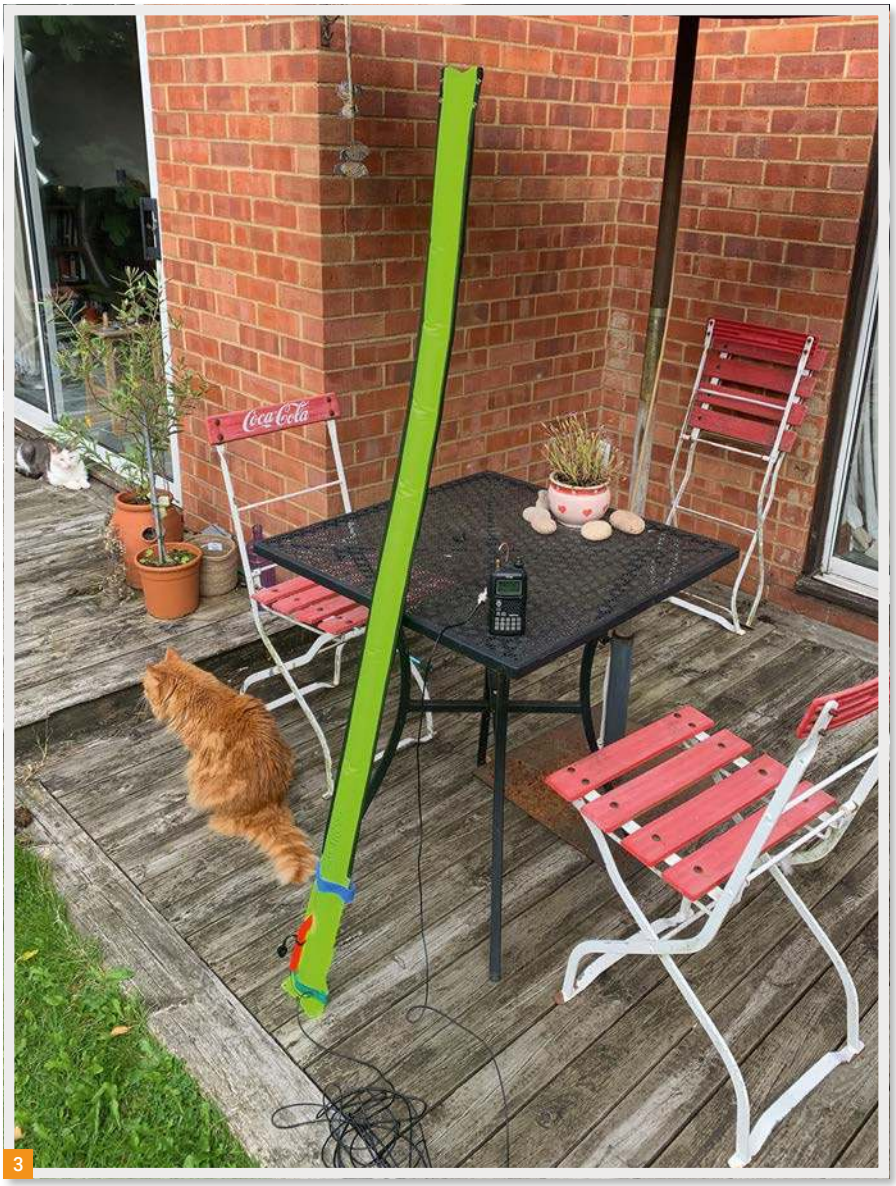
In Use

How did it work on the air? Well, I inflated the antenna, **Fig. 3**, and propped it up in the maple tree in our garden at a height


1

of around 15ft above the ground. The Swindon GB3WH and Reading GB3RD repeaters were absolutely end-stop over a distance of 15 to 20 miles, whereas there is some noise on a handheld and rubber duck antenna on receive. I was pleased to find that I could get into both repeaters with a watt or two. **Hugh G4JTO** confirmed that I was a fully quieting signal on GB3WH and I had a quick contact with **Jonathan M0JSX** on GB3RD. Jonathan was having problems receiving me but after some investigation, that proved to be an issue between GB3RD and Jonathan.

Next day, I wanted to try the antenna a little higher in the air, so I screwed a cup hook into some wood below the eaves of the house, just outside an upstairs window and suspended the antenna from that, **Fig. 4**. With 1W I was pleased to find that I could access the GB3NE repeater at



Newbury, which is inaudible on a handheld and standard rubber duck antenna at ground level in the garden, so the antenna was providing plenty of gain. I felt the ability to deploy the antenna simply at a decent height was a real positive and something that would be very useful at a temporary location, for example. With the thin coax, it would be easy to get through a window frame, although make sure you don't pinch or sever the cable.

As a portable antenna for hilltop operation, the antenna is simple to transport and deploy. You could hang it from a pole or if there is a convenient tree, hang it from a branch. You can also prop the antenna up against a wall or a fence, although because it is so light, you may need to try and secure it so that it does not blow over if there is anything above a light wind.

Reaction to the Air Antenna has been positive and most people seemed interested and intrigued by the concept. Some were interested in inflating the antenna with helium and having it self-supported. I didn't try that as part of the review, but gather from Tom Morris that it has been successfully tried and tested. One person I spoke to couldn't see the point of having an inflatable antenna but I think the high-portability and easy deployment speaks for itself.

Conclusion

I found the antenna worked well and can see that it would work very well indeed as a SOTA antenna – easy to transport in a rucksack and an efficient antenna once you get to the top of the hill. Part of me wished that it was a dual-band 2m/70cm model because it's often nice to cover both bands when you're portable. Speaking to Tom it sounded as though a dual-band model might be available in the future, with the design currently being tweaked. Tom also has other inflatable antennas in the offing; a 20m version that we hope to review here in *PW*, a UHF model for 70cm and PMR that will be only 4ft long as well as a version designed for the Military, covering 200-380MHz.

The 2m antenna costs £99.

You can contact Tom Morris on Twitter @AntennaAir or e-mail him at air-antennas@europe.com for more details or to make a purchase.

Fig. 1: The designer, Tom GM3HHN.
Fig. 2: The complete package on arrival.
Fig. 3: Inflated at ground level.
Fig. 4: Suspended from the eaves.

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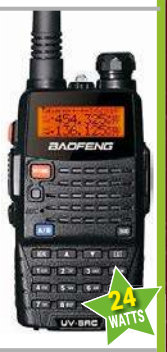

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The Alpha J-Pole Sr Antenna is only 60 feet in length. The unique design characteristics of this 6-160 Meter HF J-Pole antenna enables it to approach resonance on the major HF bands (10/12/15/17/20/40/80 Meters), all of which presents an SWR that is low enough for external tuners to achieve a perfect match, including 6 & 160 meters.

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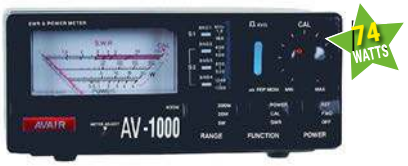
QJPS50II 50A switch mode power supply ..... ~~£129.95~~ **£119.95**
Input Voltage: 220VAC, Output Voltage: 9-15V adjustable, Output Voltage regulation: less than 2%, Output current: 50A, Meter: Displays the supply voltage and current, Cigarette plug terminal: 10A (max)



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MINI8-DRUM-100 military spec MINI-8 7mm 100m reel..... **£64.99**
RG213-DRUM-50 military spec RG213 9mm 50m reel..... **£64.99**
RG213-DRUM-100 military spec RG213 9mm 100m reel **£119.99**
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MSP-200 20ft Medium Duty (set of 4 poles) 51mm dia 1.6mm gauge . **£69.95**
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MSPX-200 20ft Heavy Duty (set of 4 poles) 51mm dia 2.65mm gauge..... **£89.95**

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TMF-2 40ft open 9ft closed 57-30mm high quality GRP mast..... **£349.99**
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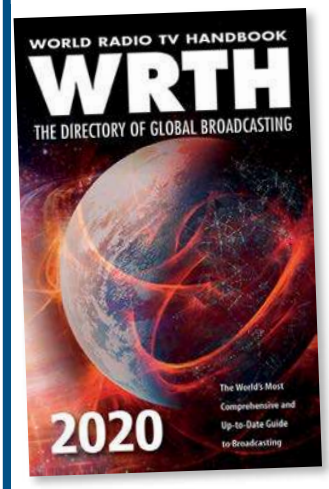

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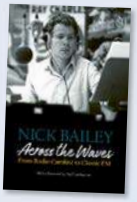

This autobiography gives a an count of Nick Bailey's life with Radio Caroline, other radio stations and finally with Classic FM. Reviewed in September's RadioUser, this is "an extremely entertaining and very readable book..."

£17.50 plus p&p

The Voice of the Crystal

Packed full of information on the fabrications of electronic components suitable for use in building crystal radio sets. Basic theory and simple analysis is combined with dozens of examples of historical practical work.

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Amateur Radio Essentials

For everyone interested in amateur radio. Aiming to answer frequently-asked questions that the editor has fielded on the phone while working for the RSGB, this book is edited from RSGB articles.

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Broadcasting Democracy: Radio & identity in South Africa

Providing an exciting look into the diverse world of South African radio, exploring how various radio formats and stations play a role in constructing post-apartheid identities.

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Looking at the early days of Japan's telecommunications, recording, radio and film industry.

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Rob Mannion G3XFD wrote: "A truly superb book but has chosen a title that really hides its 'light' under the proverbial bushel!"

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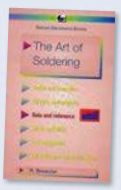
Radio Caroline

Revised since its first publication in 2003, this title details a history of offshore radio from 1958 to 1980, providing accounts of ship and fort-based radio stations and a history of Radio Caroline.

£18.95 plus p&p

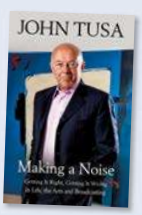
The Art of Soldering



Many illustrations are included in this title to help demonstrate the correct procedures. The Art of Soldering dissolves the mysteries surrounding the subject of soldering and features some practical exercises so as to help learn to solder correctly.

£3.99 plus p&p

Making a Noise



John Tusa looks back over a long and varied career in radio, television and the arts. In this autobiography, Etched with candour, this is an entertaining memoir of Tusa's life.

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Hart Reviews

For 35 years Peter has been writing amateur radio equipment reviews for the RSGB's journal RadCom. These reviews are real world testing of performance and analytical reporting of how amateur radio antennas, radios, amplifiers, etc. really work.

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End of Year Quiz 2019

This quiz, prepared by occasional PW contributor **Tom Morgan ZS1AFS**, is based solely on the contents of PW, January – December 2019. This is a first for quizzes because the answers can be found in issues of the current year.

1. The Marconi Centre is mentioned in a couple of issues. Where is it located, what was its WWI callsign? What was its commemorative callsign in 2018 to mark the end of WWI?
2. When was the full release of WSJT-X Version 2?
3. While several DXCC entities have moved up and down the 'Most Wanted List', which have been firmly entrenched as the top two?
4.When did the new examination syllabi for radio amateur exams come into effect?
5.The editor was a guest operator of the Royal Omani Amateur Radio Society (ROARS) for the 2018 CQWW Contest. What is the ROARS callsign? Whose call sign is A41A?
6. Where and when did the YOTA Summer Camp take place in 2019?
7. The RSGB National Radio Centre is located at Bletchley Park. Near which 20th century town and in which county is it situated. What was the official name of the establishment during WWII?
8. Where is the *RMS Queen Mary* based and what is the amateur radio callsign of the station? (RMS = Royal Mail Ship)
9. The airport at St Helena makes it more accessible that ever before. When was it opened? Can you name either of the first two amateur radio operators who flew in for a DXpedition?
10. When was International Marconi Day 2019 celebrated? How many stations need to be worked to qualify for an IMD award?
11. When does The International Lighthouses & Lightships on the Air take place?
12. The thermionic valve played a large part in the advancement of radio communications. Which English scientist is credited for this, and when?
13. Which radio pioneer and entrepreneur had a letter addressed to him as *"The Father of Radio"* returned to sender in a failed publicity stunt?
14. When is ANZAC Day, and who are the people it commemorates?
15. What is HEMA? Is it a lower award?
16. The Es'Hail-2 satellite is operational. When was it launched?
17. When was the last successful DXpedition to Bouvet Island? And what are the callsigns of the last two unsuccessful attempts?
18. What document should operators travelling abroad consult? Which level of UK licence is needed to operate in countries outside the UK? (Brexit should not alter this privilege.)
19. International Marconi Day is not always on the birth date of Gugliemo Marconi. When is it celebrated?
20. This is one for the LF enthusiasts. When were the bands 136kHz and 472–479kHz made part of the allocation and not subject to a Notice of Variation (NoV)? And who can operate?
21. Where is the BBC South Atlantic Radio Relay Station situated?
22. What is the callsign of the Massachusetts Institute of Technology amateur radio station?
23. Who showed how to trapeze antennas from one tower to another? In which country is that station?
24. What was the callsign for the 100-year celebration of Bentley Motors?
25. The Johnson Research Center, located in Texas, is not in the capital. Where is it located and what is the callsign of the amateur radio station?
26. Richard Carrington is associated with two phenomena, one of these occurred on September 2nd 1859. What are they?
27. Who is attributed with using the word 'ionosphere' first?
28. When did MOONRAKER UK Ltd start trading, and by whom?
29. Why could Mouth Athos (SY) become an even rarer entity on the air?
30. What was the collective name for the radar stations along the UK coast at the start of WWII?
31. When was the 2019 Dayton Hamvention, and where was it held?
32. In which month did Nevada start trading, and under what name was it known, then?
33. Who wrote the children's book, published by Ladybird in 1972, called *How to make a Transistor Radio*?
34. What is the main difficulty to upgrading of licences? (Hint.) This is caused by the revision of the syllabi of the Intermediate and Advanced Licences alluded to in Question 4.
35. Who held the call sign W1AW, and how is he remembered?
36. What is the preferred method of feeding a doublet antenna?
37. In which year was the world's first TV (television) service started? And when did it resume after WW II?
38. When did Market Reef become a separate DXCC entity? And how is it being celebrated?
39. Marconi's relayed reporting on an American yacht race was a sensation. This established radio as a means of receiving up-to-date news. Which yacht race was it, and when?
40. Where is the Telegraph Museum? Can you name the company that used the site for its training centre?
41. Why was the release of the Pi-4B computer, in 2019, a surprise? At what speed does the processor on the Pi-4B run?
42. The Radio Communications Foundation relies on donations. What are its primary aims?
43. Who were featured as the 'Heroes of the Rhombic Antenna'?
44. The 50th anniversary of *Apollo 11* was celebrated by GB5AML in Essex and GB50AML at Goonhilly Down. When did the moon landing take place, and when did *Apollo 11* land back on earth?
45. In which decade did the oscilloscope come of age? Was it 1930s, 1940s, or 1950s?
46. Advice to beginners regarding responding to repeater abusers was given in the October issue. What are the two priorities?
47. In *'Contests, Part 1'*, there is good advice, but the aim of a contest is not defined. The aim is to contact as many stations as one can – within the rules. When was the first event like this and what was the first contest?
48. What is the origin of the derogatory remark when someone is called a LID?
49. Navigators use Standard Time signal stations to correct their on-board chronometers. Also, radio conditions are broadcast. This year saw the centenary of WWV in Boulder, Colorado. It was celebrated by station WW0WWW. In which month was the service started? And on what frequencies does it operate?
50. How do you advertise your equipment for FREE in Practical Wireless?

The answers to the New Year Quiz can be found on page 38

1

New items from around the world

Bernard Nock G4BXD
military1944@aol.com

Bernard Nock G4BXD returns with some new additions to the collection from Japan and the USA.

A warm welcome to the Military Wireless Museum once again. It was an interesting first half of the year. Plenty of visitors, including not only radio amateurs but also others interested in history and technology in general. Several new items to the collection but a lot of time spent reducing the duplicates, rearranging displays and so on. The sale of some of the duplicates went very well and freed up a little space for the new items that will doubtless fill that space quite fast. Hopefully the next surplus sale will make more room.

Japanese Receiver

A recent donation to the collection was a Japanese WW2 receiver as used by the Japanese Army and complete with its transit or carry box. The receiver, Type 53C, is a four valve battery operated set, using 1.5V and 22.5V batteries and covering 0.4 to 5.75MHz by way of a set of five plug-in coils. It was made by the Tokyo Instrument Company and is an extremely compact receiver housed in a sturdy wooden box along with headphones, antenna wire, ground wire and spare valves.

The set, **Fig. 1**, uses a UY-14M pentode, 1.1V 60mA heater, as the RF amplifier followed by a UY-11M tetrode, again 1.1V and 60mA heaters, as a regenerative detector stage. Two further UY-11M tetrodes are used as the audio amplification stages driving headphones. Obviously, AM can be received and if the regeneration control is advanced to the point where self-oscillation takes place, then CW can be received also.

Tuning of the set is by two controls, **Fig. 2**, which are not mechanically connected, separate RF and Detector tuning controls, which makes things a little harder. The dials are highlighted with luminous paint and all are fitted with locking clamps; ideal to maintain tuning if on the move. A front panel mounted potentiometer is in series with the heater supply to set the actual voltage on the heaters to 1.1 from the 1.5V battery. A small terminal on the front allows a test meter point.

12ft of rubber covered wire was carried as an antenna, connected to the set with a special connector. A short length of wire was also carried as a ground wire and connected to a binding post on the set. In addition to the two batteries in a space beneath the receiver, 1.5V for the heaters and 22.5V for the HT supply, an additional 1.5V battery, similar to the AA type cell, was carried in a holder inside the set to supply the grid bias for the audio output stages.

The Type 53C receiver, **Fig. 3**, was part of the bigger Army 94 Type 3 Wireless station. It was developed for receiving communications from higher up the

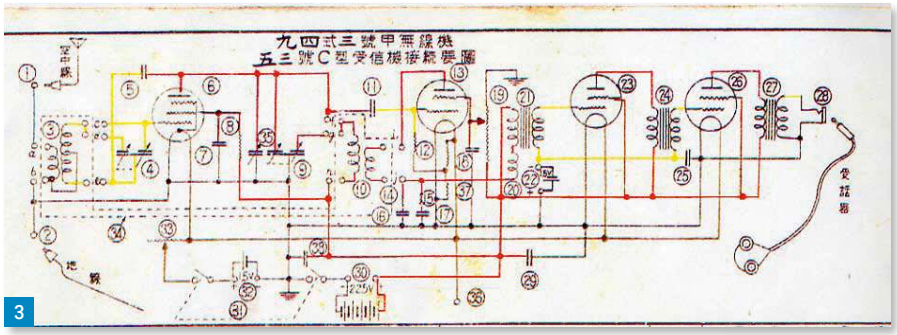
Fig. 1: The Japanese 53C receiver. Fig. 2: The two tuning controls. Fig. 3: The circuit diagram.

military chain while on the move though with a wire antenna as opposed to a whip because not actually mobile, of course. Apparently though it was little used and later cancelled as part of the bigger station. The US report on Enemy Equipment found the receiver to be very stable and have a surprisingly high sensitivity.

The interesting thing about these war-time Japanese sets is that every component is actually marked with its circuit diagram part number. This makes for easy tracing of wires from component to component and fault finding is equally as easy.

As the set has just arrived. I have yet to try it out but I do have another example of the set in the collection and a set of spare valves so it will be tested in the near future. My thanks must go to **Mr Ted Engelmann** for his kind donation.


2


3

US Navy Aircraft Receiver

Another recent acquisition was an American set made for the US Navy, primarily for use in carrier-based aircraft. This receiver is the last in a long line of sets developed for the Navy and a similar set was made for the USAAF, the US Army Air force (the US Air Force as is was not created until after WW2). The set, **Fig. 4**, is designated RU-19 and was paired with the GF series of transmitters.

The last two RU receiver designs, the 12V RU-18 and the 24V RU-19, were used in general aircraft service and unlike previous models were not specifically assigned to a GF model transmitter. These were produced by Western Electric in 1941.

The Navy GF-1 transmitter and the Army BC-230 transmitter of radio set SCR-183 are very similar – much closer than the later GF transmitters. It uses three type 10 valves (CRP-38110), two as modulators and one as power amplifier, and a CRP-38142, VT-52 serves as the oscillator. The original GF, built in 1932, delivered 1.5W out. The GF-1 produced 3W. The big design change seems to have come with the GF-2; it and subsequent GF transmitters gave 15W output.

The GF set and GF-1 was paired with the RU-3 receiver in 1934. Later models, GF-7/RU-9 (1938) and GF-10/RU-15 (1939), were followed by the popular GF-11/RU-16 set produced by Western Electric in 1941. The last GF/RU combination, GF-12/RU-17 by Western Electric, was procured in 1941. It is listed with two transmitter coil sets, 3000-4525kHz and 6000-9050kHz. The RU-17 receiver coil sets do cover from the LF band to 9050kHz but have a coverage gap between 4525 and 5200kHz:
www.smecc.org/navy__gf_series.htm

Back to this RU-19. The set is a Tuned Radio Frequency (TRF) receiver with plug-in coil packs, **Fig. 5**, nine in total, giving a coverage of 545kHz to 7700kHz. Three Type 78 valves are used as RF amplifier stages with ganged capacitor tuning with a Type 77 valve used as a detector stage and another Type 77 as the AGC amplifier. A Type 38233 double triode is used as a heterodyne oscillator and the audio output stage.

The aluminium chassis and case receivers RU-18 and RU-19 are identical save for the supply voltage, 12V and 24V, but another way to identify them is that the nameplates on the 18 have a black backing while the 19 has a blue backing. Junction boxes and dynamotor filter units are the only items in the various RU sets that are not fully interchangeable.

Oddly, while mention is made on the web of coverage up to 9050kHz the actual handbook for the RU-19 states coil packs covering 545kHz to 13575kHz and that they are interchangeable with other models, RU-3, 3A, 4, 4A, 5, 5A, 6, 7, 10, 11, 12, 13, 14, 16 and 17. Installed in the aircraft the receiver was connected by a multicore cable to a junction box. This had eight large sockets and could cater for two complete receiver setups.

From the Junction box, **Fig. 6**, a multicore cable went to the Receiver Switch Box A (B if the second set), which has a volume control, a sensitivity control, a three-way AGC switch, manual, off and automatic, a switch for CW or MCW and a jack for measuring the cathode current of the RF stages. Another multicore cable went off to the dynamotor unit, delivering 250V HT to the set, and filter, a cable to the battery supply, 12 or 24V and another couple of connectors were used for the aircraft intercom system. The last two connectors went to receiver B if installed and switch box B.

The receiver along with the transmitter already in the collection, **Fig. 7**, form the

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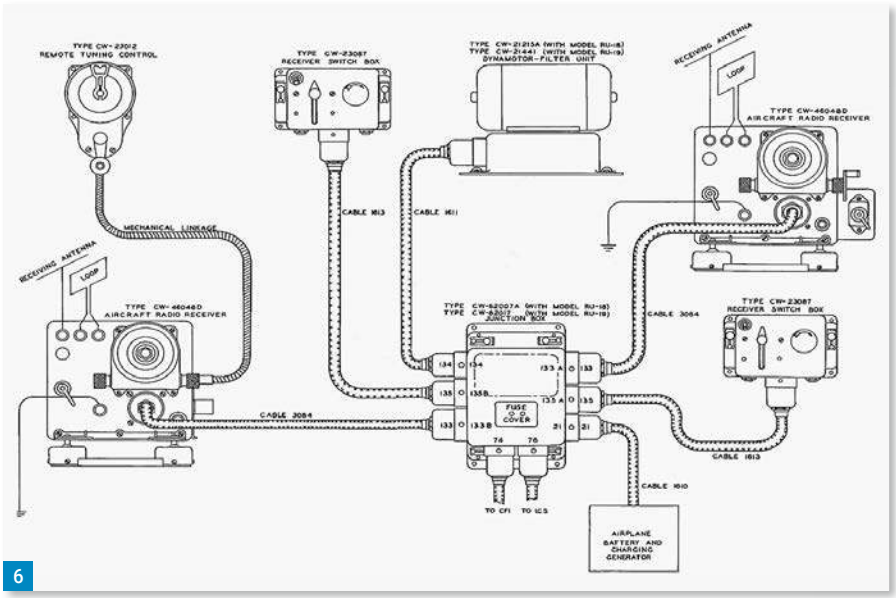
Fig. 4: The RU-19 receiver. Fig. 5: The plug-in coil units. Fig. 6: The receiver wiring diagram. Fig. 7: The transmitter and receiver pair.

basis of a very compact and lightweight system that served for many years in the military aircraft communication role. Though not specifically paired with the GF-11 transmitter the pair could be used as a station. Note, the control knob below the tuning dial on the receiver should not be there, there should be a multi pin socket. The control is an 'amateur' modification.

The model GF-11 set produced by Western Electric in 1941 was, in fact, not acquired as an aircraft set, even though the nomenclature plate lists it as such. Ships 242A details it for Marine Corps ship installations, and there is documentation on its installation in a mechanised artillery vehicle. Photographic evidence shows it in an ambulance and in other types of vehicles (see earlier URL).

The transmitter series were basically a four-valve design, tunable oscillator stage, two power output vales in push-pull and a modulator valve. Again, a selection of plug-in coils were used. The set ran about 15W of AM, MCW or CW and to work with the receiver used a junction box, transmitter control box with the dynamotor, receiver and receiver control box all going to the junction box along with an antenna changeover relay box. Lots of leads, lots of plugs and sockets.



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And Finally

The museum is now operational on the Oscar 100 geostationary satellite, going up on 2.4GHz and receiving on 10.4GHz. There is a small corner of the garden given over to growing satellite dishes, the best bloom so far is a 1.4m prime focus dish in a nice shade of green. Although there are no receivers or transmitters in the collection, not even radar stuff, that can be used on the satellite frequencies, there are a few items of WW2 test equipment that, surprisingly, go as high as 3GHz and have been very useful in checking signals at some of those frequencies.

To close, I wish you all a very Merry Christmas and a great 2020 from here at the Military Wireless Museum. Cheerio.

www.militarywirelessmuseum.co.uk

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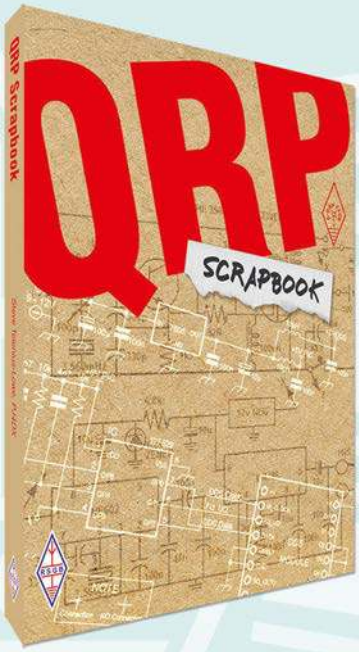


QRP Scrapbook

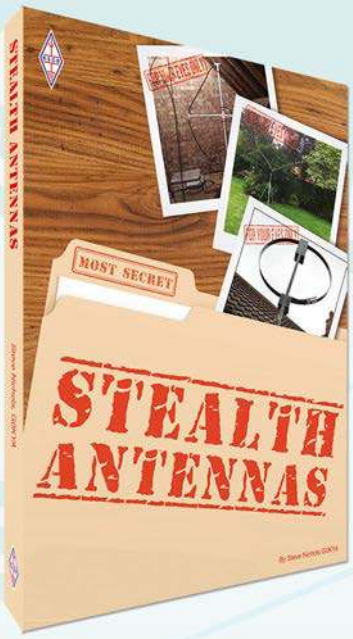
Low-power operation or QRP is one of the most popular aspects of amateur radio and the UK's G-QRP Club is a leading light in this area. This book draws together the very best articles from authors around the world that have been published in the club's journal *Sprat* in recent years. Packed with projects *QRP Scrapbook* contains all-new material not previously published in an RSGB book.

There is much included in this book and there are modern techniques including a practical RF generation system for superhets using direct digital synthesis (DDS) modules, the use of TV 'dongles' to make a software defined radio (SDR), plus Arduino microcontroller projects for a CW transceiver and keyer and much more.

The *QRP Scrapbook* has six sections covering QRP transmitters and transceivers; simple and also somewhat more complex receivers; antenna systems and test equipment suitable for low-power operation, and a 'miscellaneous' section covering subjects as diverse as how to wind toroids tidily, making your own ribbon cable, Morse keys and keyers, crystal oscillators and ceramic resonators. With the increasing problem of local interference, the noise cancelling device in this section will be of interest to all amateurs, not just those who operate with low power.

Produced in co-operation between the RSGB and the G-QRP Club, *QRP Scrapbook* is essential reading for all interested in the latest in home-construction techniques and the art and science of low-power amateur radio.

Size 174x240mm, 240 pages
ISBN: 9781 9101 9379 2
Price £14.99



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By Steve Nichols, G0KYA

Since it was first published *Stealth Antennas* has become the 'must have' antenna book for everyone who wasn't living in acres of land. This new edition has been expanded and updated and now contains all new case studies, a commentary on FT8 and FT4, a design for a 2m Slim Jim and a number of new commercial antenna reviews.

Written by acknowledged antenna expert Steve Nichols, G0KYA, who himself lives in a challenging environment for antennas ,*Stealth Antennas* remains the solution for those of us with tiny postage stamp-size gardens, intolerant neighbours, planning permission problems or living in apartments. Beginning with fascinating real-life case studies you can see what can be achieved with the dozens of original and ingenious ideas this book contains. This book ranges widely across antennas for the roof or loft space, low profile external antennas and even *really* stealthy antennas. There are receive antennas, Top Band antennas and reviews of a host of commercially available antennas that might provide exactly the right solution for your situation. *Stealth Antennas* does not neglect VHF/UHF antennas that can be easier to conceal because of their small size compared with HF antennas but what are the effects of mounting a VHF antenna in the loft? This is discussed here, as is the fear of interference and other EMC issues, which is dealt with in a whole chapter dedicated to the subject.

Aimed at everyone who has restricted spaces for antennas or feel they are radiationally-challenged, *Stealth Antennas* should persuade anyone with an amateur radio licence that they can still work the world.

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Advanced Antenna Modeling by Marcel De Canck ON5AU

Keith Rawlings G4MIU
keith.g4miu@gmail.com

Keith Rawlings G4MIU reviews and recommends a book for those who like to experiment with antennas.

Practical Wireless REVIEW

Anyone who reads through amateur radio publications, *PW* included, cannot fail to notice that 'antennas' are a very popular subject!

In years past antenna construction was often a case of 'design it and see' or if copying designs from magazines or handbooks, the constructor had to rely on the results quoted by the author and 'hope for the best' that a particular design would work for them.

With the advent of the computer it has been possible, for those who are inclined, to 'model' an antenna to get some idea if it is going to perform as expected.

There are numerous packages available to amateurs but, arguably, the three main ones seem to be MMANA-Gal, 4NEC2 and EZNEC.

MMANA and 4NEC2 are fully working programs that are free to use while EZNEC, except for the demo version, is 'paid for' software that comes in various versions.

I have used EZNEC for some years and while I also use both MMANA and 4NEC2 I am most comfortable with EZNEC and it is my 'go to' software.

There is a lot of on-line support for EZNEC, and it has a decent user manual so when I found out that **MarcelON5AU** had written a book entitled *Advanced Antenna Modelling* and which concentrates on EZNEC, I was interested to see what it had to offer over what is already available online and for free.

A look on ON5AU's website revealed not only details of his book but also several useful 'e books' and other data relating to antennas and propagation and it is well worth a visit.

www.on5au.be

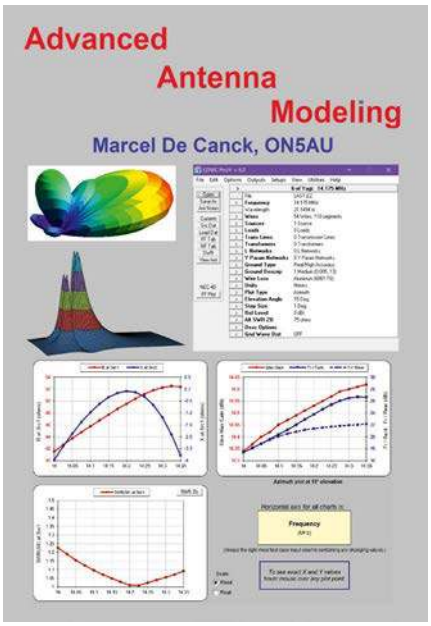
Getting back to the book: So that potential purchasers may gauge its usefulness; the website has sample PDF pages, which may be downloaded.

There is, naturally, a link to the Amazon website where the book may be purchased (It is printed by Amazon).

After getting my son, who is also licensed, to look the price up on Amazon I was intrigued when two days later he passed me a package with Amazon written all over it and inside was a copy of the book!

The book is a paperback of A4 format, runs to 584 pages and is 35mm thick.

The first thing I noted was that the print quality; the text, and also the diagrams, are of a good standard, very clear and easy to read and interpret.



Advanced Antenna Modelling by Marcel De Canck, ON5AU

I have read some publications where text and diagrams have been translated into English, and they do not necessarily 'flow' was well as they might.

This is not the case with Marcel's book. I did not find any cases where I have had to read and then re-read sections to grasp what the author means.

What does it Cover?

The answer to this is just about everything to do with modelling in EZNEC.

The books title is a tad misleading, because not only does it cover many advanced concepts, it also starts at the very beginning, as Chapter 2 'Starting Modelling with EZNEC' quickly demonstrates.

Here the author clearly explains the user interface. He also gets to grips with how 'data' is used to build a model, so the book is therefore ideal for someone just starting out.

> I have used EZNEC for some years and while I also use both MMANA and 4NEC2 I am most comfortable with EZNEC

There are further concise chapters on Wires, Loads, Sources, Transmission Lines and so on. Nothing seems to have been left out.

If you don't understand on how to place Loads on your model, or how many segments you should use or perhaps you don't understand the information being given to you on a Polar Plot, this book will explain it all.

Additionally, Appendix A lists a number of useful conversion tables.

All chapters are comprehensive, and I have already read how I could do few things differently!

The publication also covers more advanced topics, such as the use of AutoEZ, which automates the use of EZNEC. Although based on the latest edition of EZNEC i.e. v6.0, much is still valid for earlier versions. The 6.0+ version, and information on using the Pro versions and some of the differences between the NEC2 and NEC4 engines are also explained.

There will never be enough room here to list everything this book covers so go along to Marcel's website to find out more.

The author has made an excellent job with *Advanced Antenna Modelling*: the book has all the information needed in one place. If you are looking to get into modelling with EZNEC, or already a user of the software, then I would not hesitate in recommending this excellent book.

My son paid just over £40 for my copy from Amazon:

www.amazon.com/-/e/B07XBZRPLZ
www.eznec.com

AutoEZ and other software covered in the book:

https://ac6la.com/autoez.html

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Activity, HAB Tracking and More

Tim Kirby G4VXE
longworthtim@gmail.com

Tim Kirby G4VXE discusses the need to increase activity on the VHF/UHF bands and whether a beginner level licence could help.

In recent months, I have written several times about the need to make our activity on the VHF/UHF bands obvious. As I suggested before, it's not that activity on VHF/UHF is low. It's not. It's a vibrant and active scene as I hope regular readers of this column will appreciate. The problem is though, that much of the activity on the bands isn't obvious.

I wrote a month or two back in relation to the threat to the primary amateur status of the 2m band from the now defeated French proposal, that loud FM signals are needed on the bands to show our occupation to the casual listener and indeed, the regulator (OFCOM). Club nets, active repeaters, people calling CQ and people answering CQs – all these things have their part to play and we can all do our bit to help activity.

Picking up the same themes, I was interested and delighted to read a proposal from **John Regnault G4SWX** who is the RSGB's VHF Manager, for a Beginner Level Licence. John wrote a post on the RSGB Workshop reflector, which I have reproduced below with John's approval because I believe it raises important points.

"There has been lots of discussion on this reflector and elsewhere from amateurs that do not think that the hobby should be allowed to change because they like things the way that they imagined that they used to be!

"The basic FACT is this reluctance to change, the desire to involve radio clubs (stranglehold?) in the exam process and a number of elected RSGB people who are afraid of what the membership might think is assisting the hobby along to a slow death.

"I have a really hard job justifying the VHF/UHF bands based on their current usage. Yet I have amateurs saying that we need more repeater channels when many of the repeaters in operation are rarely used.

"There is an increasing need to attract a greater number of younger age people into amateur radio. The current three-tier licence regime; Foundation, Intermediate, Full, whilst it is maintaining a steady annual number of candidates has, over recent years, seen a marked decline in attracting younger people. In 2006 25% of Foundation exam candidates were under 21 years of age. By 2013 this had declined to 14%, today it is even lower.

"I am a highly technical radio amateur, yet I see plenty of room for people in the hobby with no technical skills whatsoever. The amateur radio hobby embraces aspects of both technology and personal development in communications. To date the amateur examination has required all candidates to demonstrate an understanding of radio technology, which might be appropriate as the amateur licence permits modification and manufacture of transmitting equipment. This technical requirement can be a significant perceived barrier to younger people who otherwise would like to investigate radio communications beyond the capabilities offered by licence-free CB or PMR446 transceivers. There are many other facets of the hobby that are about communicating and personal development in communications rather than building and modifying radio equipment. Technical skills, just as operating procedures, Morse if you like, can be learnt once somebody is hooked into the hobby.

"So how about this: A Proposal for a Beginner Amateur Licence. A low-power VHF/UHF (144/430 MHz) entry class 'Beginner Amateur' licence:

• Targeted at newcomers and offering opportunity for involvement by youth organisations.
• Amateur Callsigns
• A relatively simple online examination with a pass certificate issued by the RSGB
• A clear path for further progression with the online 'Beginner' exam being accepted as exemption/credits for part of the Foundation exam
• Equipment to be used will be limited to low power, 5W output, <25W ERP, CE approved VHF/UHF FM/Digital Voice transceivers. (To protect other users of the VHF spectrum in the UK and nearby nations)
• Equipment to be unmodified
• Callsigns issued to use an additional letter to clearly identify 'Beginner' licensees
• 'Beginner' licensees to be permitted to operate amateur club stations under supervision of a full licensee
• Process administered by RSGB with weekly updates provided to Ofcom

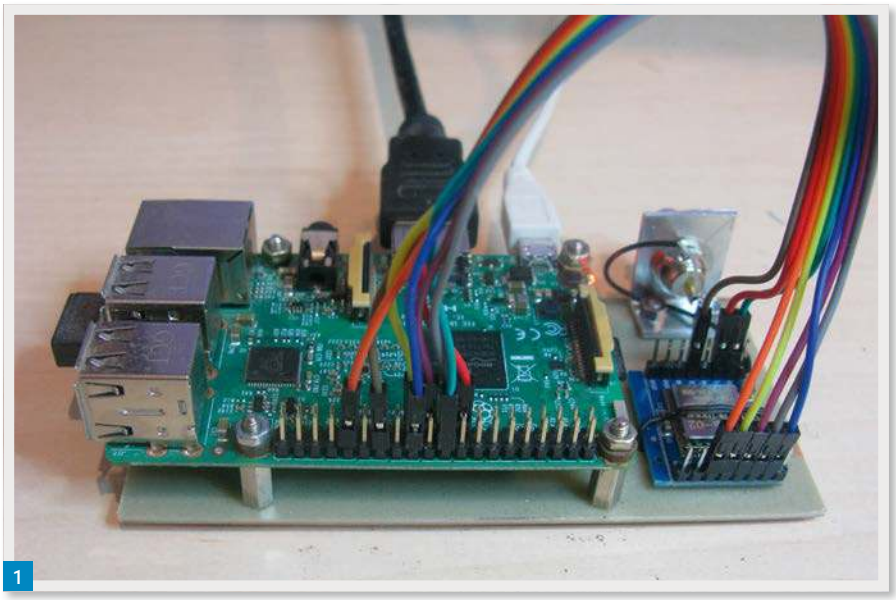


Fig. 1: Steve G4AQB has built a high altitude balloon tracker based on a Raspberry Pi and a LoRa receiver. Fig. 2: A screenshot of Peter G8BCG's 2m moonbounce contact with A21EME
Fig. 3: A map showing the grid squares that Patrick WD9EWK has operated from during 2019.

• Launch initiated by RSGB, including outreach by local radio clubs to forge links with youth organisations
• RSGB to investigate whether 'Beginner' amateur licence could be accepted as part of personal development and training by established youth organisations (Scouts, Air Cadets etc)
• Minimal cost of administration for Ofcom
• The training and development of communications skills by young people taking up a 'Beginner' amateur licence will ensure additional benefit to 'UK plc'."

Since publishing his idea, John has received lots of support but also a considerable amount of criticism from people who feel that the proposal erodes the hobby's standards or values. I know some people feel that because they had to go through a particular process, everyone else should do the same. The problem is, that if we do not change and if we do not try to do things differently, the hobby that we all love will die. Surely, we should try to make that change?

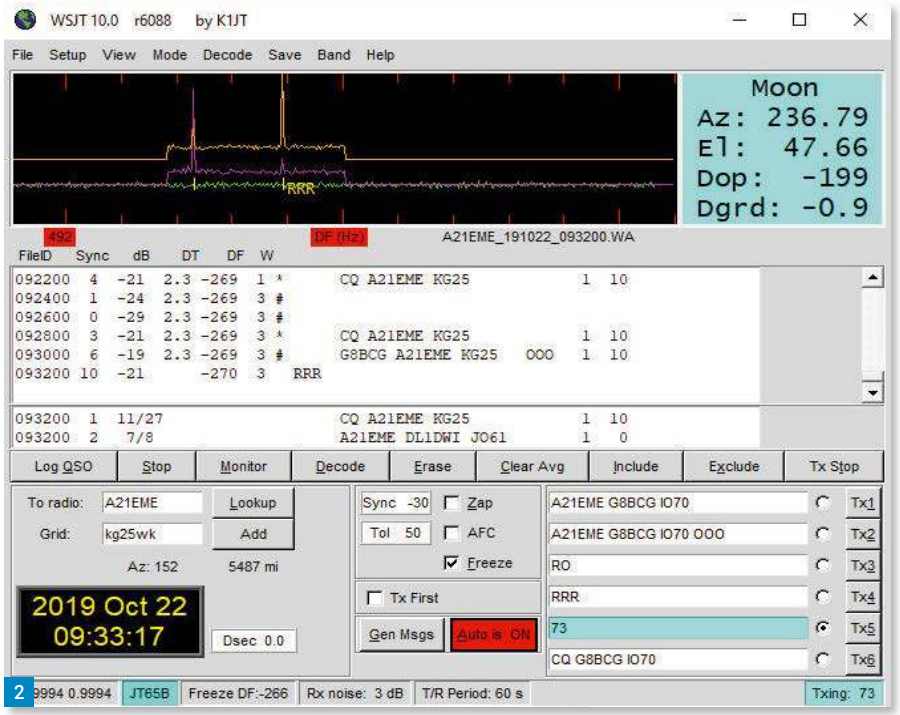
I am all for this idea. We should be making it easier for interested people to enjoy our hobby rather than harder, which is what the recent changes to the Foundation (in particular) syllabus seem to have done. Why is it that an interested person cannot take a simple test and start to actively participate in the hobby? (I can, after all, take a day's tuition and get a Marine VHF licence, which allows me to use a 25W transceiver on the Marine band). Tell me honestly, would you not have loved such an option when you were first getting involved in amateur radio?

We know that a fair percentage of those that come into the hobby may fall by the wayside. We can do our best to avoid this but it will always be the case to some extent, so it is important that we try to introduce more people to the hobby, in the hope that more will stay. We also know that not everyone who gains an amateur licence wants to talk (after all, the amateur service is about much more than just talking). Of course, we understand that! But, it is important that we make it as easy as possible for people to engage with the hobby. The proposal for the Beginner Level Licence seems to me a good way to help this to happen.

When can we start?

High Altitude Balloon Tracking

It's a couple of years since I included anything regarding High Altitude Balloon tracking in the column, but it was good to hear from **Steve MacDonald G4AQB** (Bolton) who has been spending some time on this interesting aspect of the hobby, **Fig. 1**.



"I thought I would share with you one of my recent projects that is becoming quite popular here – High Altitude Balloon Tracking (HAB). High Altitude Balloons are launched by enthusiasts usually as part of a school or group project. The balloon is loaded with a very light payload, usually a camera, GPS and very low power transmitter (sometimes only 10mW). This transmits telemetry on frequencies around 434.2MHz, which can be received and tracked. The telemetry is transmitted as data packets in RTTY mode or LoRa (Long Range) mode. LoRa modules are available very cheap on eBay for receiving the data along with software you can download to use with a Raspberry Pi. RTTY data is received using the HAB version of FLDIGI (called DI-FLDIGI).

"There is an excellent website called HABHUB, which allows you to see details of balloon flights around the world and track them on the map. By setting up DI-FLDIGI, you can participate by reporting received packets back to HABHUB, which shows your report on the site (like spots in DX Reporter) Some of the balloons also send back digital slow-scan pictures during the flight, which can be received using LoRa.

"Up to now I have been able to track three balloons, all of which were launched in the Hereford area. The signals on 70cm were quite strong once the balloons had gained height, even though they only run extremely low power. The last balloon I tracked came back down to Earth only a few hundred metres from the The Wash having travelled all the way from Ross-on-Wye. Incidentally, the balloons are followed in cars by 'chasers' to recover the payload. They can also be seen on the HABHUB maps with GPS.

"I have just completed building a LoRa receive module for 434MHz with a Raspberry Pi.

"Although I guess there are not going to be many balloons around in Winter, I look forward to using it in Spring when more HABs are launched".

More on the OpenGD77 Project

Last month I wrote about the work that is being done on an Open Source firmware project for the Radioddity GD-77 dual-band DMR/FM transceiver. As the project stood when I last wrote, **Roger Clark VK3KYY** had built on the work of **Kai DG4KLU** with help from **Colin G4EML**. At that point, the team had implemented DMR Tier 1 functionality, which means in practice, you can 'only' use the rig/firmware with a hotspot and not with repeaters (as it would transmit the same signal on both timeslots). Of most interest, the firmware also included hotspot functionality, so that the rig can be connected to a computer running suitable hotspot software such as Pi-Star, MMDVMHost or BlueDV.

Since I wrote that, development has

moved on apace and Roger has received an Alpha code version of the firmware that includes DMR Tier 2 functionality, in which you can use the rig with repeaters. In addition to the DMR features, some great features have been added to the FM functionality, including DTMF. As it is an alpha code release, some issues exist, but the vast majority of users report that the firmware is working well. It is worth saying, however, that while the DMR Tier 2 functionality is being developed the Hotspot functionality has been disabled in the code, although you can still download the 'Tier 1 version' of the code, should you wish to experiment with the Hotspot.

Don't forget that it is quite safe to try out the firmware and, if you decide it is not for you, you can easily load the Radioddity standard firmware back into the rig.

You can keep up to date with the interesting developments with the OpenGD77 firmware at: www.rogerclark.net

The 6m Band

Peter Taylor G8BCG (Liskeard) says in the south west they have had to contend with some really serious winds recently. Fortunately, tying everything down as close to the ground as possible seemed to work. Peter's objectives for the month were to work the A21EME and VP6R expeditions via EME, which he was delighted to do. He says that the two expeditions were very different in terms of scale but both were superbly organised.

Thanks to a tip-off from **Abdel Mesbah M0NPT**, I caught a 6m ES opening from G4VXE on October 27th. The band was open nicely to the south and I was pleased to work several EA1, EA4 and CT stations on FT8.

The 2m Band

Kevin Hewitt ZB2GI has been in the UK for a little while in Chatham, Kent using his UK callsign **M0GTD**. While here, he has been active on 2m FT8 using his Icom IC-271E into a turnstile antenna designed for weather satellite reception. Stations worked include M0WJL (JO01), G0KUC (IO91), GW8ASA (IO81), G3YDY (JO01), MX0CNS (JO01), 2E0RUS (IO91) and M1BMW (IO92). Kev has also heard some French and Belgian stations in the morning and late evening, calling CQ, but as yet, hasn't managed to complete a contact with them.

Peter G8BCG was pleased to work the A21EME expedition via moonbounce – a really nice one on the band, **Fig. 2**.

Here at G4VXE, interesting contacts from the FT8 log include GD3YEO (IO74), F6BTP (JN09), GI6ATZ (IO74), GW8ASA (IO81), G0RQL (IO70), GW1JFV (IO71), F4CHB (JO00), F5BZU (JO11), OR7PP (JO11), ON7LSP (JO10), F5APQ (JO00), GW6TEO (IO71), GU3HFN (IN89), F6APE (IN97), F5MYQ (JO10) and GD6ICR (IO74). I particularly enjoyed working GD6ICR. I first worked Mike when he was G6ICR in Liverpool and I was a recently licensed G6TTU back in 1983. How time flies! It was also good to work good friend of *PW* **Dave G4ASR** on 2m FT8 for the first time.

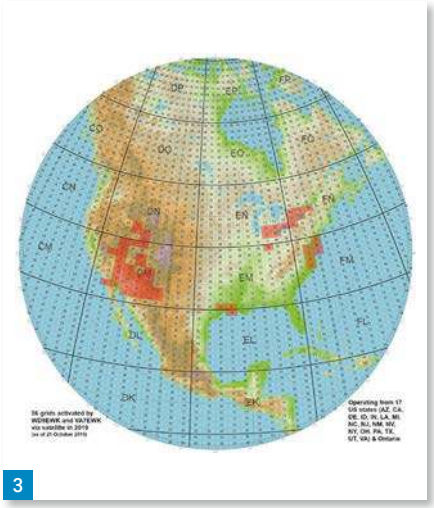
Satellites

Kev M0GTD says that his Yupiteru MVT7100, programmed to scan space-related frequencies, halted on 145.800MHz during an Italian ARISS schools contact.

Peter G8BCG writes, "*A21EME announced that they would be on QO-100 so on a wet Sunday afternoon having already worked then on 2m and 6m, I decided to have a go at a junk-box QO-100 setup in the workshop: SG labs 13cm transverter, WiFi 5W PA, 31el long-Yagi on transmit. 80cm sat dish, unmodified LNB and RTL dongle on receive. Result – A21EME in the log! As I write this, I'm up to 40 DXCC, including 9N, 9X, A2, A4, A7, FR, FY, ST, TR, VU – I didn't realise how much rare stuff was on the bird! I'm a Life Member of AMSAT NA but have not been active since the early 1980s (as H44PT on AO-10) so this is really fun!*"

As ever, **Patrick Stoddard WD9EWK** sends an interesting report from his hamfest and roving activities in the USA. "*The past month has been busy. The AMSAT Symposium was held in a suburb of the US capital – Arlington, Virginia. It was well attended, and a celebration of AMSAT's 50th anniversary. Many speakers and presenters from the early days of amateur radio satellites were in attendance, including two of the builders of the OSCAR 5 satellite, which came from Melbourne in Australia and was the first satellite launched by AMSAT in 1970. AMSAT gave updates on the Fox-1E satellite, the AMSAT linear transponder riding on the University of Washington's HuskySat satellite, and the GOLF project.*

"During and after the Symposium, I ventured away from the Washington area to work satellites from a few different locations in Virginia, North Carolina, Delaware, and New Jersey. I didn't work any European stations on this trip but made many operators around North America and the Caribbean happy. While I was on the road, J6/AA4FL was on from St. Lucia, in advance of the CQ WW SSB contest. Even though I wasn't home to claim a new grid, a new DXCC entity is still good for my log. I spent much of one day operating from the FM15/FM16 grid line in northern North Carolina, and the next day on the FM28/FM29 grid line in the rarely-heard state of Delaware. Other stops in Virginia and New Jersey added to my rover map and contributed to just over 1000 miles on my rental car.



3

"After returning home from the Symposium trip, the hamfest season here in Arizona was well underway. Hamfests in northern and southern Arizona have taken place, and I have had an AMSAT table at five different events since late September. More to come, through the wintertime in the desert...

"I took a look at my satellite log for 2019. As I write this, I have operated from 56 different grid locators across 17 different US states and the Canadian province of Ontario (**Fig. 3**). *In my 14 years of working the satellites, this has probably been the most productive year in terms of locations (grids, or US states) I have operated from. Lots of miles on the roads in the western USA, along with three trips to the east – to Louisiana and Texas in April, Dayton Hamvention and several US states plus Ontario in May, and the AMSAT Symposium along with various states along the Atlantic coast in October. I enjoy working satellites from home, and when away from home".*

Merry Christmas!

Finally, there's just space to wish you and your families a very Merry Christmas. Many thanks to all of you who have contributed to the column – or read it! Please keep your news coming and if you've been thinking about getting in touch, please make 2020 the year you do! See you next month.

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End of Year Quiz Answers

1. The Marconi Centre is at Poldhu, Cornwall. The station call sign in WWI was MPD. In 2018 the commemorative callsign was GB100MPD. (Jan 19)
2. The release of WSJT-X version 2 was on December 10th 2018. (Jan 19)
3. Number One on the list is: Democratic People's Republic of Korea, North Korea (P5), Followed by Bouvet Island (3Y/B) at Number Two. (Feb 19)
4. Examinations using the new syllabi started on September 1st 2019. Candidates who failed had until end of October 2019 to re-take using the old syllabi. (Feb & Dec 19)
5. The callsign of the Royal Omani Amateur Radio Society station is A44A. The editor was an invited operator for the CQWW CW contest 2018. A41A is the call sign of Sultan Qaboos. (Feb 19)
6. The YOTA Summer Camp 2019 took place in Sofia, the capital of Bulgaria from August 11th to 17th. The Bulgarian Federation of Radioamateurs (BFRA) hosted the event. (March 19)
7. The RSGB National Radio Centre is based at Bletchley Park. It was the WWII Government Code & Cipher School near Milton Keynes, Buckinghamshire. (March 19)
8. The amateur callsign of the RMS Queen Mary is W6RO. The ship is based at Long Island, California, and is now a leisure and activity centre. (March 19)
9. The first amateur to fly in to St Helena for a DXpedition, November 2017, was Bill G0VDE. The second was Bob Bower GM4DLG/ZD8RB. (March 19)
10. International Marconi Day in 2019 was held on April 21st. (March 19)
11. ILLW, International Lighthouse & Lightship Weekend 2019 took place on the third weekend in August. (March 19)
12. In November 1904, John Ambrose Fleming wrote he had found a method of detecting oscillating electrical currents in an antenna using thermionic valves (patented). (Marconi W/T Company records). Unfortunately, he failed to see the next step in development, putting a control grid between the filament and the anode. (March 19)
13. Lee de Forest was a flamboyant character who also sought the limelight of publicity but died in obscurity in 1961. He was one of the first radio pioneers to have a PR agent. In an ambitious stunt, the agent sent a letter addressed to "The Father of Radio, Hollywood, California". Without an actual address the letter was returned to the sender! (March 19)
14. ANZAC Day commemorates the landing of the Australian and New Zealand Army Corps at Gallipoli on April 25th 1915. The campaign, that became a stalemate, included the Battle of Chocolate Hill (August 1915) when hundreds of British Empire troops died in an ill-conceived attack on Turkish strongholds. (April 19)
15. HEMA stands for HuMPs Excluding Marilyns. Firstly, Marilyns are hills 150m, or more, above the surrounding area. These count for SOTA awards. HEMA relates to hills that are less than 150m above their surrounding landscapes. An analogy is the difference between mountain climbing and Munroe mounting. (April 19)
16. Es'Hail-2 was launched on November 15th 2018. It is positioned at longitude 26º East and its projected life is 15 years. Operating advice is on the Es'Hail-2 website, and Wikipedia. (April 19)
17. The last successful DXpedition to Bouvet Island was by the late Dr Chuck Brady W4BOW, who signed 3Y0C. This one-man show lasted from December 16th 2000 to March 5th 2001. The latest attempts were not as successful. The first was the American-led 3Y0Z. They anchored but the ship's engine problems and the safety issues regarding helicopters meant that they never landed. The second was the multi-national 3Y0I. Their ship was confined to port for non-payment for so long that they missed the Antarctic weather window. The ship had to return to port after suffering damage, without seeing the island. (April 19, see also June 19)
18. T/R 61-01 covers transmissions from countries on the list by UK Full Licence holders. This agreement covers all of the territories extra to those that have agreed to CEPT, where the UK Advanced licence is accepted. (May 19)
19. International Marconi Day is celebrated on the Saturday as close to his birth date as possible. Gugliemo Marconi was born April 25th 1874. So, in 2019 Marconi Day was celebrated on April 21st. (May 19)
20. The LF 136kHz band has been available since it was approved by WRC 2007. Before that it was a Notice of Variation of Licence from OFCOM, on application. The 472 – 479kHz band was also subject to a NoV and was made available in 2012, but only to Full Licence holders. Both are part of present allocations. (May 19)
21. The relay stations of the BBC World Service, and many others, are located on Ascension Island. This is roughly mid-way between Africa and South America. Some of the towers are up to 400ft, and the arrays can be steered electronically! (May 19)
22. The callsign of The Massachusetts Institute of Technology's amateur radio club callsign is W1MX. (June 19)
23. The trapezing antennas are at the station of ZS1AFS. The special callsign of the station, ZT1T, has a unique prefix! (June 19)
24. Bentley Motors celebrated 100 years in July 2019. The callsign was GB100BM. (June 19)
25. The Johnson Space Center situated near Houston, TX. The call of the amateur radio station is W5RRR. The capital of Texas is Austen. (June 19)
26. The Carrington Super Flare, named after amateur astronomer Richard Carrington, occurred on September 2nd 1859. He proved that the Sun rotated faster at the equator than at its poles. And so the Carrington Rotation Period of the Sun was also named after him. (July 19)
27. Sir Robert Watson-Watt was the first to coin the word 'ionosphere' in a letter written in 1926 and reprinted in Nature magazine in 1969. He thought the term was in keeping with 'stratosphere' and 'troposphere'. (July 19)
28. MOONRAKER started trading in 1978 by Charles Godefroy, mainly selling to the CB market. (July 19)
29. On May 2019, Monk (Elder) Apollo SV2ASP passed away. He had been the sole amateur operator on Mount Athos for some time. The separate DXCC entity is SY. Although SY callsigns have also been issued to Greek special event stations. (July 19)
30. The chain of WWII radar stations were collectively called Chain Home (CH). They were based on the east coast of UK and south coasts of England. The centre of operations was at Bawdsey Manor, Suffolk, on the bank of the River Deben. (July 19)
31. The 2019 Dayton Hamvention ran from May 17th to 19th. Its 'new' home is Greene County Fairground & Expo Center. (July 19)
32. Nevada, as its predecessor Telecomms, opened 50 years ago, September 1969. It is the main amateur radio outlet in the Portsmouth area and South Coast. The owner, Mike G3SED, was involved in the Camel Trophy Rally during the 1990s, supplying communication equipment and support in many countries. (August 19)
33. Many amateurs, and especially those who had children, will remember the Ladybird book, Making a Transistor Radio (1972) written by the construction guru, Rev. George Dobbs G3RVJ. (August 19)
34. After September 2019, holders of Foundation and Intermediate Licences will discover that knowledge of topics that were not in their syllabus is expected in the new syllabi. In the August issue Tony Jones G7ETW wrote a primer on the missing topics for those upgrading from Foundation to Intermediate following the new syllabus. (August 19)
35. Hiram Percy Maxim was the first president of the ARRL. Born September 2nd 1869, he was celebrated from August 31st to September 8th 2019. His callsign W1AW was used to mark the 150th anniversary of his birth. It is the callsign of the ARRL station in Connecticut. (Sept 19)
36. Strictly speaking, doublets should be fed with twin feeder into a balanced ATU. With no coax or balun the losses are minimised. Many amateurs will have used a G5RV antenna with a measured length of ribbon and coax feed through a balun. (Sept 19)
37. The first TV broadcast was in 1936 by the BBC. After cessation of hostilities it resumed in 1946 for London only. (Sept 19)
38. Market Reef became a separate DXCC entity in 1969, 50 years ago. To celebrate there was a series of mini-dxpeditions during July and August. Callsigns ranged from OJ0A to OJ0O. (Sept 19)
39. In 1899, over 1000 radio messages by Marconi giving commentary on America Cup races were relayed to a syndicate of New York newspapers. Sent from motor yacht Ponce. This first in up-to-the minute news was a sensation! And thus, radio arrived in the USA. (Sept 19)
40. The Telegraph Museum is situated in Porthcurno, Cornwall. It is at the site of the erstwhile Cable & Wireless training base before it moved to Coventry in 1993. (Sept 19)
41. The Pi team had indicated that there would not be a new model before 2020. So, it was a great surprise that the Pi-4B appeared mid-2019 with a processor running at 1.5GHz! (Sept 19)
42. The Radio Communications Foundation awards scholarships and sponsor projects and clubs that encourage more youngsters into amateur radio, and careers in radio and electronic engineering. (Sept 19)
43. Doc W6GRL and Don W6AM were best known for their rhombic antenna farms. The 'Saga of the Rhombic Antenna & its Heroes' is featured in the January 2019 issue. (Jan 19)
44. The Apollo11 landing module landed on the Moon July 20th 1969 at 2017GMT. And the mission craft arrived back on Earth on July 24th 1969 at 2017GMT. (Oct 19)
45. The oscilloscope came of age in the 1930s. This was in parallel with early development of television. (Oct 19)
46. Firstly, do not respond to the abuser. It gives them what they want, and you are rewarding bad behaviour. Secondly, licensed amateur radio operators are only licensed to talk to other licensees. (Oct 19)
47. The first organised event aimed at amateurs exchanging contacts with as many countries as possible in a limited time was the ARRL International Relay Party. This ran yearly from 1928 to 1935. In 1936, under new rules, it morphed into the ARRL International DX Contest. (Oct 19)
48. This described several US telegraph operators who could only read the Morse with the help of a tin lid place on the sounder. It amplified the sound. This was seen as not being up to the standard of those who could do so without any aids. (Oct 19)
49. WWV's 100th Anniversary fell on October 1st 2019. It transmits on 2.5, 5, 10, 15 and 25MHz continuously 24/7. However, the regular time signal did not start until 1945. Its sister station in Hawaii is WWVH duplicates 24/7 on an avoiding schedule. (Oct 19)
50. Subscribers can advertise free in the Bargain Basement column, every month.

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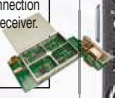

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A Simple PIC Programmer

John Dunton G1RXC
john@john-dunton.co.uk

John Dunton G1RXC follows up his previous piece (Practical Way, August 2019) by describing a homebrew PIC programmer.

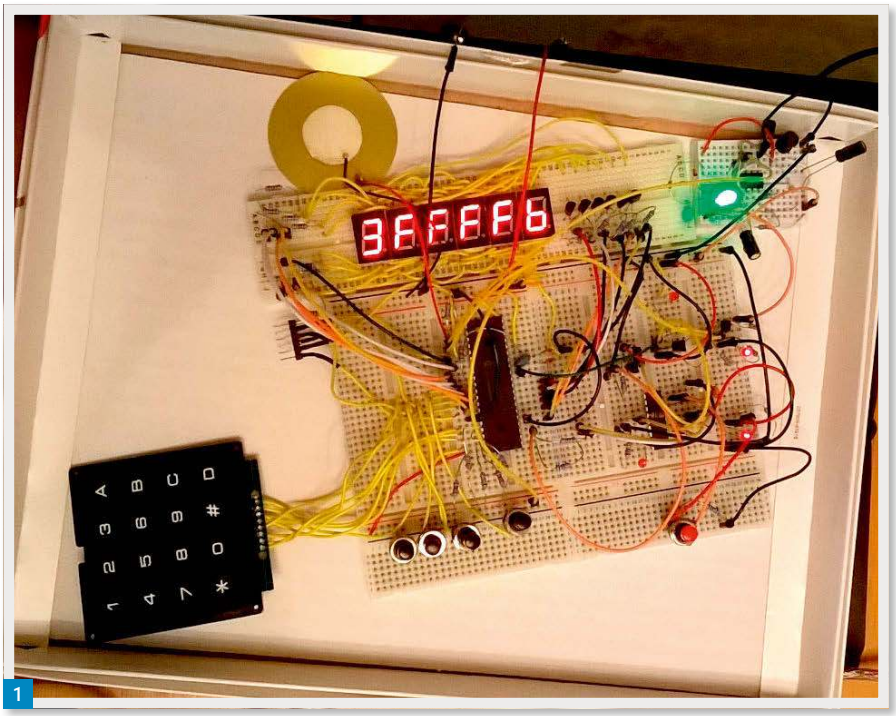


Fig. 1: The author's prototype. Fig. 2: The programmer built onto a PCB.

Unfortunately programming microcontrollers usually requires a PC with some sort of programmer attached. It seemed to me that there should be a simple PIC programming solution much like the development boards for microprocessors that were common in the 1970/80s, one with just a HEX Keypad and a row of seven segment displays. If you only need to program a few tens of words, then doing it by hand is no hardship.

For example, **Table 1** is a short program, that emulates the 74LS47 type 7 segment driver, as hex code. Program memory is 12bits, 3 hex characters wide.

The key aim was to produce something low cost, no more expensive than the USB connected programmers available but not requiring a PC or any complex software. Also, because the program would be entered by hand, there is no need to support every single part, particularly the very large memory parts now available. So, after reading lots of datasheets I settled on the Microchip Baseline 8-bit PICs, that is 10F, some of the 12F and some of the 16F family.

These parts are Flash based, no UV erasing required, are programmed over a serial interface and can be programmed in-circuit, which is great advantage for manufacturers and also for testing/debugging.

One of the interesting features of flash memory as implemented in the PIC family of processors is that in its erased state it is all '1's and programming sets it to '0'. It cannot be programmed back to a '1' without an erase operation, and this has to be a bulk erase of the whole memory. This is similar to EEPROM/UVEPROM from older families of parts. PIC heritage goes back to the mid-1970s when General Instruments introduced the PIC1650 series of peripheral interface controllers and hence the instruction set has been designed to take account of the memory characteristics. The no operation instruction, which as the name suggests does nothing, is encoded as 0x000, which means it can be used to overwrite an instruction to remove it without having to do a bulk erase. The erased state of memory as previously mentioned is all '1's, i.e. 0xFFF. The instruction this corresponds to is exclusive or working register with literal 0xFF. The xor function, used once on the working register inverts its bits, while used twice restores them. Thus, a pair of un-programmed memory locations have no effect of the logic of a program, and this means that places can be left in the code to add jumps (goto/call instructions) to modify the code rather than needing to do a bulk erase. Interestingly the xor function is the basis of many cryptography machines since two sequential xors of the plain text with the key restore the plain text.

Prototype

The prototype, **Fig. 1**, took shape over a few weeks on solderless breadboard, no smd components!

I decided that it should be possible to program the controller with the programmer so that it can be used, in theory at least, to replicate itself, although it would be a bit tedious to enter 1738 instructions by hand! So, I chose the PIC16F59, big brother of the 16F54. This 40-pin part has sufficient i/o pins to drive the display and all functions. It is a very simple part, which does not have interrupts or any complex peripherals.

Power Requirements

The circuit, shown in four modules, **Figs. 4a** through **4d**, requires a 5V supply and the PIC needs a programming voltage of typically between 12.5 and 13.5V. The current drawn from the high voltage source is typically <500µA. To avoid the need for two supplies the high voltage is generated locally. You could use a dedicated switch-mode PSU chip for this but since the current draw is so low I opted for a fixed on-time boost circuit based on a 555 timer (U2). This is capable of generating about 2mA up to 24V-ish depending on the power supply, inductor series resistance and FET RDSon. The output voltage is limited by a couple of 5.1V zeners in series with a green LED, which serves also as an HV-on indicator. Green LED forward drop is around 2.2V, hence V_{out} around 12.8V. With adequate filtering I have used this circuit as a varactor bias supply in the past up to 33V-ish.

Data Entry

The programmer has a hexadecimal keypad for data entry and four function buttons: CONNECT, INCREMENT, PROGRAM, ADDRESS/RUN. The CONNECT button also allows selection of bulk erase and processor type, by entering a number before pressing it.

The process of programming is to connect the target circuit to the programming connector (SK2) and turn on the power. Press CONNECT and the display will show the address of the configuration word of the processor and its current value. This word controls features that include the internal watchdog timer and the clock mode. The configuration word can only be programmed immediately after connecting, that is before any other memory locations are viewed. To program a location you enter the value, three hex digits, and press PROGRAM.

The INCREMENT and ADDRESS functions allow stepping through memory or jumping directly to a location. INCREMENT moves on to the next location and reports its current contents. Entering an address with the keypad and pressing ADDRESS will go to that address.

Once a program has been entered, the CONNECT button is pressed again to disconnect the target. The target is held in reset until the ADDRESS/RUN button is pressed.

At power-up the display will show 54 as below, indicating that the board is set up for the PIC16F54. This is the default mode. To change mode, enter the code for the processor chosen and press connect. The mode remains until changes are made or the programmer is powered down.

Processors supported are:

054 : 16F54, 12F508, 10F202, 10F206, 10F222, Config 3FF Reset 1FF

005 : 16F505, 12F509, 16F527, Config 7FF, Reset 3FF

057 : 16F57, 16F59, Config FFF, Reset 7FF

000 : 10F200, 10F220, Config 1FF, Reset 0FF

Config is the address of the configuration word, reset is the location of the reset vector, which on baseline parts is the top of program memory.

Power for the programmer can be from a 5V supply or three reasonably new 1.5V Alkaline cells. It draws around 70mA. I have used a 'signalex rechargeable power pack', £1 from Poundland, which gives around 12 hours service.

Preparing the program for the target, assuming the avoidance of a PC, is relatively straightforward. This article is not about writing programs for PICs but programming code into a PIC. The requirement is to convert the assembly language program into numerical op-codes that can be programmed with the programmer. The baseline PIC parts use a 12-bit wide program memory and an 8-bit wide data path. PICs are Harvard architecture processors, which means they have separate program and data paths. There are 33 instructions, covering control, logical operations, literal and bitwise operations, see Table 2.

I find that the easiest way is to write the program down leaving space to the left to add addresses and op-codes, allowing comments to be on the far right. Write labels alone on the line preceding the code.

Programming in assembly language can be addictive. It shares some characteristics of Sudoku but in my view at least is far more interesting!

The programmer can be built on Veroboard because all the parts are pin through-hole types. The usual precautions of keeping wiring a short as possible applies and mounting decoupling capacitors as close as possible to the pins they decouple.

I have designed a PCB for the programmer, **Fig. 2**, which makes assembly much simpler.

Connecting Up

Connect power via SK1 (on the PCB this is a USB B connector), the power supply can be any 5V USB source that can supply 100mA. USB chargers, USB battery packs, or three reasonably new 1.5V alkaline cells so long as the voltage is between 4.5V and 5.5V. Note the programmer board takes between 40mA and 70mA leaving at least 30mA for the target. Be careful of loads that are driven by the target PIC pins such as LEDs.

Connect the target to SK2 with a short cable, ideally less than 6in.

The basic PIC16F54 tutorial circuit is shown in **Fig. 3**. This can be built on Veroboard, solderless breadboard or whatever you prefer.

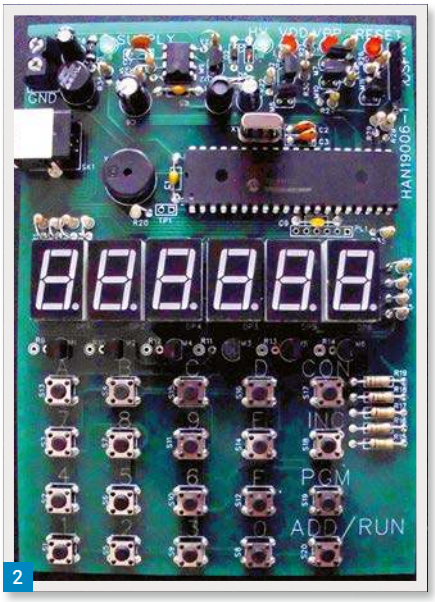
Turn On

At power-up the display will show 54 as below, indicating that the board is set up for the PIC16F54. This is the default mode.

000.054

With a target connected, pressing the [CON]nect button, will result in the display showing:

3FF.FFF



2

```
000     0065    CLRF PORTA
001     0066    CLRF PORTB
002     0C00    MOVLW 0x00 ;make PORTB
                outputs to drive LED
003     0006    TRIS PORTB
004     0CFF    MOVLW 0xFF ;make PORTA
                inputs
005     0005    TRIS PORTA

loop
006     0205    MOVFW PORTA ;read PORTA
007     0E0F    ANDLW 0x0F ;mask off high
                bits (unimplemented read as
                0 but on other parts may be 1)
008     090B    CALL display_table ;get
                segment data
009     0026    MOVWF PORTB ;set segment
                drives
00A     0A06    GOTO loop ; repeat forever!

display_table
00B     0100    ADDWF PCL,f     ;bits 7 - 0,
                                segments E D
                                C DP B A F G
00C     0877    RETLW 0x77      ;0
00D     0814    RETLW 0x14      ;1
00E     08B3    RETLW 0xB3      ;2
00F     08B6    RETLW 0xB6      ;3
010     08D4    RETLW 0xD4      ;4
011     08E6    RETLW 0xE6      ;5
012     08E7    RETLW 0xE7      ;6
013     0834    RETLW 0x34      ;7
014     08F7    RETLW 0xF7      ;8
015     08F4    RETLW 0xF4      ;9
016     08F5    RETLW 0xF5      ;A
017     08C7    RETLW 0xC7      ;b
018     0863    RETLW 0x63      ;C
019     0897    RETLW 0x97      ;d
01A     08E3    RETLW 0xE3      ;E
01B     08E1    RETLW 0xE1      ;F
```

Table 1: Example program

assuming an un-programmed chip is connected and the wiring is correct. If the display shows:

000.000

then there is probably a connection problem, in which case one of the following

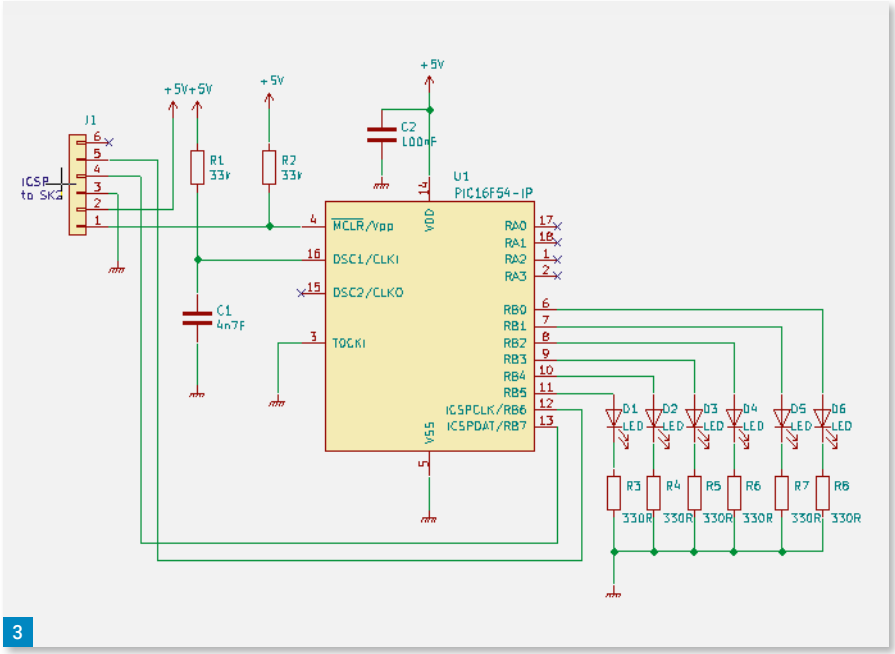


Fig. 3: PIC16F54 tutorial circuit.

conditions is likely:

- No device connected
- Device not being powered
- MCLR not connected/HV fault
- ICSPCLK/ICSPDAT swapped or not connected.

If the green HV led is brightly lit, then the HV supply is healthy. If the green HV LED is dim or off, there is either a short to ground on the MCLR pin, it is connected to the wrong pin or there is a fault with the HV supply. To check the HV supply remove the target and if the green LED remains off/dim the supply is faulty. This is very unlikely, however.

If all was well and the display did show 3FF.FFF, press B on the keypad. The display will change to 3FF.FFB. Now press [PGM] to write the data to memory. The RST LED may flash and the display should continue displaying 3FF.FFB. Press dis[CON]nect, and the display will show 000.054. Now press [CON]nect again and the display should show 3FF.FFB. This indicates that the device configuration word is now programmed. Code Protect and Watchdog disables and oscillator set for RC mode.

Press [INC]rement and the display will change to 000.FFF. This is the first address in program memory, which as it has not been programmed is set to FFF (the instruction XORLW 0xFF more on this later). The left-hand three digits display the address, the right-hand three display the contents of the location.

Now enter the following short program. For each instruction enter the three-digit instruction, press [PGM], check that the display still shows what you entered and then press [INC]rement to go to the next address.

```
000.040 clrw
001.005 tris 0x05   ;set PORT A Tristate Register
002.006 tris 0x06   ;set PORT B Tristate Register
003.CFF movlw 0xFF  ;
004.026 movwf 0x06  ;set PORT B bits
```

Once you have entered this short program, press dis[CON]nect. The display will show 000.054. Now press [ADD/RUN]. The green HV LED should go out, the power LED should be lit and the RST LED off. You should see that the LEDs attached to PORT B of the target come on.

Press [ADD/RUN] again to stop the program.

Press [CON]nect to connect the programmer and [INC]rement until you get to address 004. Now enter the following:

000 and press PGM
press INC
2A6 and press PGM.

(005.2A6 incf 0x06,f; increment instruction in memory location 5)

Dis[CON]ect and [RUN] the program. This time you should see the LEDs following a binary count. This is because

Control Operations are encoded as a 4-bit op-code followed by 8-bit literal value, except GOTO, which has a 9-bit value.

Clear Watchdog timer	CLRWDT	004
Set Option Register	OPTION	002
Enter Seep Mode	SLEEP	003
Set Data Direction for PORT	TRIS PORT	00[PORT]
No Operation	NOP	000
CALL Subroutine	CALL nn	9[nn] where nn is an 8 bit address
Jump to location	GOTO nnn	A[nn] or B[nn] depending on high bit of address

Literal Operations

AND Literal with Working	ANDLW	E[nn]
OR Literal with Working	IORLW	D[nn]
Move Literal to Working	MOVLW	C[nn]
Return with Literal in Working	RETLW	8[nn]
Exclusive OR Literal with Working	XORLW	F[nn]

Logical Operations

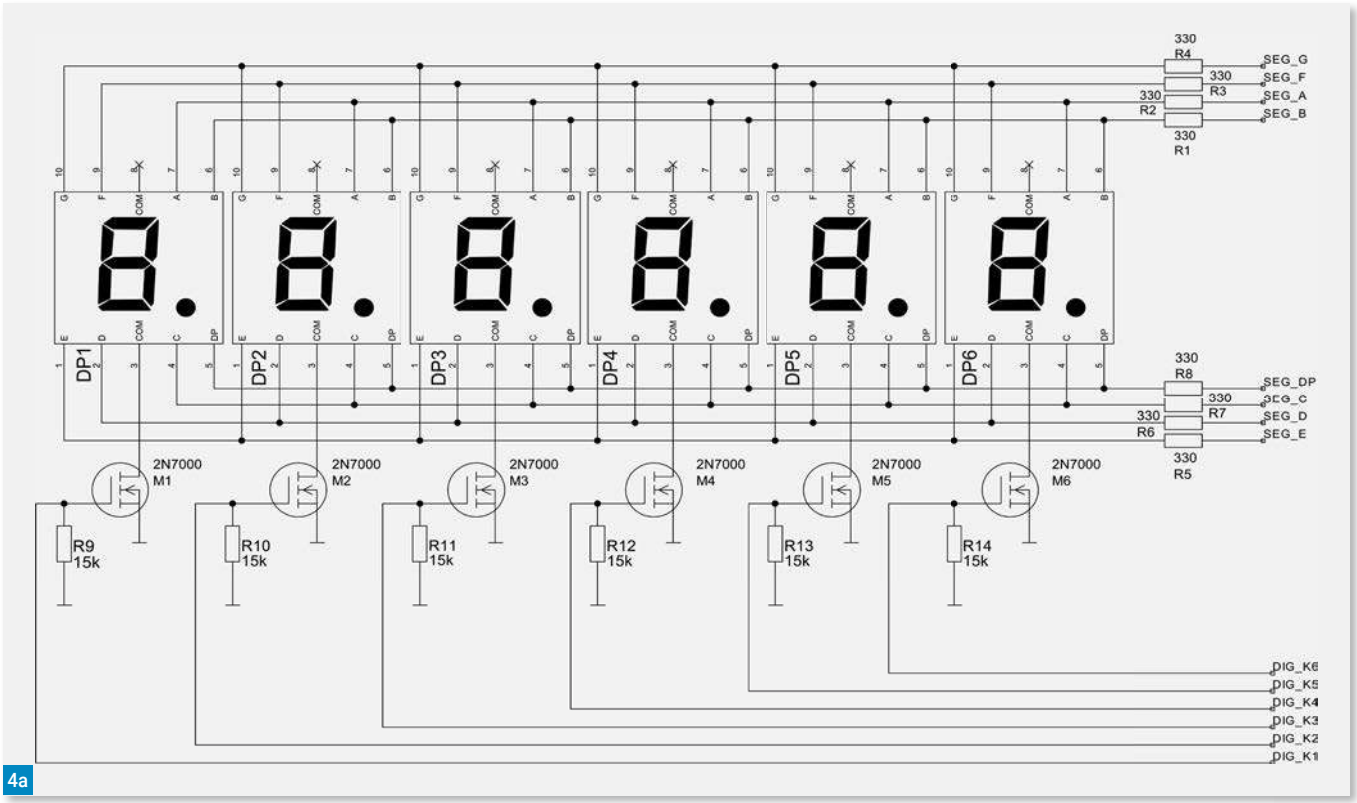
Add Working to File	ADDWF file, destination	1C0 + file (+ 20)*
AND Working with File	ANDWF file,destination	140 + file (+20)
Clear File	CLRF file	060 + file
Clear Working Register	CLRW	040
Compliment File	COMF file,destination	240 + file (+20)
Decrement File	DECF file,destination	0C0 +file (+20)
Decrement File Skip Zero	DECFZ file,destination	2C0 +file (+20)
Increment File	INCF file,destination	280 +file (+20)
Increment File Skip Zero	INCFSZ file,destination	3C0 +file (+20)
OR Working with File	IORWF file,destination	100 +file (+20)
Move Working to File	MOVWF file	020 +file
Move File	MOVF file,destination	200 +file (+20)
Rotate File Left through Carry	RLF file,destination	340 +file (+20)
Rotate File Right through Carry	RRF file,destination	300 +file (+20)
Subtract Working from File	SUBWF file,destination	080 +file (+20)
Swap high and low nybbles of File	SWAPF file,destination	380 +file (+20)
Exclusive Or Working with File	XORWF file,destination	180 +file (+20)

*Note if result stored in file add 0x20 to op-code.

Bit Operations

Clear Bit in File	BCF file,bit	400 +file +bit*0x20
Set Bit in File	BSF file,bit	500 +file +bit*0x20
Test for Bit set in File	BTFSS file,bit	700 +file +bit*0x20
Test for Bit clear in File	BTFSC file,bit	600 +file +bit*0x20

PIC Op Code Reference Table 2:



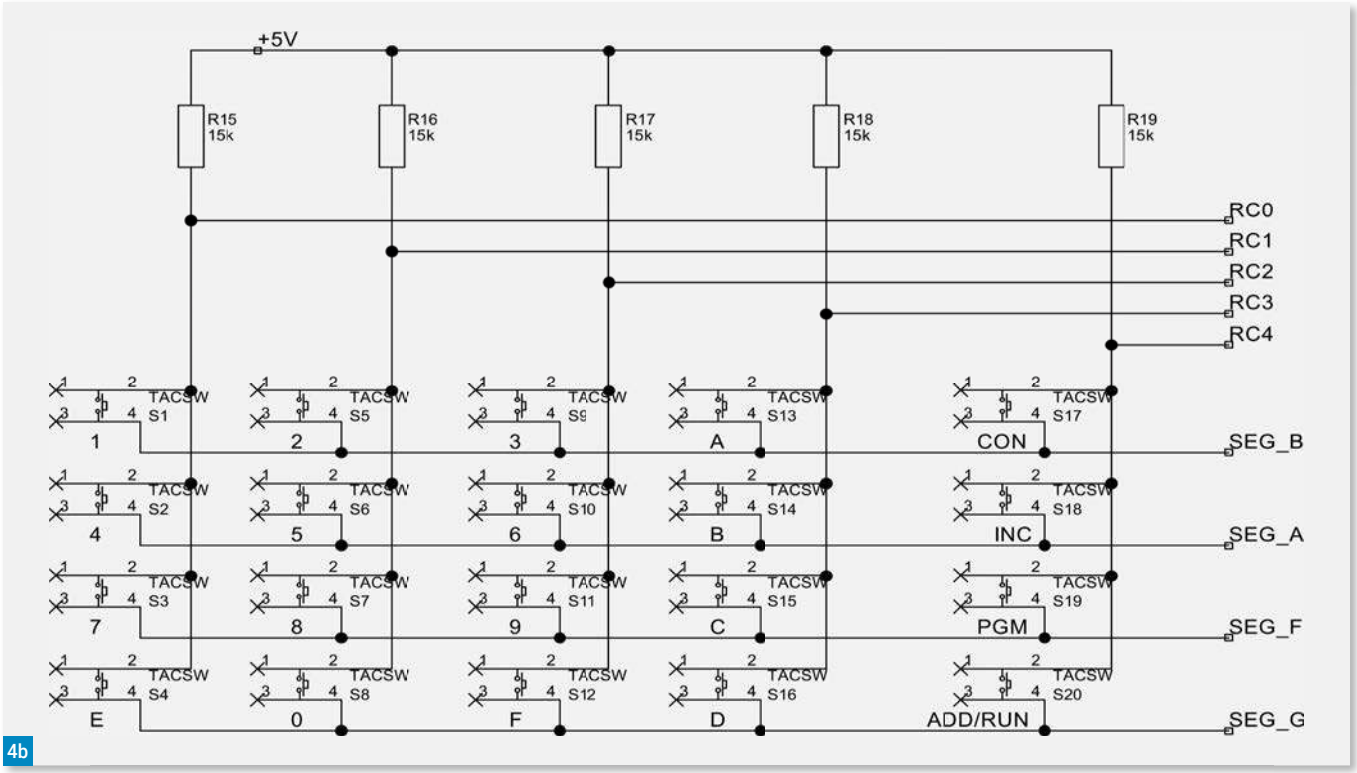
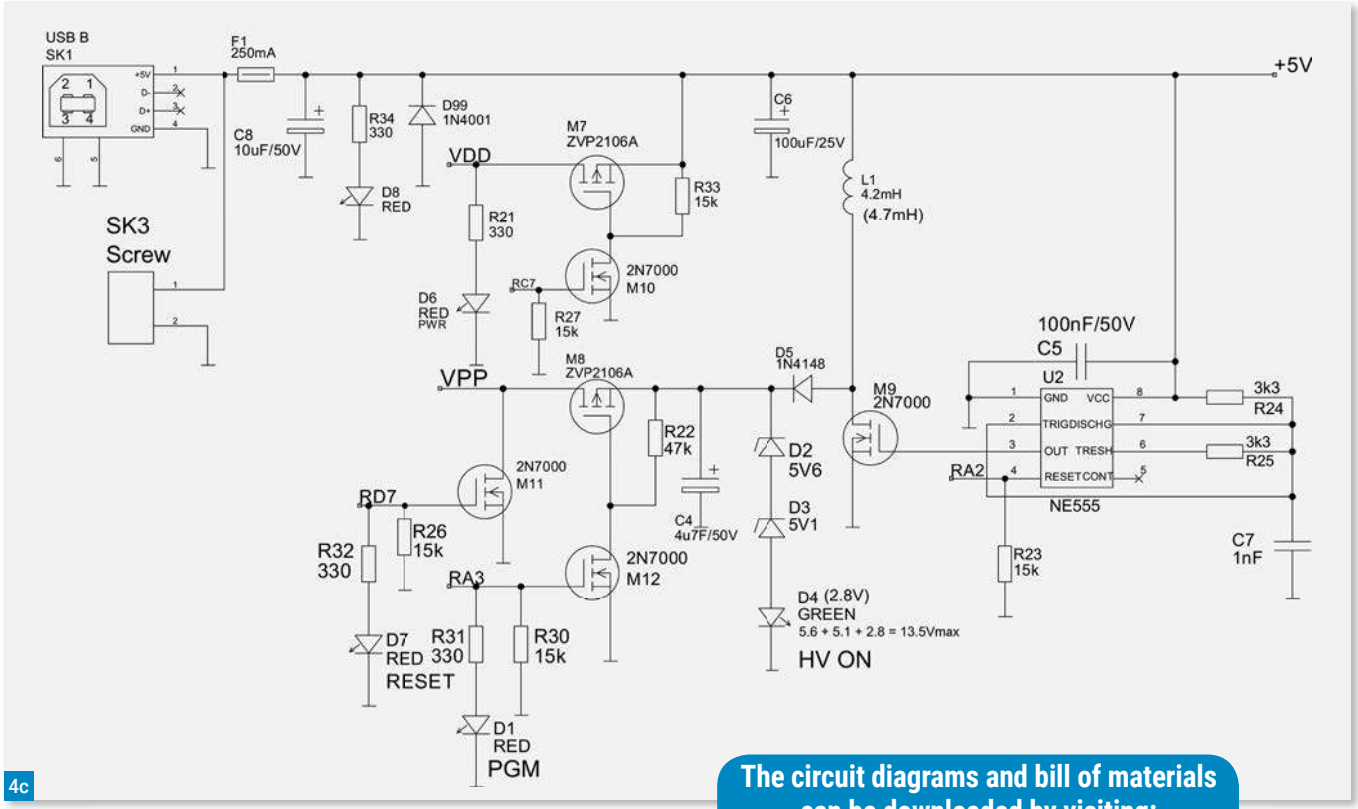


Fig. 4a: Display circuitry. Fig. 4b: Keypad circuitry.

the program is running to the top of memory, executing all the XORLW 0xFF instructions and looping round to the beginning of the program. The time between LED changes is effectively 512 instruction cycles, because there are 512 memory location for the program counter to cycle through before it repeats.

Having got this far it is time to write your own programs.

I am happy to supply a programmed 16F59 for the cost of the part and postage to anyone who wants to build the programmer. I have also designed an improved PCB, available for £15 plus p&p. If there is sufficient interest, I will make a kit with the PCB and parts available. E-mail me if interested.



The circuit diagrams and bill of materials can be downloaded by visiting: http://bit.ly/copwjan20

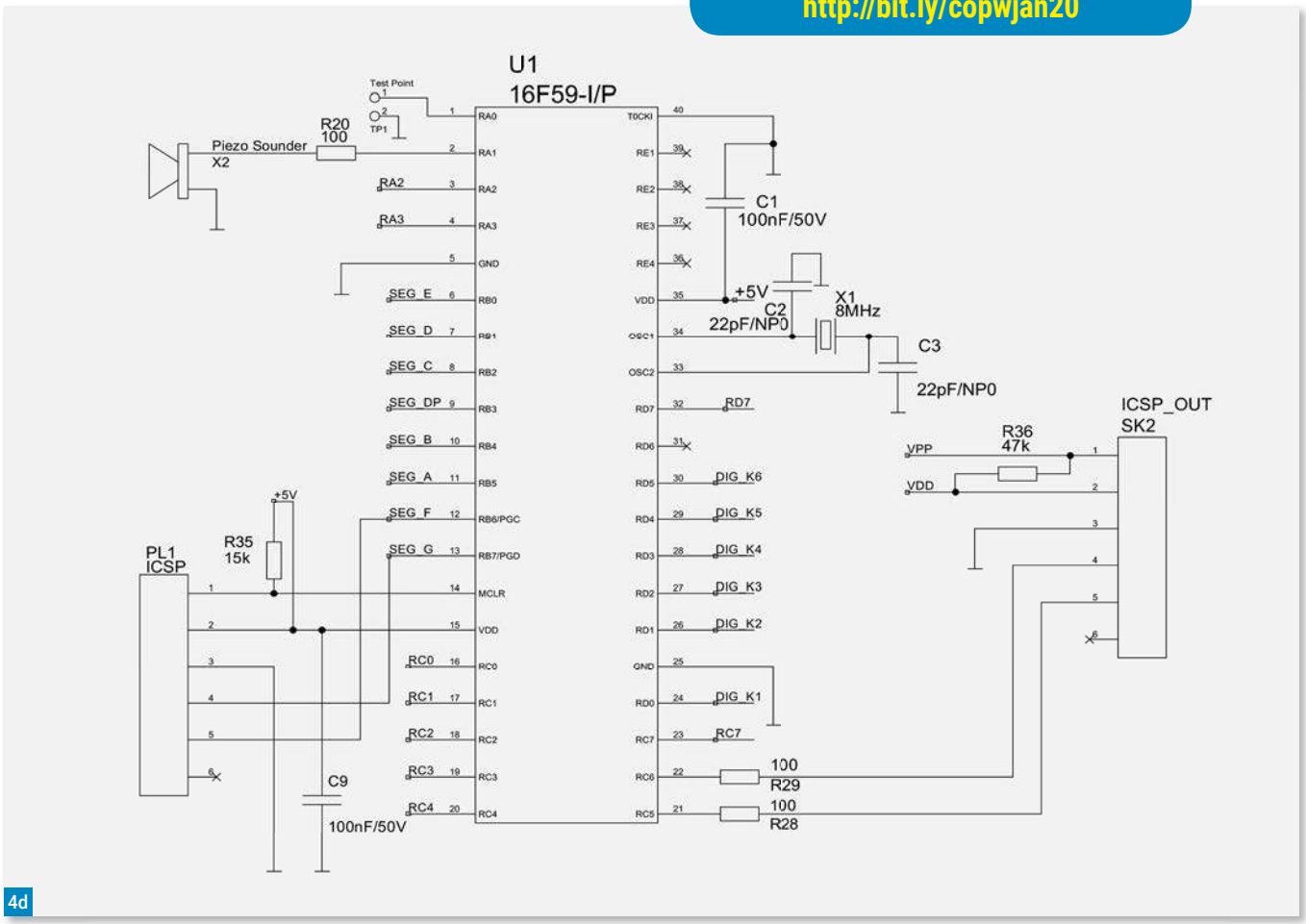


Fig. 4c: High voltage circuitry. Fig. 4d: Main processor circuit.

A Calibrated LF to HF Noise Source

Gwyn Griffiths G3ZIL
gxgriffiths@virginmedia.com

Gwyn Griffiths G3ZIL offers a design for a calibrated noise source that you can build.

It's the word 'calibrated' that distinguishes this simple construction project from the type of noise generator reviewed by **Geoff Theasby G8BMI** in April 2019's *Kits & Modules* article. This design aims to have a stable output, known to within 1dB between 100kHz and 50MHz, throughout the useful life of the battery. As a calibrated noise source it can be used to measure the noise factor (NF) of LF to HF receivers; there are no claims to be suitable at VHF. Of course, it can also be used in applications such as filter response checking described in Geoff's article.

Zener Noise Source Limitations

Zener diodes have several limitations as noise sources. Three of these are shown in the noise spectra in a 10kHz bandwidth from 0.1 to 60MHz for two example BZX55C15 diodes, **Fig. 1**. First, the noise is not white, every spectrum slopes down from low to high frequency. Second, the noise level is dependent on the current through the diode, with lower current - a higher series resistor - producing a higher noise level but with a greater spectral slope. Third, while the general trends are the same, individual diodes produce different slopes and levels. Of these eight combinations D1 with a 4.1kΩ resistor provides the least-sloping spectrum.

Despite these limitations, when used with a stable constant current source rather than a simple resistor, the zener noise spectrum shape is stable. Furthermore, its amplitude is also stable with temperature, reducing by only about 0.6dB between 23˚C and 48˚C. Because each diode is different the author can supply a selected 15V zener diode, its individual calibration graph, and a resistor or two to set the optimum current value for as flat a spectrum as possible. A decent quality PCB is also available. The calibration will have been derived using a Rigol DSA815 spectrum analyser.

Circuit Description

The straightforward circuit is shown in **Fig. 2**. A selected BZX55C15 zener diode, operating in avalanche mode, is fed from a constant current source via the PNP transistor Tr2. The current is set by the precision voltage source ZD1 and the zener-specific series resistors R12 and R7. Two resistors are used to set the current for the least-sloping noise spectrum together with an output level in the region of −111 to −114dBm in 10kHz. R5 provides bias for Tr2; C1 and C4 are decoupling capacitors.

R13 and R11 in parallel provide a 50Ω load for the zener diode and after coupling capacitors C2 and C3 in parallel, there is a 3dB Tee attenuator to improve the match to a 50Ω external load.

Tr1 is a P-channel MOSFET arranged as a power supply switch, whose gate is biased by R3 and R2. With the bottom end of R2 floating Tr1 is off; grounding the bottom of R2 turns it on. Four methods are provided to do this: a manual switch, S1; a 3-5V logic level via R1 to the 4N35 opto-coupler U1; a direct connection from the secondary of an external opto-coupler, and the switch S1 can be left on and the source activated by simply applying power. Each of these methods of turning the source on have their different uses as shown later.

D1 is for reverse polarity protection and R4 provides current to the indicator LED when the source is turned on. The power supply is formed of three PP3 batteries in series. The current consumption when on is dominated by the LED and is less than 2mA. Using a battery helps reduce extraneous noise being coupled to the output.

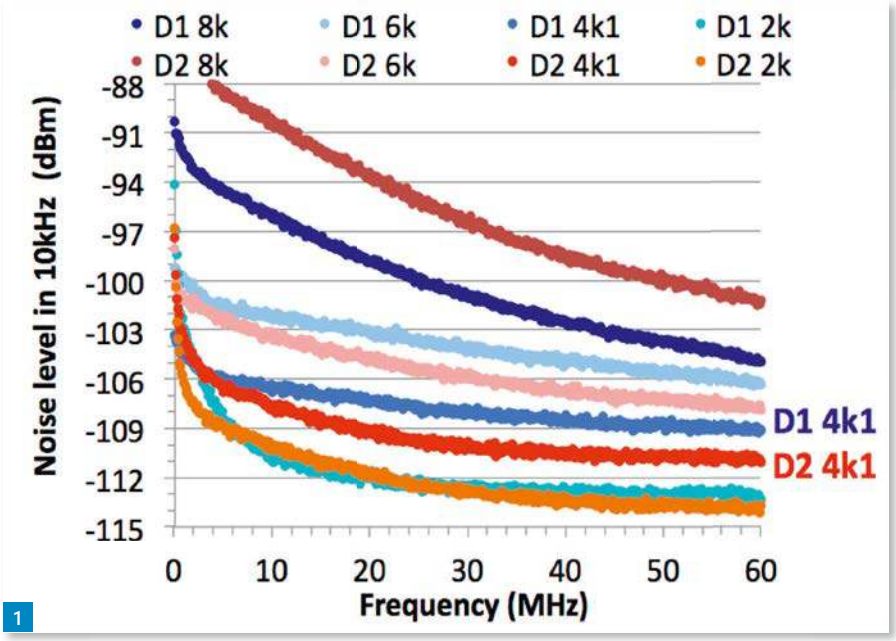
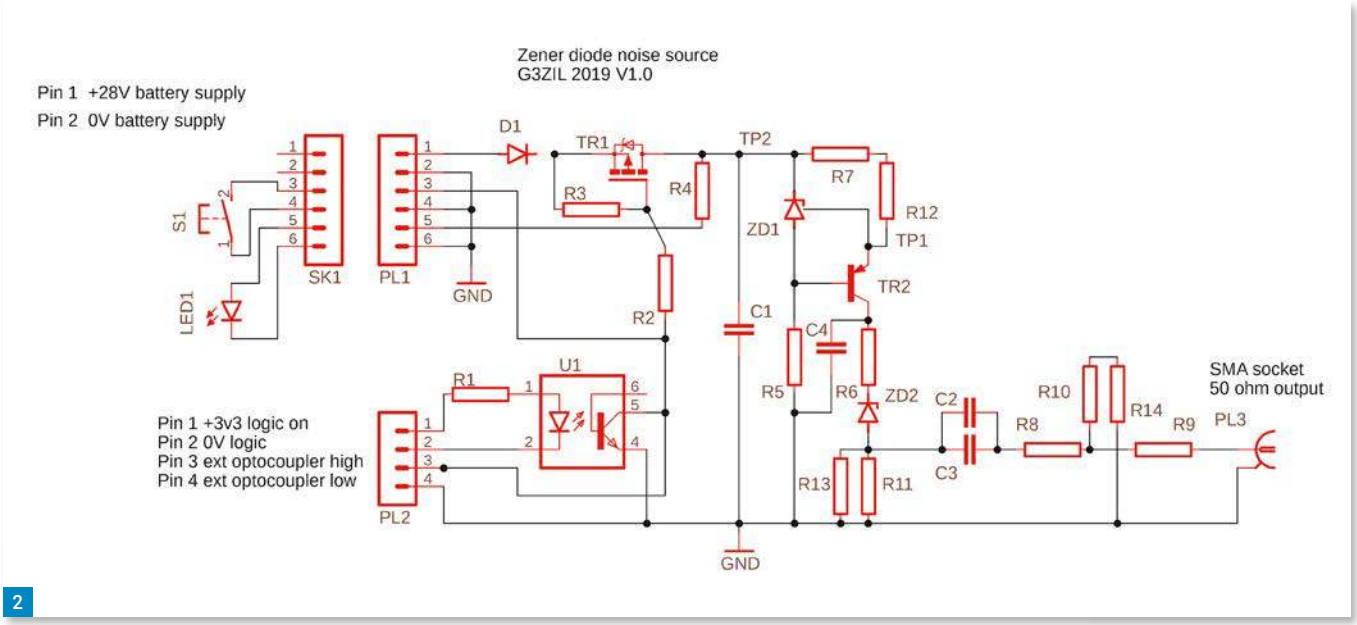


Fig. 1. Spectra for two BZX55C15 zener diodes with four values of current setting resistor, showing device-to-device variability and the shape and level varying with current. Fig. 2. Circuit diagram of the calibrated noise source. Fig. 3. First version of the PCB, Serial Number 2, with the calibration shown in Fig. 5. Fig. 4. PCB with three 9V batteries in series, switch and Mini-DIN interface connector together with the calibration graph on the lid.

Construction

After encouraging results from a matrix board prototype a small PCB was designed, the first version is shown in **Fig. 3**. The Gerber layout files were emailed to the Chinese PCB aggregator AllPCB and within seven days a batch of ten were received at a unit cost of about £2. For consistent and accurate measurements, the noise source should be in a metal box. It is just possible, **Fig. 4**, to fit the PCB, the three 9V batteries wired in series and taped together, a small toggle switch and a mini-DIN socket in a 112 x 60 x3 1mm diecast aluminium box type 1590B (often called a Stomp Box on the usual websites).

To avoid searching for the calibration information, I've glued a plastic pocket to the lid and inserted a copy of the calibration graph



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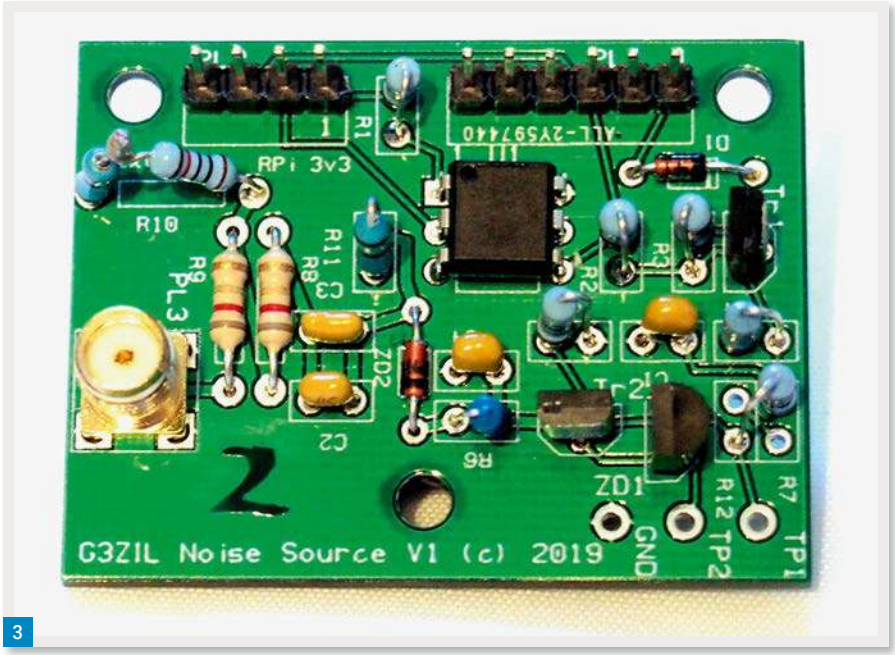

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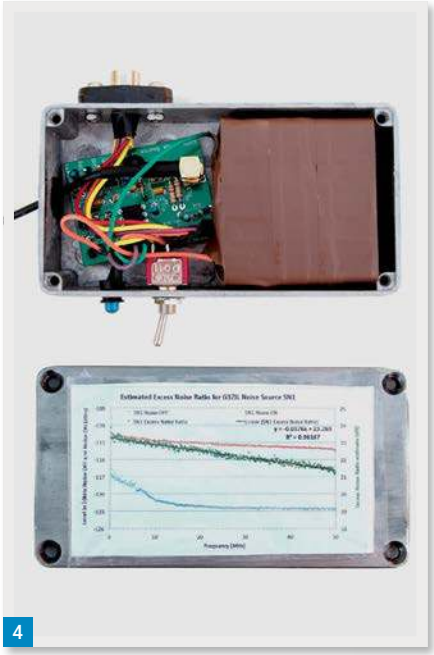


4

and best-fit polynomial equation for the variation with frequency.

A parts list appears in the sidebar, along with details of what I am able to offer by way of a short kit.

Calibrating the Noise Source

To measure a noise factor we require the Excess Noise Ratio (ENR) of the source to be known. ENR is the ratio of the total noise from the source minus the thermal noise to the thermal noise alone. As we've seen, it will vary with frequency for a simple zener, and will be specific to an individual zener and current, hence the offer to supply a calibrated zener with the PCB. An example set of calibration graphs and a best-fit ENR equation is shown in **Fig. 5**. I've measured the spectrum with the noise source on (red) and off (blue) and then subtracted the DSA815 noise power at each frequency from that of the noise source. Note that these calculations are done with power, that is as 10^(Level in dB/10) not as decibels directly. The DSA815 noise power will include the thermal noise power (which in this 10kHz bandwidth is −134dBm). The result is the estimated ENR (green) through which, in this case, a quadratic best fit with frequency has been calculated.

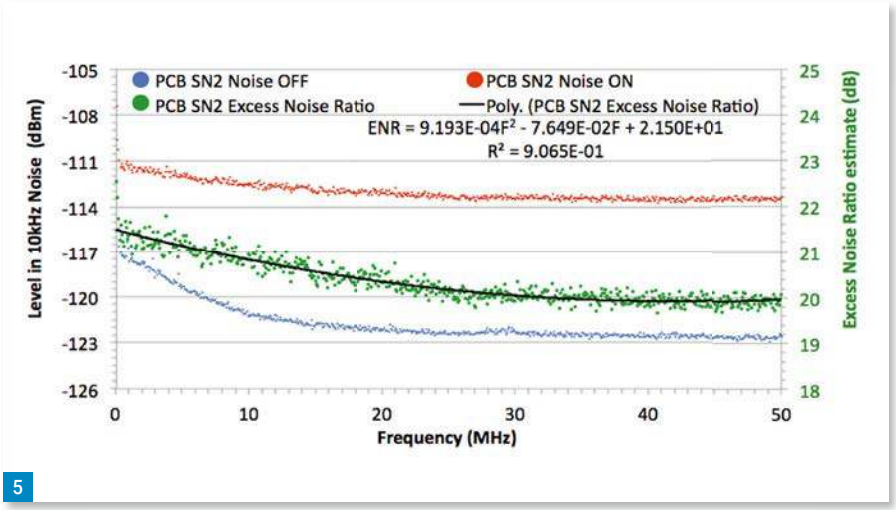
Y Factor Method for Measuring Noise Factor

The Y factor is simply the difference in dB from the output of the device under test with the noise source on to that with the source off, given that the input source impedance, gain and bandwidth are the same for the two measurements. How you obtain the output will differ among devices, as in the detailed examples below, but to illustrate the calculation, take the example of a vintage KW77 receiver at 28.2MHz where the Y factor was 9dB for a noise source with an ENR of 22.2dB at that frequency. The noise factor is:

$NF = 10 \times \log_{10}((10^{(ENR/10)})/((10^{(Y/10)}) - 1))$

$NF = 10 \times \log_{10}((10^{(2.22)})/((10^{(0.9)}) - 1)) = 13.8dB$

How does this compare with modern receivers? It is more common to see Minimum Discernible Signal (MDS) specifications at



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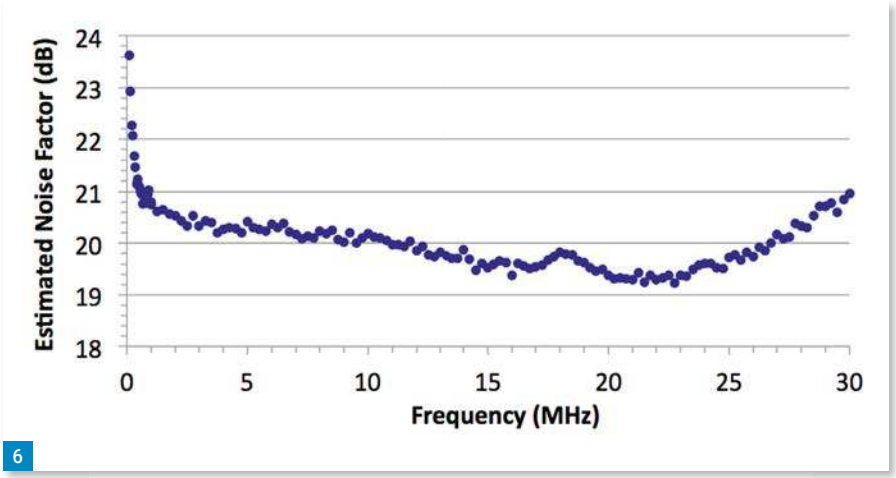


6

Fig. 5. Calibration graphs for noise source Serial No. 2 in a 10kHz bandwidth: noise from the Rigol DSA815 (blue), noise source (red) and the computed ENR (green) on the right-hand scale. The black line shows the best-fit quadratic polynomial for ENR.

Fig. 6. Variation with frequency of the noise factor of a KiwiSDR via automatic measurements.

HF rather than NF, and the MDS measurement bandwidth should be stated. In the well-known Sherwood Engineering tables the default bandwidth is 500Hz; thermal noise of −174dBm in 1Hz bandwidth becomes -174 + $10\times\log_{10}(500)$ = −147dBm in 500Hz. With an MDS of −133dBm with preamp off, the Icom IC-7300 NF is therefore about 14dB, very similar to the KW77 (but the IC−7300 NF is about 6dB with its preamp on).

Obtaining the Y Factor Audio Output

For a receiver with an input impedance in the vicinity of 50Ω the noise source can be connected directly to the antenna socket. When off, the source will look like a 50Ω termination. AGC should be off and RF gain at maximum. If a preamp is present, note whether it is on or off. The task is to measure the audio output with the noise source off and then on. In the past this might have been done using a true RMS voltmeter across the speaker terminals. If you have such a voltmeter, and hum is not heard, calculate $20\times\log_{10}(Vn/Vo)$ where Vn and Vo are the readings with the noise source on and off to determine the Y factor, then use the equation above for the noise factor.

It might be more convenient, though more long-winded, to use a PC audio recording and analysis program such as Audacity. With the audio turned up, and using a microphone in a quiet room, record say five seconds with the noise source off then five seconds on, and repeat. Audacity has an 'Analyze' menu from which you can 'Plot Spectrum' and then 'Export' as a txt file. This file can be read by a spreadsheet program, a suitable band of frequencies selected, e.g. 600-2600Hz to avoid including hum, the individual logarithmic spectral values converted to linear, summed, converted back to a dB value for the off and on cases, and the difference taken as the Y factor.

PARTS LIST

RESISTORS
ALL 1% 0.25W METAL FILM

R1	330Ω
R2, 3	100kΩ
R4	22kΩ
R5	47kΩ
R6	1kΩ
R7, 12	Select on test to set Zener current
R8, 9	8.2Ω
R10	120Ω
R11, 13	100Ω
R14	22Ω

CAPACITORS
ALL CERAMIC 50V 0.1IN PITCH

C1, 2, 4	100nF
C3	1nF

TRANSISTORS AND DIODES

Tr1	ZVP2106A P-channel MOSFET RS 669-7596 (D-G-S)
Tr2	ZTX753 PNP (C-B-E) RS 295-539
D1	1N4148
LED1	any type to hand

ZENER DIODES

ZD1	LM4041-DIZ-ADJ Shunt Reference RS 625-0863
ZD2	BZX55C15

INTEGRATED CIRCUITS

U1	4N35 opto-coupler RS 597-302

MISCELLANEOUS

PL1	6-way 0.1in pin header
PL2	4-way 0.1in pin header
PL3	SMA PCB socket
SK1 and SK2	to match PL1 and PL2
SW1	SPST or SPDT toggle or to suit
Test Pins	3x1mm Vero type if required
PCB	can be supplied by G3ZIL with ZD2 calibration graph and equation

A short kit containing the PCB, ZD2 plus calibration and suitable R7/R12, together with Tr1, Tr2, ZD1 and U1 can be supplied for £7 including P&P.

This was the method I used to measure the 13.8dB noise factor of my vintage KW77 at 28.2MHz. A Drake R4B was somewhat higher at 16.2dB at 28.6MHz.

In the case of a receiver with a low level, transformer isolated audio output the signal can be connected directly to a PC soundcard or USB dongle followed by the same procedure with Audacity or similar to record and then analyse the output. As an example, using this method, a 30m version of the direct conversion WSPR receiver I described in April 2016 *PW*, measuring within a 1350−1650Hz bandwidth, gave a noise factor of 10.8dB.

Obtaining the Y Factor Software Defined Radio

I use Gqrx v2.11.5 software on a Raspberry Pi with my SDRPlay RSP1 and its S-meter makes obtaining the Y factor very simple. At 14.1MHz, with the filter set at 'normal', mode as USB, AGC off, LNA_Atten_step at 0 and IF_Atten_dB at 20, the indicated noise level was −62dB referenced to full scale With the noise source on it was −49dB, making the Y factor 13dB and the NF 10dB. This agrees with the NF given by **Steve Ford WB8IMY** in his February 2017 *QST* review of the RSP1.

Now we get to the actual reason for designing and building this calibrated noise source: to study the noise factor with frequency for the KiwiSDR. One of the features of the KiwiSDR is an application program kiwirecorder.py that lets you set bandwidth, centre frequency and other parameters and either record a wav file or record and average its calibrated S-meter via a remote connection. In my case this is from a Raspberry Pi where, with the noise source connected to the KiwiSDR antenna, a simple bash script:

1. Sets the mode, bandwidth, frequency, and S-meter averaging for kiwirecorder.py.
2. Runs the Python program, stores the result.
3. Sets a Pi GPIO pin connected to the primary of the 4N35 optocoupler in the noise source high, turning it on, reruns kiwirecorder.py and stores the result.
4. Saves the results in a csv file with time stamp, frequency and bandwidth.
5. Loop if need be for a stepped range of frequencies.

The result can be a detailed graph of noise factor with frequency as in **Fig. 6**, stepping every 50kHz from 100kHz to 1MHz and every 250kHz above took about two hours. The general shape is consistent between adjacent frequency settings, within about 0.2dB, and the trend to a higher NF at low and high frequencies is clear.

Why the Interest in this Level of Detail?

In true amateur radio spirit, despite never having met in person, I've been able to contribute to a project started by **Rob Robinett AI6VN**, **Glenn Elmore N6GN** and others to monitor and report LF to HF band noise levels at the same time and on the same frequencies as receiving and decoding WSPR signals. The story of how we do that is available as a presentation to the 2019 ARRL/TAPR Digital Communications Conference and which I have also made available on my website: **https://tinyurl.com/y4dktw3x**

In brief, our software for the KiwiSDR finds gaps in the time and frequency domains where there are no signals, which we take to represent the noise level. Results every two minutes are reported in real time to the web by a number of stations. Through the kind permission of the US Maritime Radio Historical Society there is a bank of KiwiSDRs at Point Reyes, California at the very low noise receiver site of KPH. Our ambition is that this can be a reference site for noise below 30MHz unaffected by the local noise that plagues most of us.

References

Receiver minimum discernible signals:
www.sherweng.com
SDRPlay RSP1 Noise Factor:
https://tinyurl.com/y2xh7xcv
KiwiSDR:
http://kiwisdr.com
LF to HF KiwiSDR noise graphs:
http://wsprdaemon.org
Information on KPH:
www.radiomarine.org/#pab1_1

Exam Practicals

As a follow-on to his various features related to the new examinations syllabus, **Tony Jones G7ETW** turns his attention to the practical exercises.

Tony Jones G7ETW
Charles.jones125@yahoo.co.uk

This article is about the new syllabus Foundation and Intermediate practicals. Ostensibly hardly changed, the 2019 exercises are fundamentally altered. The devil, as ever, is in the detail. Allow me to explain, pointing out the differences and offering some implementation ideas.

Foundation Practicals

Table 1 lists the various practical exercises for the Foundation level. The HF receive exercise is now gone. In this exercise, students were hands-on an HF radio. Without having to transmit they learned about callsigns, operating and bandplans. Valuable as this was, this exercise was extremely time consuming. Turning, then, to the current offerings:

10a1: Morse Code and Digital QSO

The retention of a Morse code 'appreciation' – it is not, and never has been, a test – remains controversial. To some, CW is the Holy Grail, but for others it is just another mode. I would hate to see Morse disappear from the syllabus completely but I was delighted when a digital QSO was introduced as an alternative.

A Foundation course already has two QSOs, and this would add a third. FT8 and other modern modes are unsuitable – it has to a real-time person-to-person mode. Pre-recorded scripts are not allowed so students would have to type everything, including CQ calls. Tutors would need operating skills in the mode chosen. There are also technical issues such as PC-to-radio interfacing difficulties. For these reasons, I expect take-up of this new exercise will be slow.

10a2 and 10a3: FM and SSB QSOs

The QSOs used to be band-specific. Two pairs of complete stations were needed, one for VHF FM and one for HF SSB. QSOs may now be conducted on any band (schedule and bandplan permitting), even the same band. The exercise would need fewer tutors and kit but I have my doubts about this – a VHF FM QSO has a different 'feel' to an HF SSB QSO. On the other hand, following a script and first time on air, I wonder how many students take much away from that.

The tutor supervising the student absolutely has to hold a Full licence.

Students must now log their QSOs.


1

Logging is optional (Ofcom interventions aside) but 'recommended', we teach. This is a useful addition and takes very little time.

A word of advice – keep the power down for these QSOs. If a 'real' station responds to a CQ call, they won't know to wait patiently while the supervising tutor conducts the student through the scripted QSO, and their patience may be sorely tested. It is much better to control both ends of the QSO.

10a4 and 10a5: Antenna Tuning Exercises

'Tune a Dipole' has not changed. Prior to V1.3 the 2019 syllabus specified that a transmitter and VSWR meter must be used but this restriction has been dropped and antenna analysers are acceptable again. See **Fig. 1** for a suitable dipole. Notice the choke balun. To get reliable results, especially with several QSOs taking place metres away, this is essential.

The second antenna exercise introduces students to matching using a manual ATU. The syllabus does not specify band but only on HF is ATU use customary and equipment readily available.

The 'antenna' could be a resistor network but an actual antenna is better for two reasons. Firstly, students discover that as wavelength increases ATU inductance settings increase (when tuning too short an antenna) and, secondly, a resistor network is stone deaf whereas a real antenna, as it gets nearer to be being tuned, brings in signals.

10b1: Station Build

Nowhere else in the syllabus is station build covered. For CB radio operators this is easy stuff but people new to electrical hobbies may have never seen red and black wires before. When a successful student subsequently buys their first equipment, thanks to this they should know how it goes together.

This exercise is not equipment, or band, specific. I have put this exercise on using all sorts of kit. See **Fig. 2**, showing a completed station for a Yaesu 2m mobile radio. It is not necessary to demonstrate a working station but the exercise is more satisfying if that is done.

Planning and Resourcing

The Foundation exercises could be put on with a very lean crew. The QSOs, if both conducted on one band (2m would be my preference) could be done with two tutors using multimode radios such as FT-817s. One tutor, taking a few students round a table, could cover the CW exercise with a single key and oscillator. Station build, using an HF radio, could be combined with the ATU exercise and handled by one

Fig. 1: A dipole suitable for the relevant exercise. Fig. 2: A simple station for the station-build exercise. Fig. 3:PCB for soldering, station build and measurements exercise. Fig. 4: Suitable circuit for transistor gain demonstration.

tutor. Tune a Dipole only needs one tutor as well. It would be hard work, but a team of six tutors (including someone to sort out problems and keep things moving) could do this I think.

Intermediate Practicals

The list of Intermediate-level practicals appears in **Table 2**. The mains plug exercise is now gone. Most tutors, myself included, considered it a waste of time. The only training in plug wiring is now at Foundation level.

10b2, 10b3,10b4 and 10c1: Soldering, circuit build and measurements exercise

10b2, 10b3 and 10c1 can be combined, and for educational and logistical reasons it makes sense to do this. As for the previous syllabus, I have designed a PCB for this. See **Fig. 3**.

With ten pins and five components to solder, 10b2 is more than achieved in a productive, satisfying way. Connecting some jumpers from X4 and X9 to various combinations of X5 to X8, the series and parallel configurations of 10b3 are possible, facilitating 10c1's required measurements.

The book shows this being done with drawing pins. What can I say? Five years ago, when I made my first board for the Intermediate course, I wanted a student's first circuit building experience to feel (fairly) modern, and many tutors I know agree.

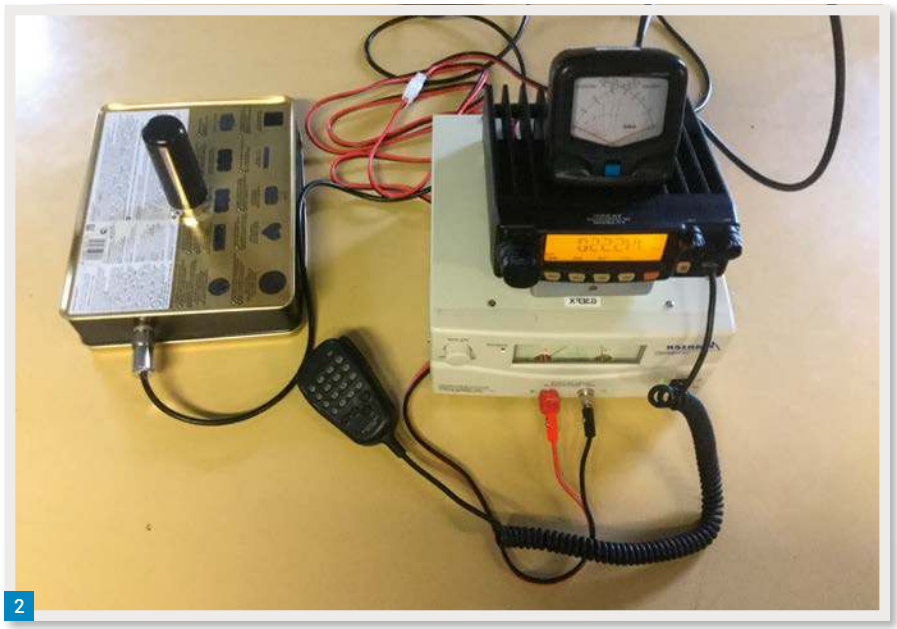
10b4: Transistor gain demonstration

The transistor switch is not part of 10b3. Tutors will need a demonstration circuit (something like **Fig. 4**), on which students can touch two contacts, read off the currents (simultaneously, ideally) and calculate the gain.

The triangle of unconnected pins X4, X5 and X6 suggests a modification to accommodate a transistor but this wasn't planned. When I go to a Mk2, I will address this omission.

10b5: Construction Home-project

The Construction home-project is not changed at all; students must build a simple 'radio project'. My club uses a MW radio kit from Rapid Electronics, **Fig. 5**. Another suitable kit – suitable as in



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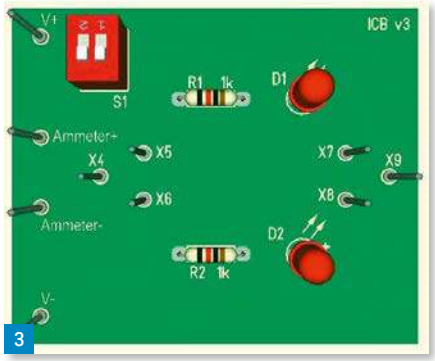

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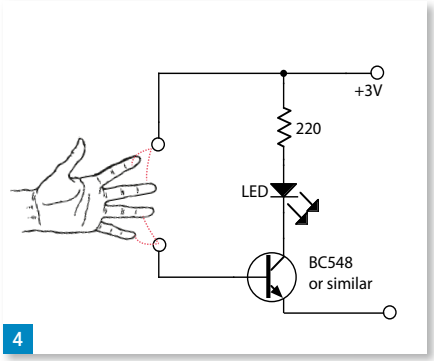

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Syllabus V1.3 ref	Syllabus V1.3 detail
10a1	Morse Code appreciation OR Digital keyboard QSO
10a2	SSB QSO (must be logged)
10a3	FM QSO (must be logged)
10a4	Tune a dipole by changing antenna dimensions
10a5	Match an antenna system for two bands using an ATU
10b1	Station build

Table 1: Foundation Level Practical Exercises

challenging enough but a straightforward build – is a rather nice VFO from Spectrum Communications, **Fig. 6**.

The new syllabus specifies that the completed project must 'work as intended'. I am not sure I agree with this – some projects presented are horror stories, yet students learn a lot from the experience.

10b6: RF connector on coax

This is unchanged. The exercise is not quick but it's appropriate at Intermediate and students like it. See **Fig. 7**. Fitting a compression-type PL-259 is fiddly but it's a skill a student might actually use.

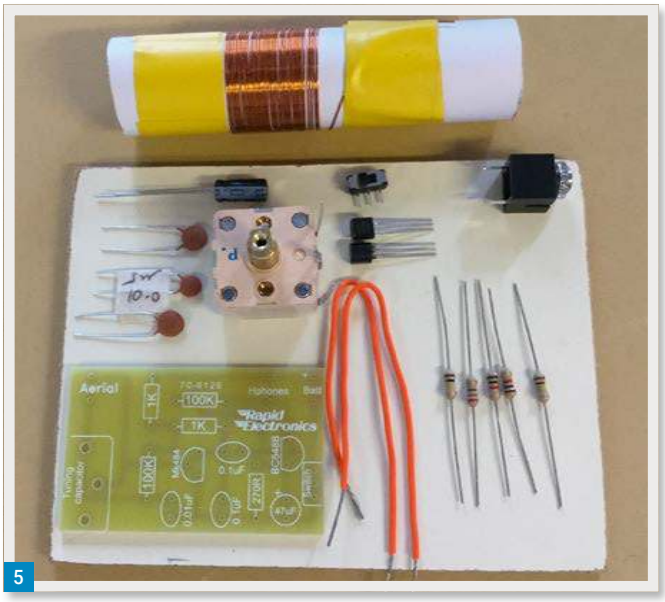
10c2 and 10c3

These can be combined too. A battery or bench PSU will be required, and the resistor values will need to be quite high to minimise currents and hence opportunities for scorched fingers, but this is straightforward stuff.

10c4 to 10c8

This exercise goes much deeper than the old VFO calibration exercise did. The syllabus says 'Band Edges and two intermediate points are required to be marked *at zero beat*'.

Zero beat calibration is 'old school',



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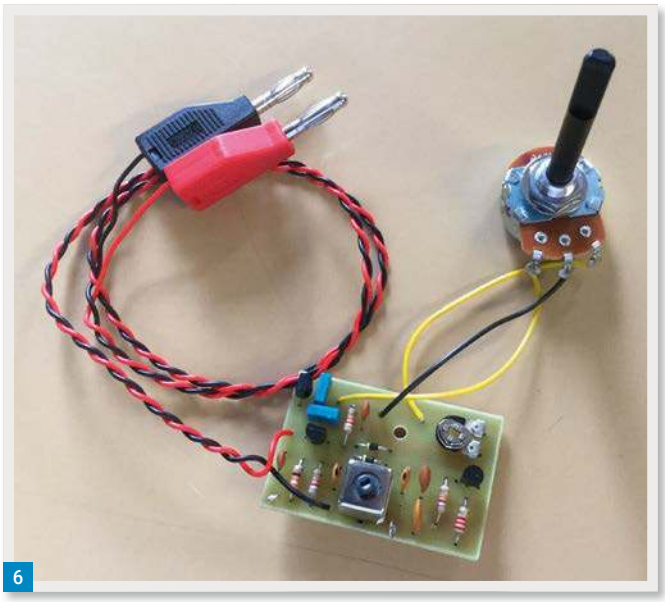

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Fig. 5: MW radio kit from Rapid Electronics, suitable for the home construction exercise. Fig. 6: An alternative to the kit of Fig. 5 – a VFO from Spectrum Communications. Fig. 7: Soldering to a PL-259 plug.

proper radio engineering. A receiver is tuned to the oscillator and, at the same time, another signal of great stability and accuracy is received. When the beat frequency vanishes, the oscillator-under-test's frequency is known because the reference signal's frequency is known. I think it's a big ask to do this with students. Using a frequency counter is much easier and 2019 – realistic, just as using an analyser is preferable for tuning a dipole at Foundation.

For the temperature stability checks I have my wife's old hairdryer.

A compressed air blower would undoubtedly be better for cooling but the hairdryer was free! Tutors will need an additional crystal oscillator.

The Missing Practical

Digital signals is a huge part of the new syllabus, yet it is absent from Intermediate practicals. This seems odd, although it is hard to imagine what a suitable exercise might be without including Operating. Advanced has no practicals, so a new Full licensee may get there with no hands-on experience of Digital Signals.

But then perhaps that is nature of the animal – if everything happens in software, what could a student do?

Conclusion

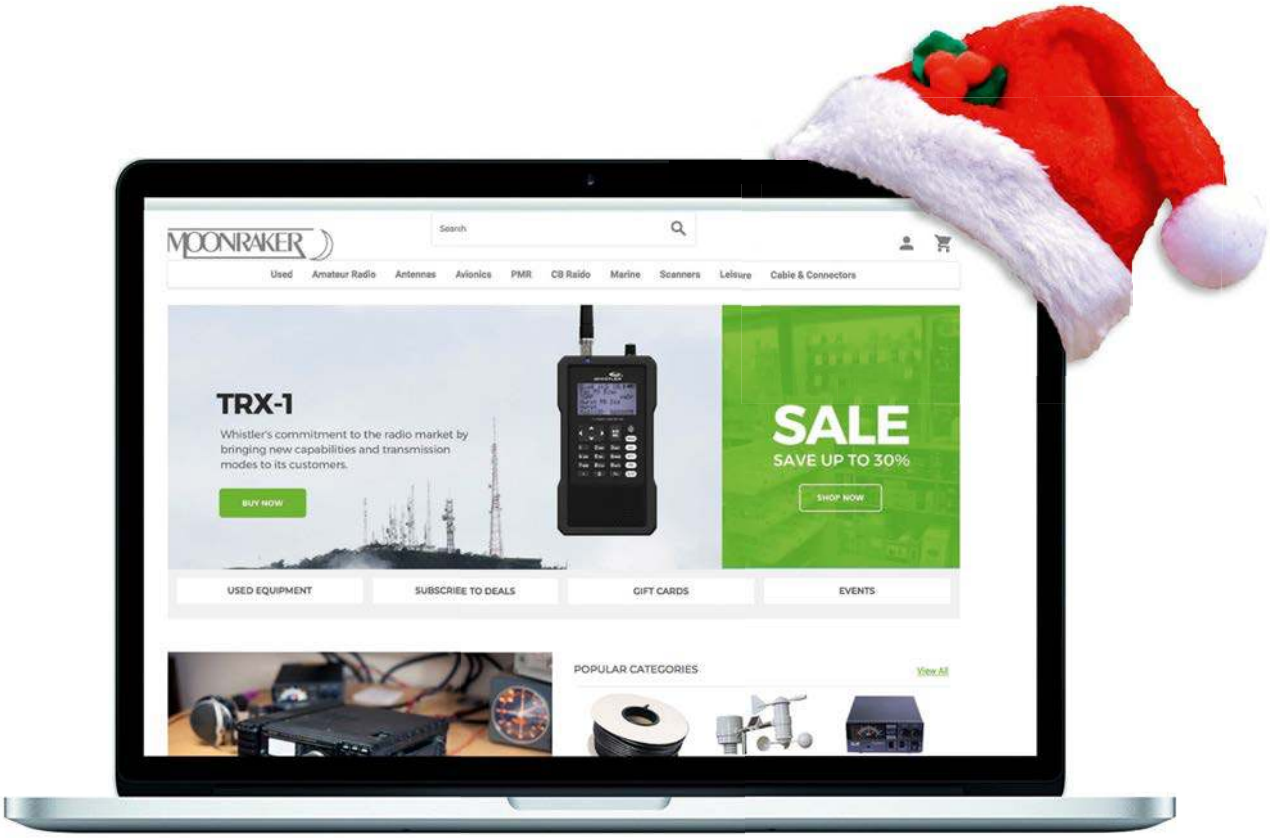
I said in my opening paragraph that both courses' practicals had noticeably changed and hopefully readers will agree. Foundation practicals have shrunk and I think they will be easier and quicker to put on. At Intermediate level, the opposite applies – just as the theory has gone up a notch, the practicals are more demanding. But by careful planning, including taking advantage of the underlying opportunities for combining them, the practicals need not become an ordeal, I suggest.

(By the time this is published, I will have my new boards back from China. Please e-mail me if you are interested in using these. I plan to do kits as well.)

Syllabus V1.3 ref	Syllabus V1.3 detail
10b1	Before starting on project, student reviews Safety from Foundation
10b2	Solder five good joints (no electronic purpose required)
10b3 and 10c1	Make simple circuit and measure V and I (no soldering required)
10b4	Demonstrate transistor has gain (no construction required)
10b5	Student project
10b6	Fit RF connector to coax
10c2	Determine resistance by using colour codes and compare with direct measurements
10c3	Determine resistance by measuring V and I and using Ohm's Law
10c4	Demonstrate crystal oscillator is stable when subject to mechanical shock and temperature variations
10c5	Demonstrate non-crystal oscillator isn't stable when subject to mechanical shock and temperature variations
10c6	Find at least 2nd and 3rd harmonics of oscillator using spectrum analyser or RX
10c7	Demonstrate reduction in harmonics when using LPF or ATU
10c8	Calibrate VFO using RX, frequency counter or spectrum analyser

Table 1: Intermediate Level Practical Exercises

Get your presents
just in time for Christmas



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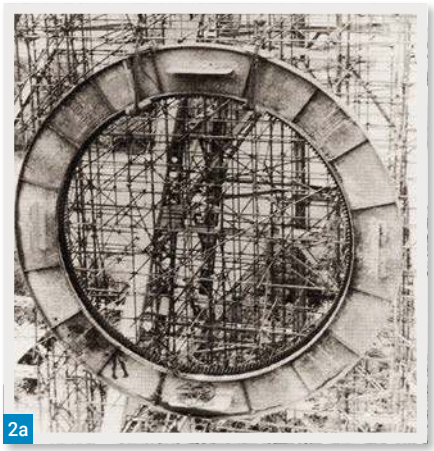
Radio Eye on the Sky (Part II)

Dr Bruce Taylor HB9ANY
bgtaylor@ieee.org

Dr Bruce Taylor HB9ANY concludes the story of the origins of Jodrell Bank with the saga of the construction of the iconic Lovell Telescope.


1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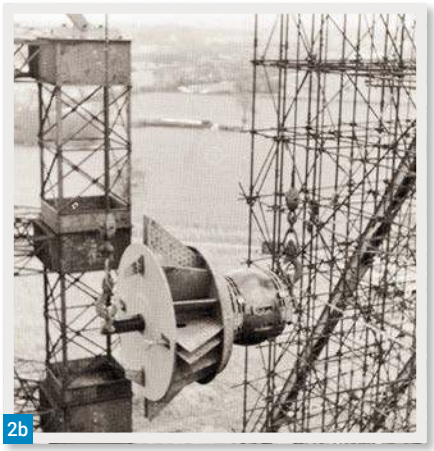

2b

With the aid of a few colleagues and a farmer, **Bernard Lovell** had successfully built a static 218ft diameter parabolic dish antenna for £1000, using garden spades to mix the concrete for the foundations and wooden ladders to erect the wires of the reflector bowl. So surely it would be straightforward for a large firm of experienced professional structural engineers to construct a slightly bigger version that could also be steered in any direction? Perhaps for around £50,000?

Hence it came as a surprise that most of the engineering firms approached by Lovell said that it was impossible, and the first company that did accept the design challenge said that it couldn't be built for less than £250,000. So it was a relief that when the Sheffield consulting engineer **Charles Husband** visited Jodrell he declared *"It should be easy – about the same problem as throwing a swing bridge across the Thames at Westminster"* and they would *be "reasonably safe with a figure of £100,000"*. The final bill was £750,000; over £20m in today's money.

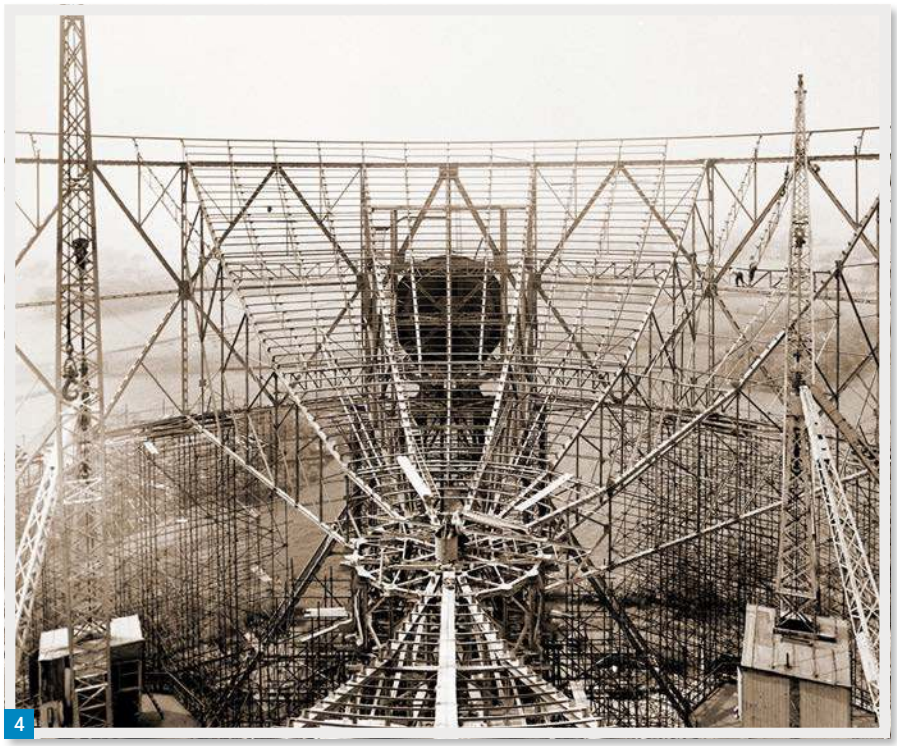
During the war, Husband had worked on aircraft manufacture for the Ministry of Works and in 1946 he designed a facility for testing jet engines at altitude. His prestigious company designed many fine bridges and would later go on to design the antennas for the Goonhilly satellite earth station, Sri Lanka's tallest building and the replacement Britannia Bridge after **Robert Stephenson's** structure was destroyed by fire in 1970.

Go-Ahead

In February 1950 support for the first phase of the project was given in remarkably short time at a critical meeting of the Royal Astronomical Society in the Edinburgh University apartments of **Sir Edward Appleton**. £3300 was allocated to allow Husband to prepare a detailed design for a 250ft diameter antenna, so that tenders could be invited for its construction. Lovell recalled later that it was perhaps fortunate that his distinguished Cambridge rival, **Martin Ryle G3CY**, wasn't present at the meeting, since his own antenna proposal was in an earlier phase. Although Lovell fully justified the project by an impressive list of possible scientific applications, Appleton remarked with judicious foresight that the greatest use of the antenna might be for fields of research that couldn't be envisaged at the time.

Lovell and Husband lost no time in making an application to the Department of Scientific and Industrial Research (DSIR) for £120,000 for the construction of the antenna, a control building and other works, such as sinking a borehole on the site to determine what foundations would be required. At a meeting of the Research Grants Committee on June 22nd Lovell received immediate authority to proceed with the detailed design study and it appeared that there wasn't a cloud in the sky. Passing joyfully through Trafalgar Square as he left the meeting, Lovell was thrilled to think that the top of Nelson's column was merely at the height of the trunnion axis of the splendid antenna that he proposed to build. Little did he realise then what endless tangles and frustrations lay ahead.

A first problem arose with the acquisition of the preferred field for the construction, which became the subject of a disputed estate following the death of the elderly lady owner during negotiations for its purchase. Lovell found himself emmeshed



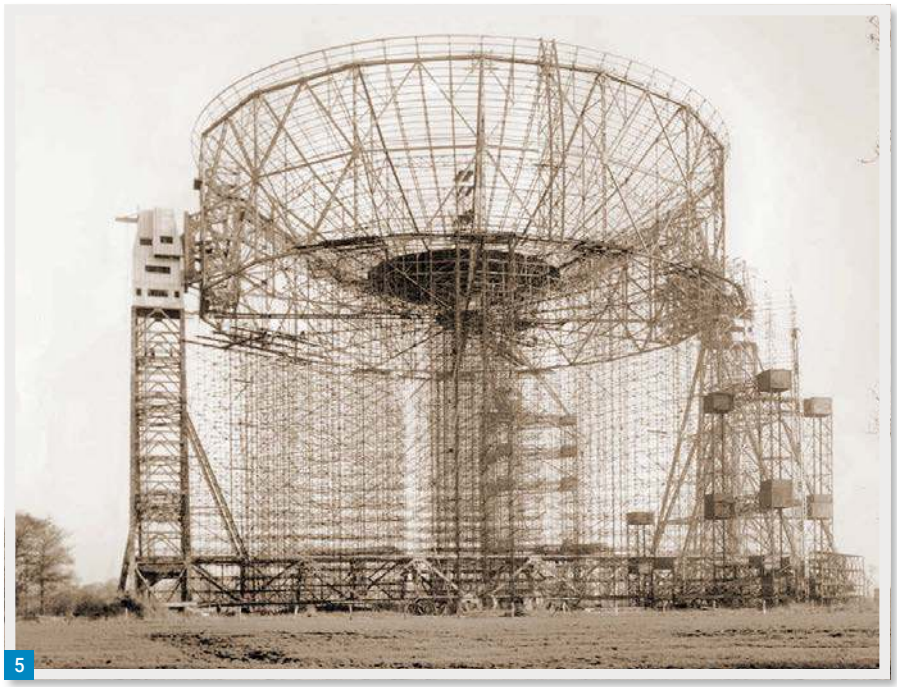


Photo 1: The success of the 218ft fixed transit antenna underpinned the ambition to build a fully steerable paraboloid of similar aperture. (Glyn Evans) Photo 2: The 27ft diameter gun turret rack (left) and trunnion assembly with large roller bearing (right) were hoisted in 1955. (Jodrell Bank) Photo 3: The two cranes have just hoisted the trunnion bearing to the northern tower. (Jodrell Bank) Photo 4: The beginnings of the paraboloid are apparent as the ribs are mounted. For scale, note the two men working on the right side outer connecting panel. (Jodrell Bank) Photo 5: During construction the skeleton bowl was supported by 90 miles of scaffold tubing. (Jodrell Bank)

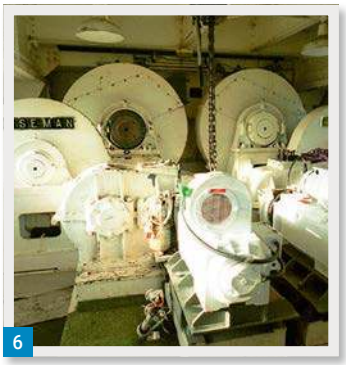
in family quarrels, which again and again held up a near agreement. Faced with a deadlock, the piling contractors had even begun boring in another field when a High Court decision finally settled the legal problem. Transferring the work to the final site was at one stage blocked after a tractor was seen operating in the field during the night. An irate farmer was found to have demolished the contractor's hut, throwing it into a ditch together with all the marking-out pegs, and placed a ferocious bull in the field!

First Steps

From July 1950 onwards, Lovell and Husband were in almost daily contact and even the severest winter weather didn't stop Husband making regular journeys across the Pennines from Sheffield to Jodrell. No one could have foreseen the bitter conflict that would arise a few years later after an important government committee censured them for lack of contact.

The first major technical problem was the need for a pair of enormous circular gear racks to drive the dish in elevation, which would cost many thousands of pounds to manufacture. Fortunately, the battleships *Royal Sovereign* and *Revenge* were at that time being broken up by Thos W Ward in Inverkeithing. The 27ft diameter internal-tooth racks from the 15in gun turrets hadn't yet been destroyed and they were procured with their pinions for their scrap value and transported to Manchester for a total cost of only £1000.

Unlike large optical telescopes, it wouldn't have been possible to mount a 250ft diameter antenna on an inclined equatorial mount parallel to the earth's axis of rotation. Instead, it would have to be turned in azimuth on a circular railway track, and tilted independently in elevation on a horizontal axis 180ft above the ground. But the narrow beam of the antenna would have to track objects in the heavens with very high precision. Today, a PC or microcomputer could easily solve the equations of spherical trigonometry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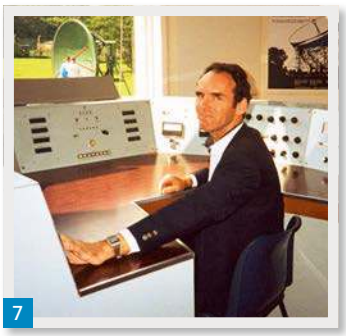
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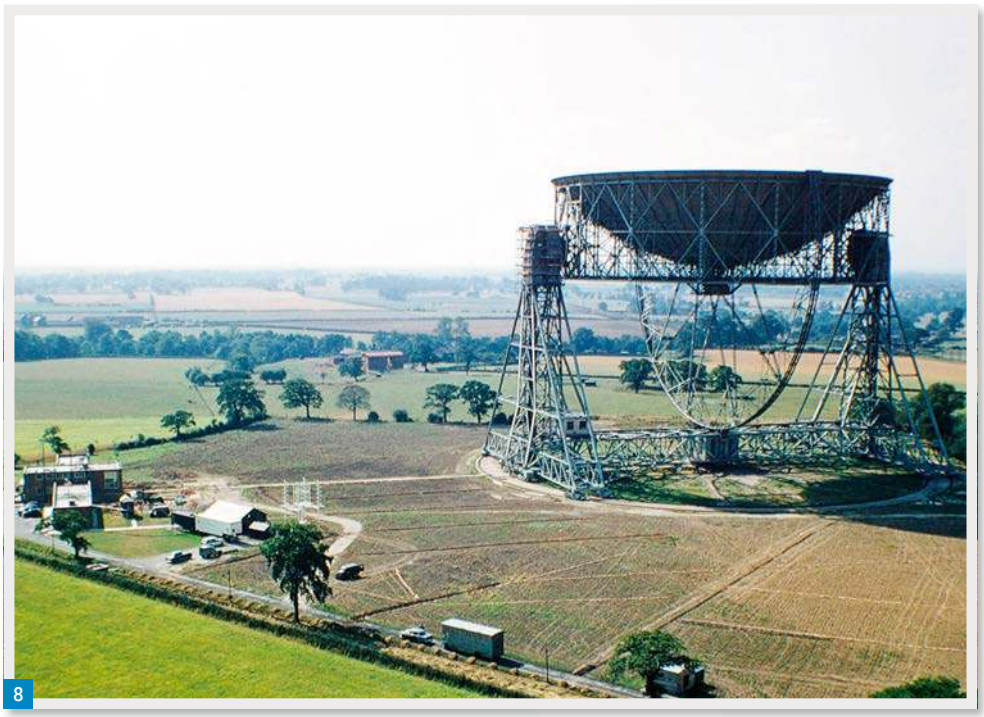
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to produce the az-el signals to drive the antenna in sidereal motion. But in 1950 this had to be done by a complex analogue system that eventually comprised 50 magslip resolvers. It was replaced by a Ferranti Argus computer in 1970.

The Metropolitan-Vickers metadynes used for controlling battleship turrets also inspired the first studies of the antenna drive system. Metrovick estimated a cost of £28,600 for a Ward Leonard drive system with a pair of 50hp DC motors on the bogies of the supporting towers to rotate the antenna in azimuth, and another pair in the towers to drive the dish in elevation. But within two years it became evident that this estimate was an irresponsible guess, the price had almost doubled, and the drive system contract had become a nightmare.

With little possibility of additional funding from the DSIR, Husband approached Siemens in Germany, who proposed a system at a much lower price that could be delivered in nine months instead of three years. There followed a number of manoeuvres and intrigues that held up the placement of an order until 1956. Several people in authority were fiercely opposed to the pro-European movement, and just as the acceptance documents were finally about to be dispatched to Siemens a call was received from the UK firm Brush, which had been pressured into quoting a competitive price against them. Metrovick was abandoned in acrimonious circumstances, Siemens was dropped, and in due course Brush delivered a satisfactory drive system on time.

The drive system was not the only item that ran over budget, and a year after the original estimate of £120,000 the figure had more than doubled to £242,000, a very substantial sum in 1951. Prices had risen by £20,000; the cost of the foundations had been underestimated by £20,000, and an alarming discovery had been made about the design of the antenna.

The Reflector

Initially it had been planned that the parabolic reflecting surface would comprise a wire mesh with a relatively coarse opening of 4 x 4in. However, calculations showed that at 300MHz, the highest frequency of intended operation, this would result in 20% of the incoming radiation being lost. To reduce the loss to an acceptable 2%, the mesh opening would have to be reduced to 2 x 2in and the amount of steel in the structure would have to be increased to support the greater load.

In 1951 observers in Australia, Holland and the USA almost simultaneously discovered spectral line emission from hydrogen gas in our galaxy at 1420MHz. Because this radiation penetrates the dust clouds, it offered an important new tool for understanding the galaxy. Hence Lovell requested that Husband modify the mesh from 2 x 2 inches to 2 x 1in, at least in the central portion of the reflector out to a radius of 50ft. The extra wind loading caused by this modification meant that more steel stiffening had to be added to the design. With the addition of other items, such as lifts in the supporting towers, the estimated cost of the antenna rose to £439,000.

By 1954, the Soviet Union was making rapid progress with the development of ballistic missiles, which could only be detected at long range by a radar with an antenna having high gain at centimetric wavelengths. It was thought that Lovell's antenna might have a role to play in defence, either for making tests or even operationally. For the reflector to perform efficiently at 10cm, the mesh size would have to be reduced to 0.75in, the supporting framework would have to be stiffened, and the tower holding the feed at the focus would have to be made more rigid. Lovell agreed to make these modifications for the Air Ministry in exchange for a payment of £46,000. In the event the payment was never made, since the required funds weren't available in the defence budget. But it was too late. The drawings for the modifications had already been issued, and in any case Lovell felt that the work should go ahead as it was in the national interest.

Then a further difficulty with the wire mesh design arose. The mesh could only be produced in strips a few feet wide, and no economical way could be devised to make the thousands of electrical joints between the separate strips once they had been installed in the dish. So the design was changed once again to use solid steel

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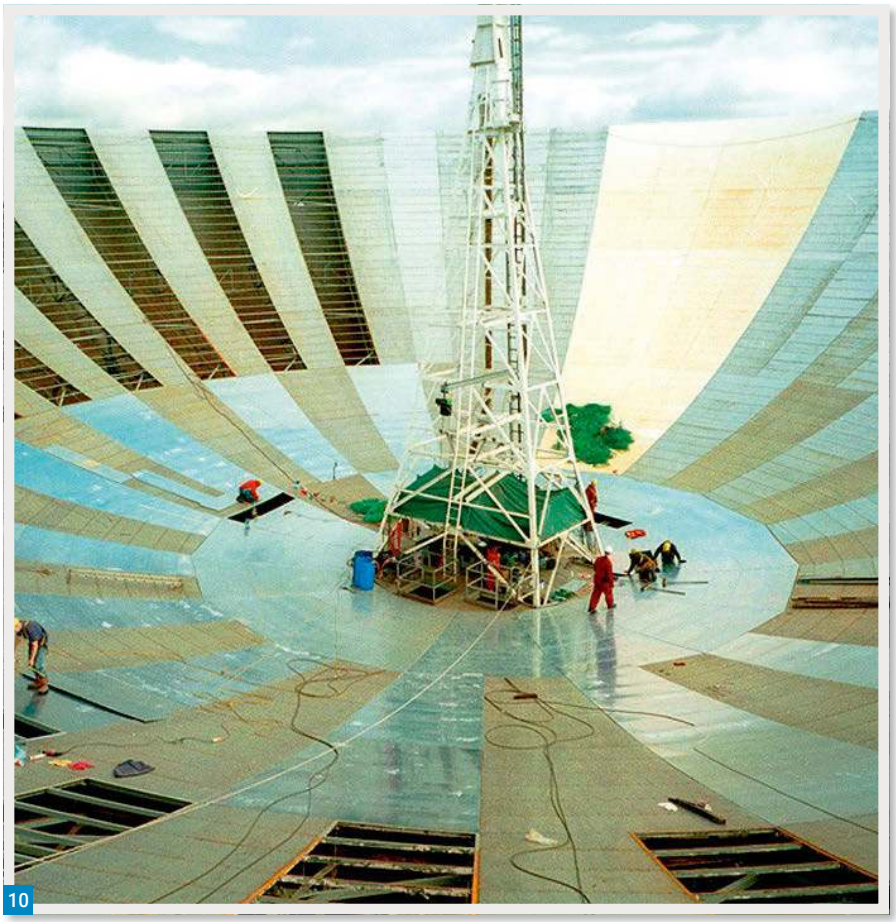

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sheets instead of open mesh for the whole reflecting surface. The plates, which were about 3ft square, could be welded together in concentric rings, working outwards from the centre. Since there is no leakage through the solid reflector, the gain at 144MHz was expected to be about 39dBi and the beamwidth less than 2°.

In 1970 the reflector was upgraded by constructing a new more accurate solid-sheet surface above the original bowl, which extended the frequency range to 5GHz. The new surface was made shallower than the original so that the distance to the focus box is greater, increasing the effective area illuminated by the feed. Since the reflector surface added in 1970 had become badly corroded by 2000, it was replaced by 336 new galvanised steel plates, set using a holographic profiling technique that gives the best performance at 6GHz. They are painted white to reflect the heat of the sun and prevent them from warping. In heavy rain, the bowl can collect more than 1000 litres of water per hour. It has big drainpipes!

Crisis

By 1954 it became clear that the modifications to the design of the dish were going to necessitate major changes to the supporting structure, increasing the weight of steel required and leading to a huge overexpenditure. In addition, wind tunnel tests of a model of the antenna by the National Physical Laboratory revealed that in gusty conditions the structure was likely to suffer from the type of oscillatory resonance that had destroyed the Tacoma Narrows Bridge in the USA. To prevent this happening, it would be necessary to attach a huge vertical 'bicycle wheel' structure to opposite edges of the dish, connecting it to damping wheels mounted on the diametrical girder. Later this was replaced by a more robust double wheel structure, which has a load-bearing as well as a damping function.

The effect of all the changes, combined with the continually increasing prices of steel and labour, led to the estimated cost of the antenna rising to £630,000. The project was now £260,000 in debt and in deep crisis. A committee of enquiry was set up and the British press vehemently decried the waste of taxpayers' money. This led to an investigation by the Public Accounts Committee (PAC), which based its report on the interrogation of the newly appointed secretary of the DSIR, a distinguished professor of chemistry who had no direct knowledge of the history of the project. When the report was published it accused Lovell of irresponsibility in using public funds, and Husband of making design changes without consulting him.

Husband was furious. He had been in almost daily contact with Lovell for five years, and for a consulting engineer to be accused of lack of cooperation with his client would be disastrous for his company. He demanded that Lovell write a letter to *The Times* denying the allegations and threatened Lovell and the University with legal action for damages. But such a refutation was impossible, since the PAC report was a privileged document. Just as the huge antenna was approaching an operational state, it seemed that Lovell's career was over and he would be landed in prison. But then a miracle happened.

Photo 6: At the top of the towers the gearboxes behind the 50hp elevation motors drive the gun turret racks connected to the reflector bowl. (Jodrell Bank) Photo 7: The displays in the control desk indicated galactic latitude and longitude, right ascension, declination, sidereal time, actual and required azimuth and elevation and universal time. (HB9ANY) Photo 8: The Mark I antenna with the USAF/STL telemetry equipment in front of the control room at the left of the picture. (Jodrell Bank) Photo 9: The steel lattice tower supports the focus box with a cryogenic container housing the receivers. (University of Manchester) Photo 10: Laying new surface panels. (Jodrell Bank)

Photo 11: The Mark IA antenna has a new reflector with reinforced steelwork and twin load-bearing circular girders. (HB9ANY)

The Sputniks

That miracle appeared unexpectedly on October 4th 1957, when amateurs around the world reported receiving the beeping from the 20MHz transmitter onboard *Sputnik I*, the earth's first artificial satellite, which had been launched without prior warning by the Soviet Union. The implication was clear. Soviet space technology was much in advance of the US *Vanguard* effort, and a carrier rocket that could launch a satellite could also deliver a military payload over an intercontinental range. Lovell was astonished to learn that there was no defence radar in the West that could track the rocket and he was asked to see if he could do so.

A small 36MHz 150kW meteor research radar set was quickly hoisted to the small laboratory under the bowl of the new antenna and the rocket was located within 24 hours. Suddenly the eyes of the world were on Jodrell Bank, the control room was seething with reporters and cameramen, and the BBC had more engineers on site than Lovell had on his staff! Three weeks later public enthusiasm was raised to even greater heights with the launch of *Sputnik II* carrying the dog Laika. Jodrell Bank duly detected the carrier rocket at a range of a thousand miles and tracked it as it burned up in the atmosphere a month later.

In spite of the public excitement and acclaim, deadlock among the funding authorities over the outstanding debt prevented the antenna being handed over to the University and Husband prepared to serve Lovell with a writ for damages of £1m. The University informed Lovell that as long as the PAC record stood, they would not be able to defend the case and without any means of paying he would be imprisoned.

It was not until July 1958 that the crisis was resolved, when the PAC was persuaded to issue a rebuttal of its original accusation and an additional grant of £130,000 was received from the DSIR. The antenna was freed for use by the University but in spite of a successful public appeal a debt of £85,000 remained. It took further developments in the space race to save Jodrell Bank.

The Space Probes

in July 1958 a large trailer was spotted approaching Jodrell Bank carrying a container marked *"US Air Force, Project Able"*. This gave away the fact that Lovell had secretly been asked if he could track the *Pioneer* rockets that the USAF would attempt to send to the moon using its *Thor-Able* launch system. The rockets were unsuccessful as moon probes but Jodrell Bank tracked *Pioneer 2* and recorded the scientific data that it transmitted on 108.06MHz as it travelled 71,100 miles into space before falling back to earth.

Jodrell Bank received even more favourable publicity when it tracked the more successful Soviet *Luna 2* probe that was launched in September 1959. Lovell received a telex from Moscow indicating the rocket's transmitter frequencies, coordinates and expected lunar impact time, which allowed the antenna to track the probe down to the surface of the moon. The trajectory was confirmed by analysis of the doppler shift of the received 19.992MHz signals, dispelling the doubts expressed by some commentators that the mission had succeeded. Shortly afterwards Jodrell Bank was once again in the limelight when it received the signals from *Luna 3* transmitting the first photographic images of the far side of the moon.

The antenna also played a critical role in the *Pioneer 5* mission to explore the cosmic rays, magnetic fields and solar flare particles in interplanetary space. A high-gain ground station antenna was required to communicate with the spacecraft, since its low power transmitters had omnidirectional onboard antennas. In addition to receiving the telemetry on 378.2MHz, Jodrell Bank transmitted the commands to the probe on 401.8MHz to separate it from its Thor-Able launcher. The imagination of the public was captured when the antenna received weak signals from the spacecraft out to 22.5m miles from earth.

A few days after this success Lovell received an unexpected telephone call, not from the media but from **Lord Nuffield**. *"How much money is still owing on that telescope of yours? I want to pay it off"*. As Lovell started to thank him, he replied *"That's all right, my boy, you haven't done too badly"*.

Lovell's long and bitter struggle was finally over. Ten years after its conception, his dream had become reality and the debt had been cleared at last. It had been a challenging, tortuous and hard-fought adventure, but Lovell's enthusiasm and tenacity had paid off and the world's largest steerable antenna was at last free to pursue its mission of probing the mysteries of the radio emission from the heavens.

Yaesu FT-817 Internal Batteries

Colin Redwood G6MXL looks at the options for replacing an expired internal battery for the popular Yaesu FT-817 and FT-817ND transceivers and welcomes the Summits on the Air Flavours Challenge for 2020.

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For well over ten years the Yaesu FT-817 and later the FT-817ND multi-mode transceivers have been very popular radios. They cover all the main HF bands, 6m, 2m and 70cm. They can be operated with a supplied flexible whip antenna on 6m, 2m and 70cm, or with an external antenna on any of bands covered by these remarkably compact and flexible transceivers. For their power supply, they can operate from an internal rechargeable battery or from a 12V DC external supply.

I described the steps in setting up the transceiver for basic FM and SSB QSOs in the December 2009 and January 2010 *What Next*.

My Experiences with the FT-817

I've had my FT-817ND for ten years, during which I've taken it to numerous portable activities and holidays in the UK and further afield in DXCC entities from Iceland to the Canary Islands. I've used it for SSB, FM and various data-mode contacts on bands from 80m to 70cm. When used away from home in the UK, I have generally relied on external Sealed Lead Acid batteries (SLAB) or in recent years a LiPo battery.

All this time I've kept the original internal Nickle Metal Hydride (NiMH) battery (designated FNB-85 and rated at 1400mAh) installed and charged it just before each trip, but rarely used it for more than an occasional QSO.

The earlier FT-817 (non-ND) models were supplied with Nickel Cadmium (NiCd) batteries with a capacity of 1000mAh. The newer FT-818 model (reviewed in last month's *PW*) is supplied with a higher capacity NiMH battery designated SBR-32MH and rated at 1900mAh.

Recently I wanted to use my FT-817ND for the first time in several months on the internal battery. I charged the battery overnight with the official Yaesu NC-72U charger using the rig's timing

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arrangements. Once I got to my favourite contest site, I found that although the transceiver was receiving fine, within a second of starting a transmission, it stopped and closed down. I connected an external SLAB and the transceiver performed faultlessly, enabling me to work some nice 2m DX as far as the French-Swiss border at a distance of over 600km from Dorset. It was clear that there was a problem with the internal battery supply.

Back home, I enquired on the Amateur Radio UK group on Facebook, to see if others had encountered a similar problem. The general conclusion was that the battery had *"gone QRT"* to quote one reply. What I hadn't expected was the range of suggestions of alternatives to the 'official' Yaesu battery. Essentially, they fell into three solutions in addition to the 'official' Yaesu replacement.

Yaesu Replacement

My initial thoughts were to replace the

battery with an identical one, **Fig. 1**. I checked prices on several *PW* advertisers' websites and found that a new one would cost from £37.90 to over £51.00 (including delivery). By sticking with a genuine Yaesu, I would know exactly what to expect from the battery, and I probably wouldn't need to lift the cover for another ten years, assuming of course that I continue to use it in a similar way to the last ten years.

I found a second-hand one available for £28.00 + £4.95, but I decided I didn't want to risk buying a battery that might not have a long life. I also considered purchasing the higher capacity (1900mAh) SBR-32MH used in the FT-818, but this was even more expensive.

Equivalents

I found a number of 'equivalents' to the genuine Yaesu being advertised on Amazon and eBay. The ones on Amazon had generally received favourable reviews, including by some amateurs who I recognised and whose judgments I respected. At a price of £13.09, including free carriage (one-third of the price of the official Yaesu version), these certainly seemed worth considering, especially as my FT-817ND was well out of manufacturer's warranty. I ordered one from Amazon. It arrived promptly and appeared to be almost identical in size and weight but was obviously different in colour (green) and had different labelling, **Fig. 2**.

AA Batteries

The second alternative proposed by the Facebook group participants was to populate the Yaesu battery box (FBA-28) with eight high-capacity rechargeable AA cells, **Fig. 3**. I didn't have the required battery box, but I was able to obtain one from a *PW* advertiser. High capacity NiMH AA cells are readily available in various capacities from various suppliers. I've found Amazon's own-brand NiMH cells that I bought a few years ago for another purpose have been reliable, but there are numerous others available.

Windcamp WLB 817S LiPo Battery

The final suggestion came from several of the Facebook group participants and was something that came as a complete surprise to me. The Windcamp WLB-817S is a 3000mAh LiPo battery, **Fig. 4**, that fits in the battery compartment of the FT-817. Being a LiPo battery, it requires different charging arrangements, and comes with a separate charger and a replacement battery compartment cover. In addition, there is a separate board built on to the cover to isolate it from the 'standard' external supply socket, **Fig. 5**. At the time of writing in early November 2019, there doesn't appear to be a UK source for these. Those available from abroad appear to all have either a US or Euro-style plug on the charger.

Reading the reviews of the Windcamp LiPo batteries on Amazon (both the UK and US Amazon sites), I have concerns regarding the charger (safety, reliability, RFI, plug type). I'd suggest readers check carefully before considering any purchase that the charger is rated for UK mains voltage. The nominal battery voltage is higher at 11.1V in comparison with the other batteries, which are nominally 9.6V, and enables the FT-817 to operate at 5W output. I'd also advise readers planning to travel by air with their FT-817 to carefully check the up-to-date regulations regarding transporting LiPo batteries. In the end, while the extra capacity looks very attractive, there are downsides. I'm not sure that I would feel safe to install any LiPo battery and forget about it for ten years.

Connector

The battery connector is known as a JST connector, **Fig. 6**. These are available in numerous sizes. Plugging and unplugging these JST connectors is fiddly, and best not done in a rush. It is one of the reasons that I looked for an internal battery solution that wouldn't require repeated connecting and disconnecting.

Weight & Capacity

Many amateurs use their FT-817s and FT818s for portable activity where weight can be an important consideration. In **Table 1** I've shown the weight and capacity of the various options. For the AA cells, I've used a typical capacity. Cells with smaller and greater capacities are available.

Conclusions

No doubt readers will have their own views of the 'best' solution for their own circumstances. If your transceiver is still under guarantee, then I would be cautious before using anything other than the 'official' Yaesu branded battery or rechargeable AA cells. If you need to be able to swap discharged batteries for charged batteries in the field, then I think the rechargeable cells are probably the best option because this can be done without unplugging the fiddly JST connectors. Otherwise, each of the options looks worthy of consideration. Which you choose will probably be influenced by how much you operate using the internal battery and costs. In all cases, remember that the maximum power obtainable with an internal battery is rated at 2.5W. Using an external 12V battery or external 13.8V power supply will allow the maximum power (5W from the FT-817 and the FT-817ND and 6W from the FT-818).

Fig. 1: A 'genuine' Yaesu FNB-85 NiMH battery rated at 1400mAh. Fig. 2: An 'equivalent' to the Yaesu FNB-85 NiMH battery advertised on Amazon. Fig. 3: The Yaesu battery box with eight AA 2000mAh NiMH cells from Amazon. Fig. 4: The Windcamp WLB-817S is a 3000mAh LiPo battery.

SOTA

I last looked at the Summits on the Air (SOTA) awards programme in some detail in the August 2015 issue of *PW*. The main SOTA awards split into three main types. The first is available to those who operate from designated hill and mountain summits, known as 'Activators'.

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Fig. 5: The alternative Windcamp battery cover required when using a Windcamp WLB-817S battery. Fig. 6: The small JST connector used to connect the battery on a Yaesu FT-817.

The second is available to those who make contacts with the same summits (typically from the comfort of their shacks at home), known as 'Chasers'. The third type is for shortwave listeners. Within these main types are a range of certificates and awards:

www.sota.org.uk

Not every hill or mountain counts as a summit for SOTA purposes – some apply for HuMPs Excluding Marilyns Awards (HEMA) instead. I explained the differences in the April 2019 issue. The details also vary slightly between countries. To meet SOTA criteria, a summit has to be a significant height (at least 150m in the UK) above the surrounding land and must be reached by 'person power' (on foot or bicycle). For SOTA purposes summits are ranked by their height, with a greater number of points obtained for activating or working higher summits.

Each country is subdivided into one or more SOTA regions. Within each region every summit that counts towards the awards is assigned a SOTA reference. There is a very useful online database, which lists the various summits, together with a history of activations.

www.sotadata.org.uk

SOTA Flavours Challenge

The reason for returning to SOTA is that the SOTA awards programme has recently announced a series of themed challenges that will take place during 2020. The idea is to encourage SOTA activity on bands and modes that are popular in amateur radio generally but somewhat under-represented in SOTA. Nonetheless, the spirit of the Challenge is to encourage activators and chasers to try something new!

During 2020 the first seven days of each month will be designated Challenge Days, **Table 2**. This guarantees that there is no bias towards weekday or weekend days, and also ensures that the majority of each month will see a more 'normal' distribution of SOTA operating. No doubt there will be some Flavours that operators may not be interested in or are not equipped for. There is nothing stopping you from making other SOTA contacts with other modes and bands on the Challenge Days but these contacts won't count towards the Flavour Challenge.

To take part in the Flavours Challenge, you simply operate as a SOTA activator or chaser as you would normally do and submit your logs to the SOTA Database as normal. For activators, eligible Challenge contacts will be scored by multiplying the number of unique QSO partners by the number of unique summits activated. For chasers, eligible Challenge contacts will be scored by multiplying the number of unique activators worked by the number of unique summits worked.

Some of the dates chosen for the Challenge Days appear to me to have been chosen with an eye on likely propagation and activity. The June Challenge, for example, coincides with what is usually close to the peak of the summer Sporadic E season in the northern hemisphere.

Option	Claimed Capacity (mAh)		Weight (g)
Genuine Yaesu FNB85	1400	13.44Wh	200
FNB85 equivalent	1500	14.4Wh	200
Genuine Yaesu SBR-32MH	1900	18Wh	250
AA Batteries and FBA-28 case	2000	19.2Wh	245
Windcamp LiPo	3000	33.3Wh	172

Table 1: Claimed capacities and weights of the various options for internal batteries for the FT-817/FT818.

Month (1st to 7th)	Challenge
January	LF - 160m & 80m
February	Data modes
March	Digital voice
April	LF – 160m & 80m
May	Data modes
June	12m, 10m & 6m
July	70cm
August	17m
September	Data modes
October	Digital voice
November	LF – 160m & 80m
December	12m, 10m & 6m

Table 2: Dates and bands/modes for the 2020 SOTA Flavours Challenge.

Safety

Finally, if you are considering activating a SOTA Summit, please take suitable precautions. No matter what time of the year, the weather can be very different at the summit to lower down and can change rapidly.

More from Mike

Mike Richards G4WNC
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This month, **Mike Richards G4WNC** continues his tutorial on interconnecting SDRs and data modes decoders in software. He also has a new spectrum analyser from SDRPlay along with free Pactor monitoring and JS8Call news.

Last month I showed you how you can interconnect the audio between SDR rigs and data modes software using virtual audio cables (VACs). Another interconnect that can be very helpful is full CAT (Computer Aided Transceiver) control. While many operators use VOX to handle the Tx/Rx switching, CAT control lets you change frequency from the data modes software and automatically transfers the operating frequency and mode to the log. This is another case where it's better to use a digital interconnection rather than looped physical serial ports. In the majority of rigs, CAT control is managed using a COM port. This uses a simple communications protocol that employs a UART (Universal Asynchronous Receiver Transmitter). In addition to handling the serial messages, UARTs normally include flow control lines. These are used to stop the flow of data when the receive buffer gets full and so manage communications between fast and slower devices.

In much the same way as we used virtual audio cables last month, we can use virtual COM ports to interconnect the serial CAT data from the SDR to the data modes software. You will also see the virtual COM ports referred to as Null modem emulators. The best solution for Windows virtual COM ports is the open source com0com application that can be found on SOURCEFORGE at:

https://tinyurl.com/v36gu2u

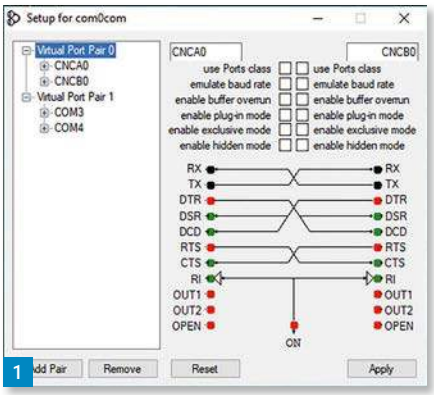
This open source software lets you create and name multiple virtual COM ports and is very versatile. There used to be a problem with Windows 7 & 8 because the com0com drivers were only test signed and rejected by those operating systems. I believe this may now be fixed but, if you do encounter problems, signed drivers for an older version of com0com can be obtained from this site:

https://tinyurl.com/u2jofuu

Those running other versions of Windows, including Windows 10, will be able to install the current version (v3.0.0) of com0com without issue.

Installation

The download link at SOURCEFORGE provides a zip file that contains 64-bit and x86 versions of com0com. To install the software, you first double-click and unzip the archive and then double-click on the appropriate version for your operating system. You can then follow the defaults to complete the installation. Once installed, you should open the setup panel, **Fig. 1**. The setup panel is very easy to use and includes a diagram to show how the current connections are configured. As you can see from Fig. 1, com0com creates interconnected pairs of COM ports. This is slightly different to the way virtual audio cables are used. The created COM ports are fully bidirectional but you need to remember that the SDR and data modes software will use different port numbers. I've illustrated this in **Fig. 2**. Here you can see that the data modes software sends and receives data using COM 3 while the SDR uses COM 4. For successful communication, you also need to ensure that the COM settings (baud rate, data bits, etc.) are identical for both the SDR and data modes software. If you need additional virtual COM ports, these can be created by opening the Setup panel and clicking the Add pair button. For the ports to be visible and allocated conventional COM port names you also need to tick the 'use Ports class' box for both ports. Once created, the virtual COM ports are automatically started, as a service, during boot, so are always available. Should you want to uninstall com0com, you need to navigate to the installation directory (usually c:/Program Files (X86)/com0com) and double-click on the uninstall.exe application.



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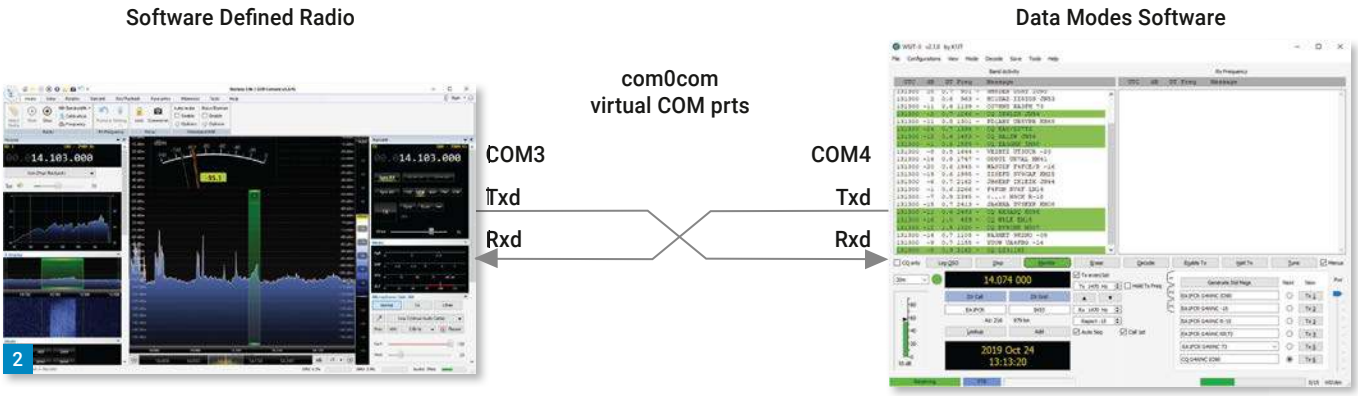
Monitoring Pactor

Amateur Pactor is still used extensively to support emergency communications and HF e-mail services. As the name suggests, Pactor has been derived from the Packet radio and AMTOR modes. These are both full error-correcting communications protocols. AMTOR was originally designed by **Peter Martinez G3PLX** as a replacement for RTTY and was optimised for keyboard-to-keyboard QSOs. It is an impressive mode where the two communicating stations are locked together and the message is split into short character groups. After the transmission of each short group, the sending station waits for an acknowledgement from the receiving station before it will send the next group. It is a very effective mode but is restricted to a single, relatively slow, transmission rate. Packet Radio, on the other hand, also uses full error correction but is often too fast for reliable HF communications.

Pactor takes the best elements of AMTOR and Packet radio to create an adaptive, error correcting, communications link. Pactor communications links normally start with a low baud rate to initiate the contact and assess the link quality. The protocol will then increase the link speed to the maximum that the link can sustain. Using this system, Pactor can provide reliable and efficient communication links over a wide range of propagation conditions. While the original Pactor 1 system is open-source and supported by modems from several manufacturers, all the subsequent developments of Pactor, versions 2 through to 4, are proprietary systems owned by the German company SCS. Because of this, it has been difficult to monitor these transmissions without specialist equipment. However, that has just changed because SCS have released monitoring software (pmon) for Pactor modes 1 to 3 with the latest, Pactor 4, promised for 2020. The monitoring



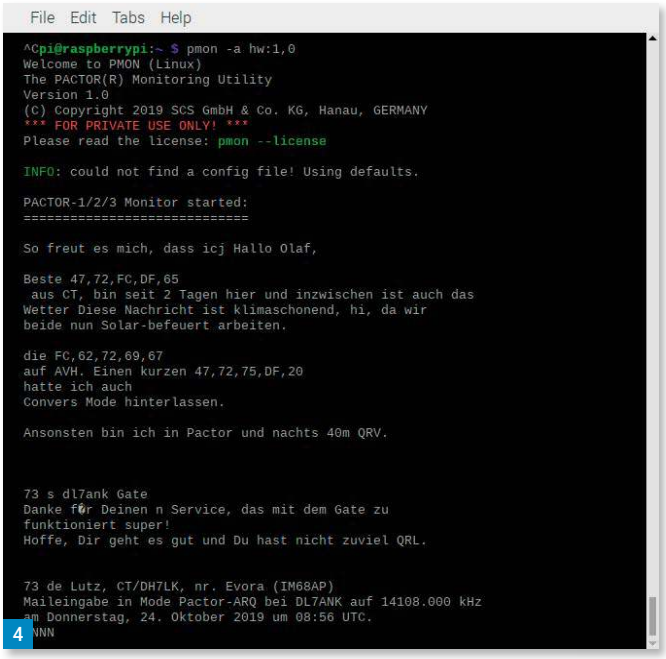


Fig. 1: com0com Setup panel showing interconnections. Fig. 2: Connecting COM ports using com0com. Fig. 3: Pactor pmon listing available sound cards. Fig. 4: Decoded Pactor message.

software uses a command line tool and is only available for Linux on the Raspberry Pi. There are currently no plans make pmon available on other platforms.

Installing pmon

Installation of pmon is straightforward and the instructions can be found here:

www.p4dragon.com/en/PMON.html

On that site, you'll download a script that will automatically add the SCS repository and install the pmon application. By adding the SCS repository, you will be able to automatically keep the version updated using the standard 'sudo apt update and upgrade' commands. Once successfully installed, you need to connect a USB sound card to accept the audio from the receiver. You can then check that pmon can see your sound card by entering the command: pmon -a ?

This will produce a list of available sound cards as shown in the **Fig. 3**. If you have a single USB sound card, it will show-up as hw:1,0. To start basic monitoring with that sound card use the following command:

pmon -a hw:1,0

However, when monitoring for the first time, it's worth using additional command line options to make sure things are working correctly. I suggest you begin with the following: pmon -a hw:1,0 -t 1 -v 1

The -t 1 option is a test mode that prints the incoming audio level every second so is helpful in setting the input level. The -v 1 option starts the Pactor decoder in verbose mode, where it will print additional message control information instead of just the message. Once you're happy that everything is working you can revert to the basic command where only the messages are displayed.

The best place to find Pactor activity is the 20m band and most transmissions are located just above 14.1MHz. Decoding of Pactor signals is fully automated, although you may see a warning message if the audio level to the sound card is either too low or too high. As soon as pmon detects a Pactor 1, 2 or 3 signal it will automatically decode it and display the message contents, **Fig. 4**.

SDRPlay Spectrum Analyser

SDRPlay have posted a new spectrum analyser application for use with their RSP receivers, based on the Mirics chipset. The RSP spectrum analyser was developed by **Steve Andrews** and is available for free downloaded from:

www.sdrplay.com/spectrum-analyser

The spectrum analyser works with the following SDRPlay models: RSP-1, RSP-1A, RSP2, RSP2 Pro and RSPduo (in single tuner mode). Installation is straightforward and the resulting spectrum analyser has an impressive range of features. This includes a scan width of 1kHz through to 2GHz! The spectrum analyser is packed with controls so you can adjust the display for a wide range of uses. In addition to the main trace, you can enable up to four additional traces each of which uses a different colour and can be set to show the raw signal, peak hold or an average. There is also a hold facility for each trace that freezes the display to make measurements easier. As a further aid to measurement the analyser

Fig. 5: VHF/FM spectrum analyser display.
Fig. 6: SDRPlay RSP1A FM rejection filter plot.
Fig. 7: Low cost noise source from eBay.

includes four markers that can be placed on either of the four traces. These markers are controlled via the Markers panel and can be set to either track the signal or to float at the assigned point on the display. To place a marker you first enable the markers, choose the marker letter (A, B, C or D) and then select the trace. Now you can drop the marker in place using the mouse.

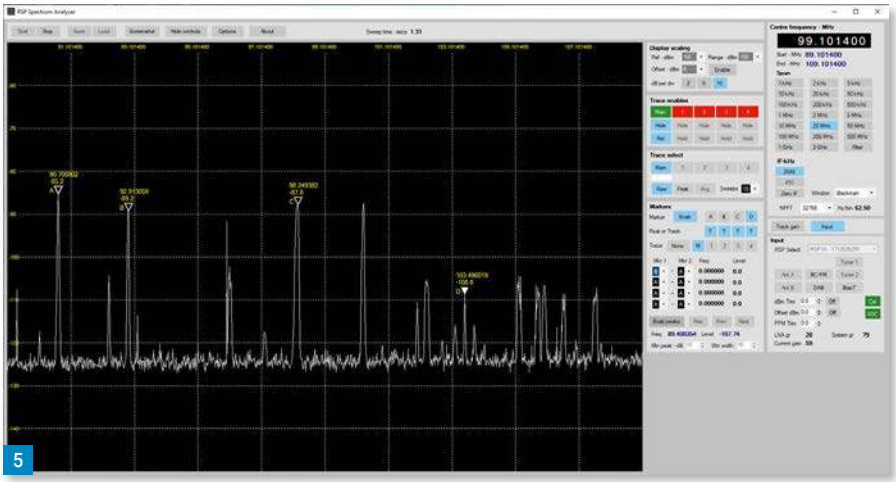
In **Fig. 5**, I've shown the spectrum analyser displaying the VHF/FM band with markers displayed for four stations. Also, in the Markers panel is a basic maths function that automatically measures the difference between any two markers, including the cursor, which is shown as marker F. Another useful tool is the Peaks display. When activated this will place peak marker on each peak and the first marker will show the frequency and level at the peak. You can then step through all the peaks with the First, Prev and Next commands. I found that this works best with the display held. In addition to viewing signal quality, spectrum analysers are a useful workshop tool for checking the performance of filters and amplifiers.

This SDRPlay spectrum analyser includes the option to control an Arduino-based tracking generator using an AD9850/9851 DDS (Direct Digital Synthesiser) chip. The Arduino code is included with the Spectrum Analyser installation and you should typically find it in: C:/Program Files (x86)/Andrews developments/RSP-Spectrum Analyser/ArduinoFirmware/

You can also find information on using the tracking generator in the SDRPlay forum at:
https://tinyurl.com/wmvq78o

An alternative way to measure amplifier and filter responses is to use a wideband noise source. The noise source is connected to the input of the filter/amplifier and the output connected to the RSP spectrum analyser. I've shown an example of the results in **Fig. 6**. In this case, I have measured the response of the VHF/FM rejection filter in the SDRPlay RSP1A. As you can see, it produces a very useful result. The noise source I used was from eBay, **Fig. 7**.

During my testing, the spectrum analyser worked very well. The software did crash occasionally but that was easily fixed by restarting the analyser.



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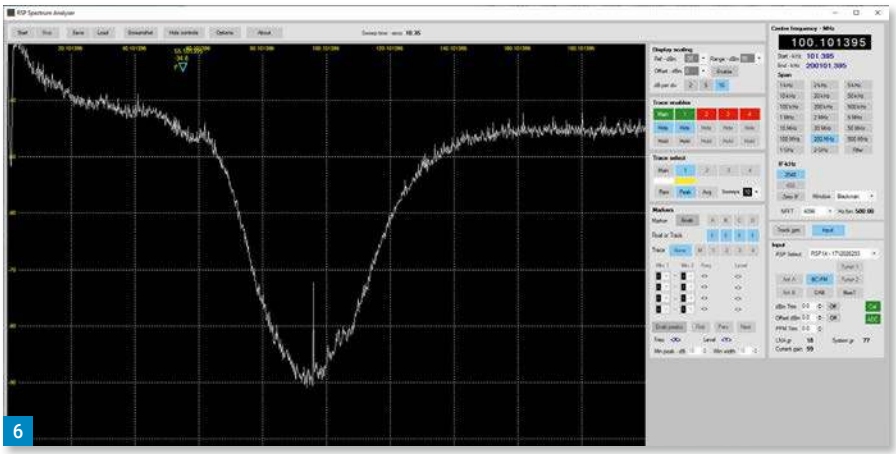

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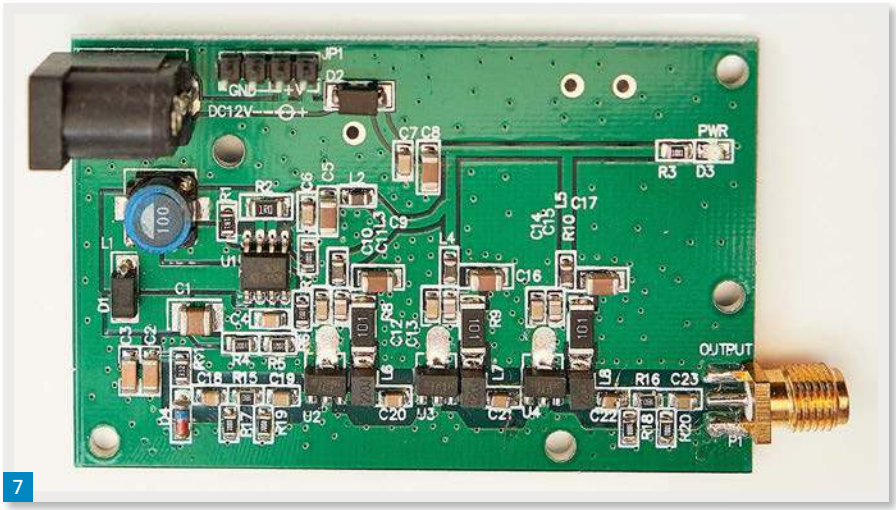

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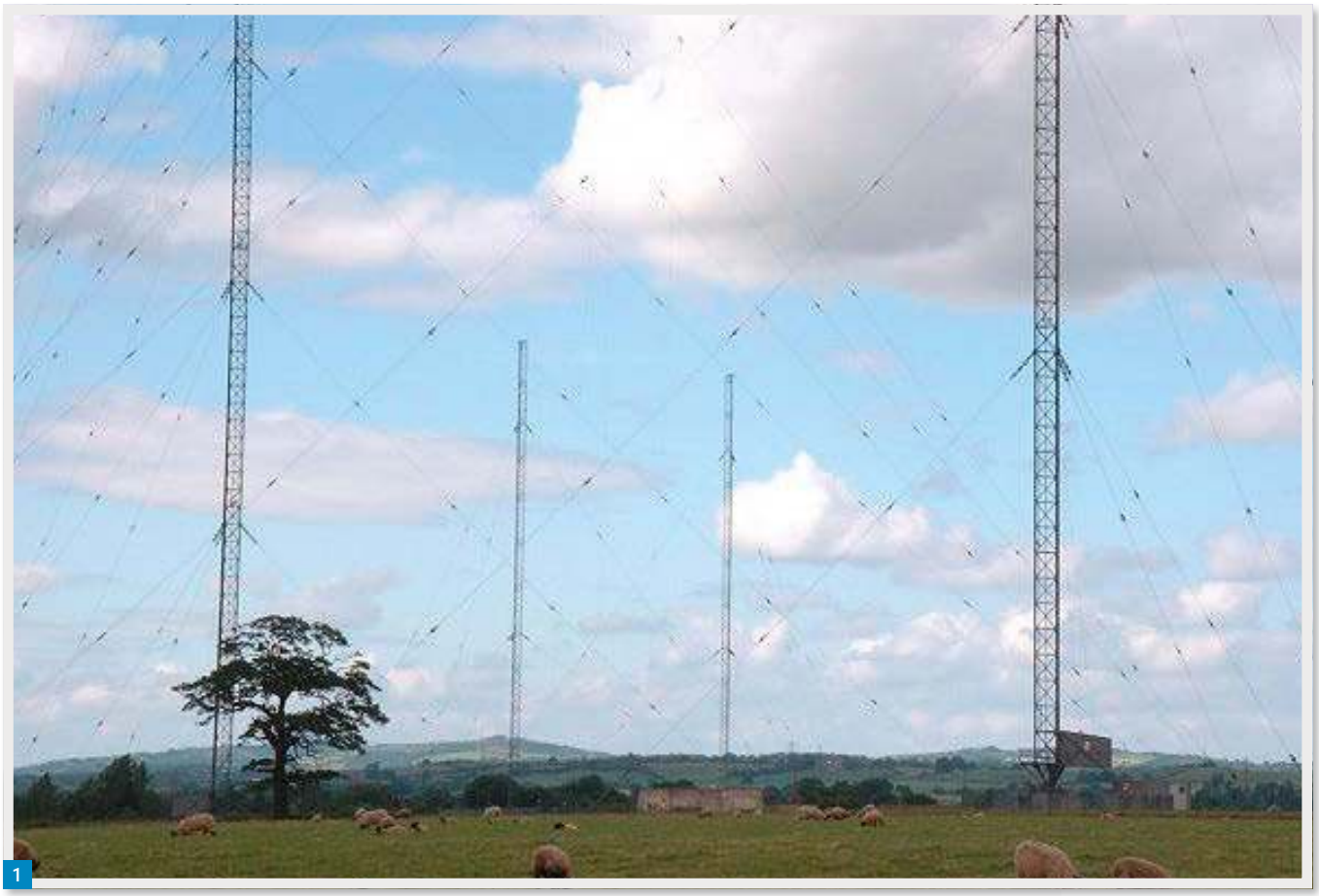
JS8Call-Upgrade

Just to round-off this month, **Jordan Sherer KN4CRD**, the developer of JS8Call is about to launch version 2.0 of JS8Call. This is an adaptation of FT8 that enables free text keyboard-to-keyboard QSOs The beta version of JS8Call is currently available to try, but the full release may well be available by the time you read this. Among the important changes is the addition of two higher speed modes that can be used when conditions allow.

While the normal communications rate is around 16WPM, the fast mode runs increases this to about 24WPM and the Turbo mode soars to 40WPM. As you might expect, the faster modes require more bandwidth with 80Hz required for the fast mode and 160Hz for Turbo. You can see the latest news and download JS8Call from:
http://js8call.com



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Joe Chester MW1MWD
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A Review of the Footsteps Project

To round off his Footsteps project from 2019, **Joe Chester MW1MWD** ponders what did Marconi really achieve?

We sat in the Lounge of the Haven Hotel, Poole, under a photograph of **Marconi**. The image is quite well known, taken around 1900, when he was just beginning to get results from his experiments sending Morse code with a spark-gap transmitter. We had just finished our own day of portable operations on the hotel's beach. I made QRP contacts on 80m with a short vertical, and across the English Channel on 40m. We were very happy with our results, using modern equipment to 'mimic' what Marconi did in the same place 120 years ago. It was time to assess the results of our experiments.

Our esteemed Editor, elsewhere in the magazine, said that the Footsteps project was about *"a bit of light-hearted portable fun"*. And while I can't deny this, I want to highlight the slightly more serious intention of trying to understand Marconi's work, to repeat some of his experiments in some meaningful way, and to try to figure out what it was like for Marconi, 120 or so years ago. Not many of us get to be experimenters in a completely new field. I'm not trying to undervalue Marconi's achievements – but I was curious. What Marconi reported he heard were signals transmitted on very low frequencies, using very primitive, inefficient equipment (or apparatus, as he called it). At that time, he didn't know the wavelengths he was using, he didn't understand propagation, and, as **Don** alluded to previously, as the heights of his antennas increased, the actual frequencies he was using dropped lower and lower.

Today, after a century of scientific investigation into radio engineering, solar physics, and the nature of the atmosphere, we have a vastly better understanding than Marconi did. Consequently, there are some doubts that Marconi's early experiments were that successful. Operating on 80m (or even lower) in daylight hours with low power into a really inefficient antenna is not something we radio amateurs would normally do. But that's what Marconi did! I am also operating at sunspot minimum, with all that that means for propagation. So was Marconi. Hence my Footsteps Project probably has more in common with Marconi's efforts than you might at first think.

What Did I Learn?

So, what about results. Like Marconi, I spent hours tweaking my equipment at home before each outing. Sometimes I improved things a bit, sometimes not (such as the time when the tree clippers of an Accountant-turned-gardener chopped through my feeder cable – accidentally of course!). Like Marconi, I asked other operators to listen out and report my calls, by putting details of times and frequencies on a QRZ page. I got to operate from the same locations Marconi used. I made QSOs at two of these locations. Again, like Marconi, I have reported these results, this time in the pages of *PW*. What I found was that my results were intermittent, and unreliable at best. But, of course I did! That is the nature of these experiments. And this is exactly what I believe Marconi found.

And this is where I think I hear the shadows from the past. Let's go back to the Haven Hotel, 120 years ago (when we were there it was exactly that). Marconi had no scientific background or training. He wasn't interested in that side of things. He had an idea of starting a business. I think a little bit of context might help us to understand things a bit more clearly. We are at the end of what would become known as an age of adventure and exploration, the early days of the modern scientific revolution. Scientific endeavour at that time was generally the preserve of the wealthy. Royal Institution lectures were attended only by the gentry, the Lords, the business elite. Into this world a young Marconi arrives, a young man unknown to the scientific community.

After he came to England, his principal backer was his mother. She came from a wealthy background, and had many rich friends, who she cajoled into backing her son's ideas. The Board of the company he founded at that time were predominantly grain merchants, who were also important in his mother's family business, the distilleries (her maiden name was Jameson!). So, I'm sure that young Marconi had the opportunity from the earliest days to explain what he was trying to do, and even do little parlour demonstrations in order to secure the interest and ultimately the investment he needed.

Imagine the Scene

Imagine the scene at the Haven Hotel 120 years ago. Marconi has another story to tell over dinner. *"Guglielmo, tell the ladies and gentlemen what happened this week"*, his mother says. *"Actually, I think I heard Morse code being transmitted from over in France today"*, he would have been delighted to be able to say. This would have enhanced his claim to have invented a new way to send messages without wires. Not quite what we would understand as a scientific endeavour, more the interested dabbling of a favoured child.


2

1. The Droitwich masts – an imposing sight from the M5. 2. A typical modern amateur radio antenna system suitable for DX chasing. EA1DLU uses an Optibeam linear-loaded dipole for 80m, above a Yagi for the higher bands. 3. The lounge at the Haven Hotel nowadays.

Now don't panic, I'm not trying to remove Marconi from his plinth in the annals of radio. What I am trying to do is reimagine what it was really like back then. So, we come to the heart of the matter. Let's start from what we know today. LF broadcasting is hard. The energy losses are substantial and get worse the longer the wavelength. Think about the size of the BBC Radio 4 antenna farm in Droitwich for the 1500m (198kHz) wavelength (previously for the Light Programme on 200kHz!). On 80m, I was able to mimic (I won't say copy) Marconi's equipment design. I used a vertical, which if shorter that Marconi's 52m monster, has the same lossy characteristics. I used a base loading coil, very similar to the one he used. To mimic the other inefficiencies in his transmitter system, I used low power. And what did I find?

Results and Conclusions

The operation on the Welsh coast was my best performance, and I did manage QSOs across water and across the English Channel. It would be easy to now conclude that I have confirmed Marconi's success. But operations on 80m in daylight are difficult and successes were few and intermittent, and I'm operating at sunspot minimum. Then I leap into Marconi's world and discover that it must have been the same for him. And I note that he too was working very near sunspot minimum. Propagation back then was probably as bad as it is now. Some days were better than others and like a DX hunter, he got just enough of a buzz, no pun intended, to keep him at it, blindly, day after day.

His successes, however few and however inconsistent they were, were presented to his mother's friends, and they, like him, started to believe that a big business payoff might be just around the corner. I'm not saying that Marconi didn't hear anything, or that what he said he heard was just wish fulfilment. But it was intermittent and random, and a great deal of luck played its part. Not quite the kind of directed scientific enterprise we sometimes imagine. More a case of determination and maybe bloody mindedness, day after day, to get something, anything positive to report – a tweak here, a twist there, an extra turn on the coil, a bit more power, a bigger mast, on and on and on.

A final comment about the transatlantic experiment. Being Marconi, this test has the same general characteristics as his earlier work. He put up even taller poles and increased the size of the spark with

3

huge capacitance plates. This required an increase in the power he generated. But he is still on LF, where the losses are enormous. And his receiver is just a random length of wire, held up by a kite, connected to a telephone handset. At the outset of my quest, I detailed the work done by scientists and engineers who have examined what Marconi did, and with what equipment. Their conclusion from this is that it is difficult to believe that what he said he heard was actual Morse code form Cornwall.

Nowadays radio amateurs routinely make transatlantic QSOs from the UK on 160 and 80m, with powers of 100W or less, but they have the advantage of modern, sensitive and selective receivers, resonant antennas (in most cases) and, perhaps most importantly, an understanding of low frequency propagation (that skywave propagation on those bands is essentially confined to the hours of darkness).

So, for my modest setup, I believe that a transatlantic QSO using a lossy vertical, and QRP, on 80m in daylight at sunspot minimum, is just plain impossible (although, actually, sunspot minimum may well be the best time to try long-distance tests on the very low frequencies he was undoubtedly, though unknowingly, transmitting on). Adding this to the other results I had, I am convinced that luck played a large part in Marconi's earliest successes, and whatever these were they were even more extraordinary than any of us realise.

The Arrival of Science

Science came to radio mainly after the WW1. Amateur operators started playing a role, and a few highly competent scientists and engineers started trying to establish how wireless transmissions worked. Appleton confirmed experimentally the existence of layers in the atmosphere, which Heaviside had suggested earlier, and that these were the main components in radio wave propagation. The Marconi Company moved with the times, and new and more powerful equipment was manufactured, using the latest scientific advances. Here Marconi was at last in his element, and his forte as a business entrepreneur delivered astounding successes, both as equipment manufacturer and as a service provider. Many amateurs contacted me during the project, for which I am very grateful. Some, like **Bruce G4EUW**, owe their careers to Marconi's successes. And in a way there would be no mobile phones without his kickstarting the age of wireless.

Marconi's story is not really about technical, scientific or engineering achievement. All the pieces of the communications system he used had, more or less, been designed by others, often for more scientific purposes. Marconi's genius was that he saw something no one else saw, at a time when that was exactly what the world needed and wanted. It was an era of big ships, both transatlantic liners and naval battleships. People on these ships wanted a means to communicate with the shore. Marconi alone saw this clearly and at an early stage. His foresight, backed up with access to commercial support, almost guaranteed his success. As Bruce said in a recent e-mail, *"Marconi was a very successful entrepreneur, and just put it all together thank goodness or I wouldn't have had such a very interesting career at sea"*. Amen to that.

I would like, if I may, to end on a personal note – at the end of my (less than exotic) career, I worked in telecommunications, specifically on the starting up of the internet. One of the companies to whom I provided assistance was called Marconi Communications, which could trace its lineage right back to the original Marconi Company of 1897. I'd not want to say that I had any part in the eventual demise of that company, and the disappearance of the Marconi name from the communications field. But I can say with absolute certainty that my input didn't do them that much good either!

In 2020 I'm off on another journey. I've requested permission from the Management here to set up a portable station on Mars or the Moon but this request has been denied. But I have another idea! 73 and good DX.

Online Propagation Predictions

Steve White G3ZVW looks at propagation prediction software and websites.

Steve White G3ZVW
practicalwireless@warnersgroup.co.uk

Long, long ago people had a variety of methods of finding out what propagation on the various HF bands was likely to be, although they weren't always reliable or even based on science. They had personal knowledge built up over the years, information passed on from others, magazine predictions, hearsay and sheer luck! Although propagation prediction is not a precise science, these days we have better methods at our disposal, namely software and the internet.

Before I go into anything in detail let me say that there are now so many tools at our disposal it would be impossible to discuss them all in the space available here, so this feature will cover just one that is popular and has been found to be fairly accurate. Something many of the current methods of prediction are based on is IONCAP, the Ionospheric Communications Analysis and Prediction program. Modern online tools refer to this when you visit a website.

Software

There's a lot of prediction software about, both paid-for and free. Some programs are as accurate as it is possible to be (note I do not say they are guaranteed to be totally accurate), but the prospect of greater accuracy can make them complicated to use. This feature will concentrate on just one that is quite easy to use – which is very important for those who are new to the subject or easily put off by complications – PREDTEST.

Complications

Before I go on to tell you about using this online tool, I need to let you know about why the use of any propagation prediction software isn't simple, even if you know what the state of the ionosphere is. This is because the signal that is likely to be received at the far end of a contact doesn't only depend on the propagation between the two stations concerned.

First, you need to know how powerful the transmitter is. Then, consider what antenna the transmit station is using and how high it is. Next, consider what antenna is being used at the receive station and how high it is. In some software the conductivity of the soil in the vicinity of each station is also considered, because it too has an effect. The slope of the ground surrounding each station also has an influence! Finally, consider which mode of transmission is being used. SSB might be the mode of choice for many, but at about 2.3kHz in bandwidth it is unlikely to be received as well as any narrowband mode. Morse (CW) is narrowband and the most traditional mode of them all, so it is likely to be received much better than SSB when propagation is marginal. Nowadays, thanks to personal computers we also have lots of digital modes that can be used. Phase Shift Keying (PSK) in its various incarnations can be received and decoded by a computer when it is too weak for the human ear to hear it and modern modes such as FT8 and FT4 are even better at getting through.

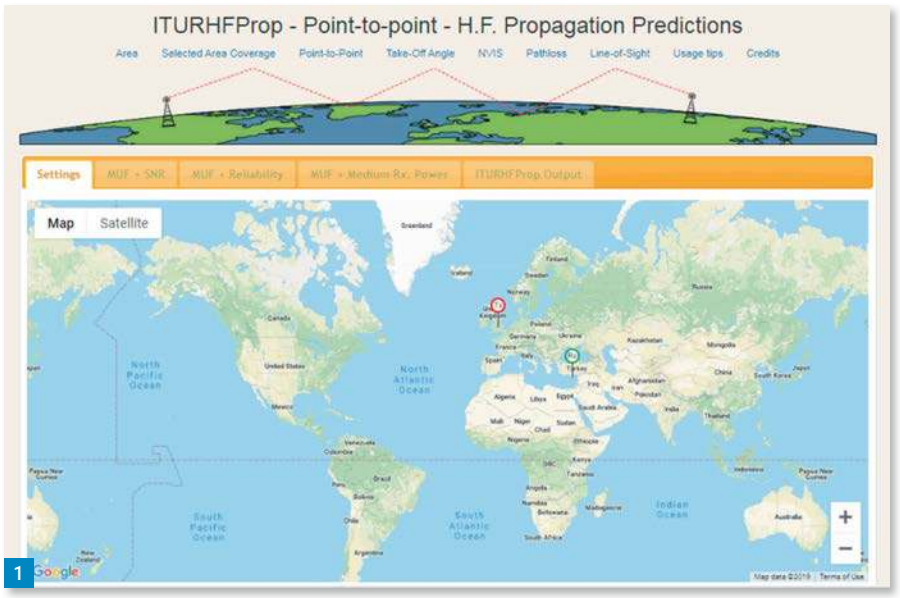


Fig 1: World map on the Predtest website.
Fig 2: Area in which parameters are input.
Fig 3: Predtest graph of propagation.

Practical Example

Where possible I like to give practical examples, so when writing this column I looked up DXpedition operations that had been announced for January 2020 (the date of this edition of *PW*). There were several, but one that caught my eye was ZC4UW, the Cambridge University Wireless Society's DXpedition to activate the UK Sovereign Base Area on Cyprus. It is scheduled for January 2nd-7th. Cyprus isn't too far from the UK, which is an advantage when HF propagation is likely to be adversely affected by the poor state of the ionosphere at Solar Minimum. The distance between Cyprus and the UK is a bit over 3000km, which is essentially one hop of the F2 layer of the ionosphere. The F2 layer is responsible for the longest range radio refractions but isn't likely to be highly ionised. This makes a big difference.

First though, some perceived wisdom. It is well known (see the very first edition of this column in March 2016) that you should operate higher in frequency during the day and lower in frequency at night, so without looking at any charts or running any software I would say to try the upper HF bands (14-28MHz) when the radio path between the UK and Cyprus is in daylight and the lower HF bands (3.5-7MHz) at night. Now consider the general state of the ionosphere, which is not strongly ionised because we are at a Solar Minimum. A distinct lack of Sunspots means the upper HF bands are in really poor shape, so during the day I wouldn't expect stations in the UK to be able to work Cyprus on 21MHz with any degree of reliability or on 28MHz at all. In the upper part of the HF spectrum that leaves the 14 and 18MHz bands, but even 18MHz isn't likely to be 'open for business' at all times. During the day 7MHz and 3.5MHz

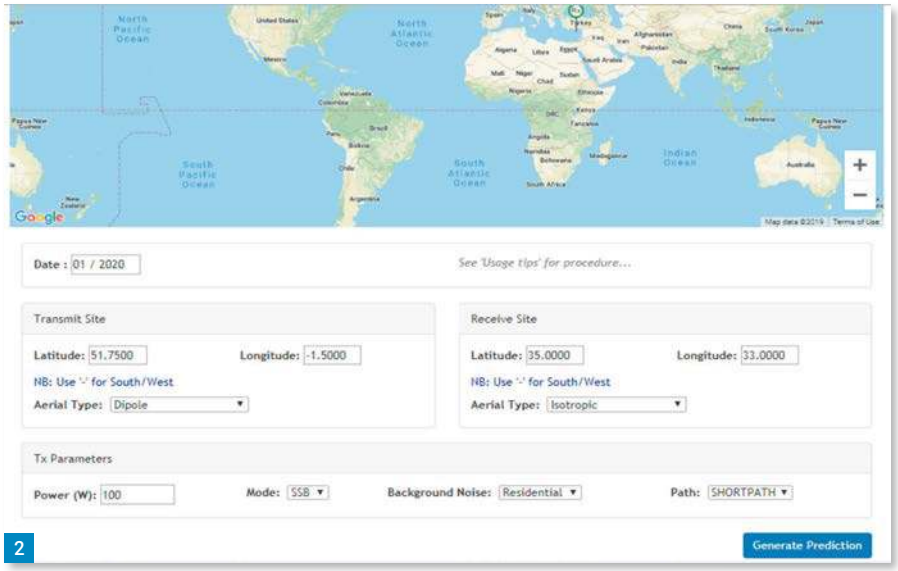
won't work for you but at night 7MHz signals should be strong and 3.5MHz signals should be of workable strength. There is, of course, one HF amateur band I have yet to mention, namely 10MHz. Being at a kind of halfway point between LF and HF, this band can often enjoy good conditions both during the day and at night. It is not greatly affected by the Solar Minimum but because it is only 50kHz wide only narrowband modes are permitted, by international agreement. This means CW (Morse) and data modes are permitted but telephony (e.g. SSB) is not. In fact, this restriction is no bad thing, because narrowband modes can get through much better when radio conditions are marginal.

Now let's look at what PREDTEST says about working from the UK to Cyprus in January 2020. It's a simple, online tool, so there is no need to download or install software or an app. Visit the website at:

www.predtest.uk

Even though it is simple you still need to input information to obtain meaningful results.

• First of all, near the top of the page, click on **Point-to-Point**
• This will bring you to a map of the world, **Fig. 1**.
• Input the following information into the boxes below the map (see **Fig 2**).
• Date: **01/2020**
• Transmit site latitude: **51.75** (or whatever your latitude is)
• Transmit site longitude: **–1.5** (or whatever your longitude is, West being negative)
• Transmit antenna type: **Dipole** (or whatever your antenna is)
• Receive site latitude: **35** (the latitude of Cyprus)
• Receive site longitude: **33** (the longitude of Cyprus)
• Receive antenna type: **Isotropic** (or whatever the antenna is)
• The transmit parameters should be:
• Power (W): **100** (or whatever your power is)
• Mode: **SSB** (or whatever the mode is)
• Background noise: **Residential** (or whatever your local environment is)
• Path: **Shortpath**
• Then click on **Generate Prediction**.



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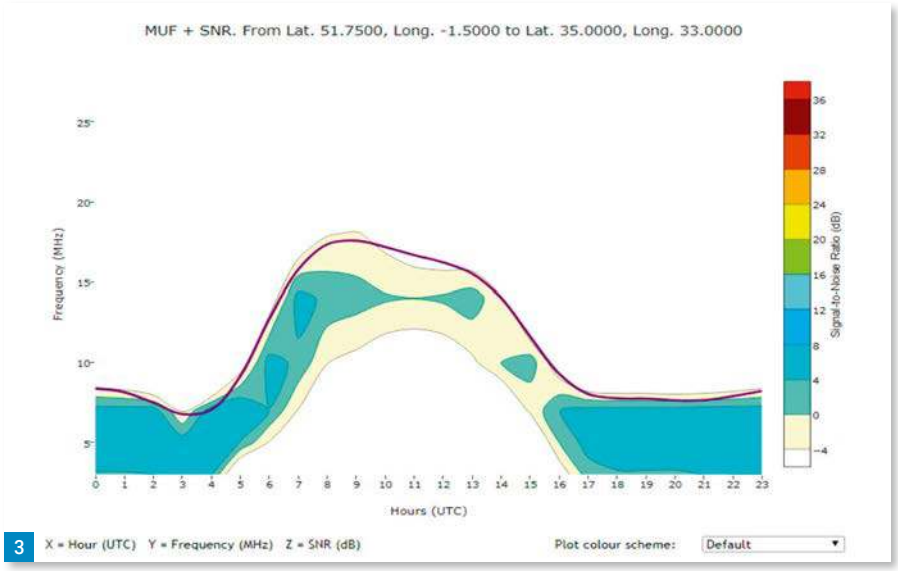

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The Results

You will be presented with a graph like the one shown in **Fig 3**. It shows the hours of the day along the bottom axis and frequency on the vertical axis. The Maximum Usable Frequency (MUF) is the wavy purple line and the coloured areas show the Signal-to-Noise ratio (relative signal strength) on various frequencies at various times of the day.

Move the mouse pointer around the graphic to show more information that is position sensitive.

What this graphic shows is:

1. The Maximum Usable Frequency is higher during the day than it is at night, but never above 17.5MHz.
2. Signals are unlikely to be strong on any band at any time, because the coloured areas of the graphic never go green/yellow/orange/red. The 'fuel gauge' on the right gives colours to show a relative indication of Signal-to-Noise, higher up the gauge being stronger.
3. The best band during daylight hours will be 14MHz.
4. The best bands at night will be 3.5 and 7MHz.
5. 10MHz will be the best band at about 6am.
6. During daylight a QSO might just be possible on 18MHz, but no higher in frequency.

Now go back to the previous page, alter some of the parameters and see how the changes you just made affect the results. In particular, change the mode to FT8. It will make a huge difference to your potential for making a contact, including bringing higher frequency bands into the equation. Even though FT8 signals might read the same on an S-meter as an SSB signal, the Signal-to-Noise ratio when using FT8 will be much better because the bandwidth required it is much less.

Finally, go back and change the latitude and longitude from Cyprus to somewhere much further afield. Doing this will drop a pin on the map at the new location. When you've clicked **Generate Prediction** the new graphic will demonstrate (1) how difficult it is to make long distance contacts on HF at this point in the Solar Cycle and (2) why the new mode FT8 has taken the HF amateur bands by storm.

Your Letters

Send your letters to: Practical Wireless Letters, Warners Group Publications plc West Street, Bourne, Lincs PE10 9PH
E-mail: practicalwireless@warnersgroup.co.uk

VHF/UHF Operating

Dear Don,

Chris Speak M7COP (*Letters*, November) is quite right to extol the virtues of VHF and UHF operating and I hope he continues to get great enjoyment from the bands.

However, (you knew it was coming), he's not so squeaky clean when he promotes the virtue of the cheap handheld as a VHF/UHF thing. The little QCX transmitter is a full band, 5W transmitter on any band you build it for and costs about 50 quid or less. Of course, the user has to knuckle down and learn a new skill but isn't that why we joined amateur radio and not CB?

The QCX isn't unique. There are many HF transceivers now available for very little money. The uBitX and BitX rigs spring to mind and it seems more and more arrive each month. The BitX series are also SSB.

Amateurs who can use Morse code enjoy a very different and potentially cheaper hobby from those who can't, yet to learn Morse takes no more than 10 to 15 minutes a day. Some will scoff, but ten minutes a day releases a world of QSOs for a few tens of pounds. I really can't see why more people don't do it.

So, VHF, UHF and HF all available for a few quid if you know your onions.

David Perry G4YVM
Salisbury

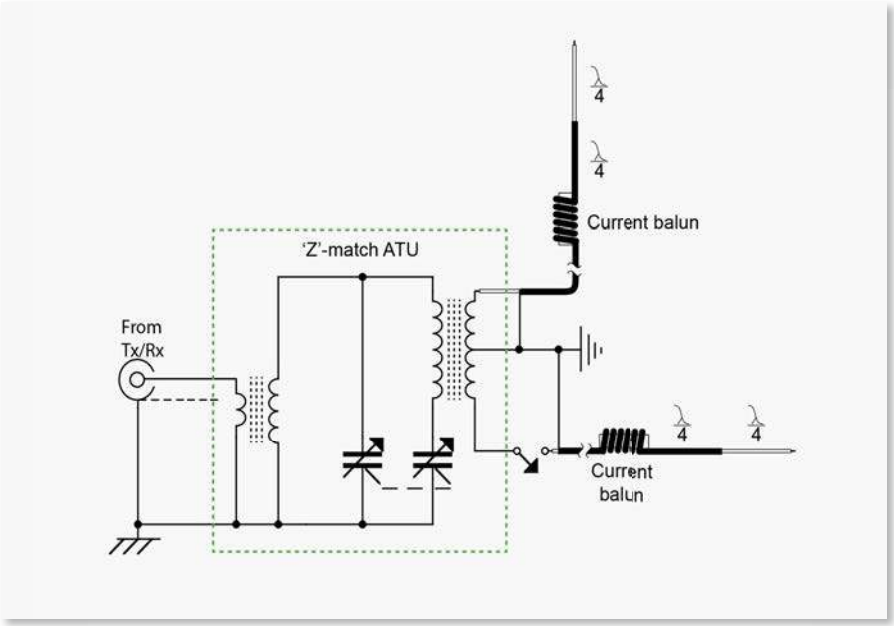
The Double Vertical Quarter Wave Coaxial Antenna

Dear Don,

Some time ago I was at my summer QTH and experimenting with a vertical quarter-wave coaxial antenna connected to a Z-match ATU working in the 20m band. Near the end of my vacation I decided to make the following experiment.

Another quarter-wave antenna was fabricated and in the Z-match ATU secondary output I added four more turns to connect the new antenna. A switch was included to allow me to use one or two antennas at the same time. The schematic, see diagram, is self-explanatory.

The original antenna was hanging from a bamboo pole and the new one was supported in a horizontal position to a pine tree. Therefore, the two radiators were at right angles.



Jorge's experimental double quarter-wave antenna.

Outstanding results were obtained with both radiators working at the same time. First, other stations appreciated an increase in my signals and second, fading was reduced just a little bit.

How we can explain these effects? In my modest opinion the signal increase is due to the increase in the radiating surface. The fading reduction could be due to a change in the radiation pattern that now is different to the classic antenna dipole. Unfortunately, an antenna analyser was not available to obtain more data.

The current chokes included after the two quarters, were made using a coil of coax around a PVC core. An improvement could be to substitute it by a ferrite choke. In many magazines there are advertisements displaying this type of choke that could be perfect for this application.

But the worst thing is that I cannot repeat this experiment because the tree from which I hung the horizontal section collapsed in a heavy storm. I think that this antenna needs more experimentation to find its real potential, therefore I invite more people to continue the test that I cannot perform now.

Jorge Dorvier EA4EO
Madrid

*(**Editor's comment**: Good to hear from you Jorge. I suspect at least part of the explanation lies in the 'double' antenna having both vertical and horizontal polarisation – fading is often the result of changing polarisation of incoming signals. But I'd be interested in reader feedback with thoughts on your intriguing antenna configuration!)*

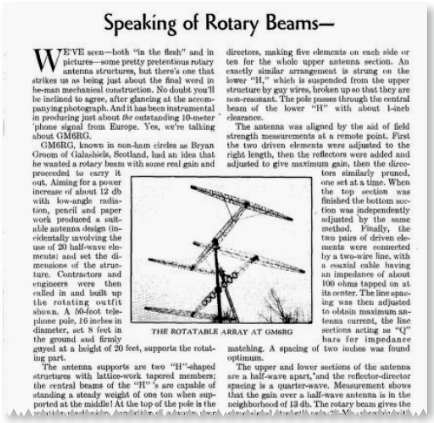
How Hot does the 7400 Get?

Dear Don,

Referring to the D70BOX project (*Practical Way*, October), it's probably old news since I'm even further behind with my reading list than usual!

However, it looks as though all the pins down the left-hand side of the IC are connected to GND although two of those pins are outputs. This wouldn't be a problem if it was a quad AND gate, because all the inputs grounded would send the output the same way, but it's a NAND gate, which means the output is inverted and wants to go for Vcc.

The G6RG (GM6RG) QSL card from 1930.



Speaking of Rotary Beams—

WE'VE seen—both "in the flesh" and in pictures—some pretty pretentious rotary antenna structures, but there's one that strikes us as being just about the final word in he-man mechanical construction. No doubt you'll be inclined to agree, after glancing at the accompanying photograph. And it has been instrumental in producing just about the outstanding 10-meter 'phone signal from Europe. Yes, we're talking about GM6RG.

GM6RG, known in non-ham circles as Bryan Groom of Galashiels, Scotland, had an idea that he wanted a rotary beam with some real gain and proceeded to carry it out. Aiming for a power increase of about 12 db with low-angle radiation, pencil and paper work produced a suitable antenna design (incidentally involving the use of 20 half-wave elements) and set the dimensions of the structure. Contractors and engineers were then called in and built up the rotating outfit shown. A 50-foot telephone pole, 10 inches in diameter, set 8 feet in the ground and firmly guyed at a height of 20 feet, supports the rotating part.

The antenna supports are two "H"-shaped structures with lattice-work tapered members; the central beams of the "H"'s are capable of standing a steady weight of one ton when supported at the middle! At the top of the pole is the [illegible] directors, making five elements on each side or ten for the whole upper antenna section. An exactly similar arrangement is strung on the lower "H," which is suspended from the upper structure by guy wires, broken up so that they are non-resonant. The pole passes through the central beam of the lower "H" with about 1-inch clearance.

The antenna was aligned by the aid of field strength measurements at a remote point. First the two driven elements were adjusted to the right length, then the reflectors were added and adjusted to give maximum gain, then the directors similarly pruned, one set at a time. When the top section was finished the bottom section was independently adjusted by the same method. Finally, the two pairs of driven elements were connected by a two-wire line, with a coaxial cable having an impedance of about 100 ohms tapped on at its center. The line spacing was then adjusted to obtain maximum antenna current, the line sections acting as "Q" bars for impedance matching. A spacing of two inches was found optimum.

THE ROTATABLE ARRAY AT GM6RG

The upper and lower sections of the antenna are a half-wave apart, and the reflector-director spacing is a quarter-wave. Measurement shows that the gain over a half-wave antenna is in the neighborhood of 13 db. The rotary beam gives the [illegible]

1938 QST feature, with GM6RG 28MHz beam.

The quick and dirty bodge is snipping the unused pins off the IC but that sets a trap for any future repairer. Performing surgery on the copper tracks is an alternative but the end result might not be pretty. A really lazy bodger could countersink the copper lands for the unwanted pins so they're difficult to solder, but that creates a risk of the pin ends getting dog-eared and making contact anyway.

My preferred fix is to use a 7401 or 7403. They're both open collector types, and I think one of them is rated for 15V. You have to add external pull-up resistors, but it's no biggie when you're only using half the outputs. It won't match the rise time of a standard TTL totem pole output, but I doubt that will cause many difficulties at 700Hz.

On another topic, the **Bob Harry G3NRT** crystal set (*Letters*, October). I didn't notice a bleed resistor in the schematic presented. As far as I can recall, a crystal earpiece needs a bleed resistor because it's more or less a capacitor. The capacitance charges up to the highest peak and then just sits there not doing much.

Since its intended purpose is to be a transducer and not a capacitor, the specifications normally mentioned in connection with capacitors are seldom supplied. The most obvious point being that an earpiece with leaky 'dielectric' might produce some sound without a bleed resistor but it's unlikely to give its best.

★Star Letter

The Star Letter will receive a voucher worth £20 to spend on items from our Book Store, or other services offered by Practical Wireless

It started with TVI

Dear Don,

I send the following after reading **Tony Smith's** recent *Valve & Vintage* piece (December) about amateur radio during WWII. It brought back some memories.

In 1973, I had moved to a new QTH in Peebles and draped a makeshift longwire antenna to the foot of the garden. Matched up to an ATU, this gave me acceptable results on 80m – the only band my home-made SSB transceiver operated on.

Then came the knock at the door. I pleaded guilty to interfering with next door's TV when I transmitted.

As Peebles is in a valley surrounded by hills, in the 1970s there were very few external TV antennas and these were confined to houses high on a hillside. Our neighbours, like nearly everyone in the town, had a rented television set and had 'piped' TV from the local relay company who had wires running between and along properties carrying the TV signals. No doubt, because of the proximity of my antenna to these cables my 80m transmissions were swamping the piped TV.

However, I'd been told that the piped signals carried down the relay company's wires were close to the 80m amateur band and the company had been informed at the outset of operations that should TV interference be caused by an amateur station, the company had to solve it. Hmmm – interesting.

I contacted the radio interference office based in Edinburgh explaining the situation and soon was paid a visit. He checked my equipment, verified that my signal was in the amateur band (!) and asked me to make some test calls while he went down the street. About 30 minutes later he returned confirming that my signals were 'leaking' into the piped TV system. He could see my interference in most houses my side of the street and a few on the opposite side.

As a result, he formally requested that I close down my station for seven days, adding that this time would be enough for the relay company to *"do something"*.

The relay company contacted me and a plan of action agreed upon. They would erect a 'balanced' antenna. I still had my wound-up W3DZZ trap dipole used at my previous house, so true to their word, an engineer and a fitter arrived soon after. Up went the W3DZZ and no interference was seen on test calls. Case completed to the satisfaction of both the radio interference officer, relay company and myself.

Before he left, the engineer remarked that he'd only ever put up one other amateur antenna *"and that was before the war in Galashiels"*. Bells started the ring with me and I went inside and produced my copy of a wartime RSGB publication, *The Amateur Radio Handbook* – 2nd edition 11 printing 1944, to show him the picture (page 201) of a Scottish amateur's antenna for 28MHz. The engineer went quite quiet and then asked if I'd looked closely at the photo: *"Could I see someone standing on the beam?" "Yes." "Well that's me!"* He said that this would have been about 1937 and the amateur was a **Mr Groom**.

Subsequently, I asked some of the older amateurs in the Borders about Mr Groom – it transpired that Bryan GM6RG had been very active on 28 and 54MHz before WWII and had a good signal into the USA. One story told to me was that he'd worked a station in the US who gave his location as California, only to be asked by Bryan *"Which part of California? – I might need to turn the beam!"*

Another tale was that during the war, he'd heard some transmissions from near Melrose (not far from his Galashiels QTH) and this had led to the arrest of someone.

GM6RG seems to have disappeared from the amateur scene after the war but was responsible for setting up a radio relay system in Galashiels. Bryan passed away in the 1950s. His enormous antenna system was written up in a 1938 *QST*. There are also a few references to GM6RG on the internet.

Bruce McCartney GM4BDJ
Langholm, Scotland

Resistor values published in projects always seemed just random. I'd put 47kΩ in series with a 2MΩ potentiometer and tune for best sounding smoke.

I've no idea about the impedance of early telephone set earpieces, but the Armed Forces mostly used 4kΩ headphones, I believe they usually formed the non-isolated anode load. It's alleged that a common practice among infantrymen was pinching the headphones off the tanks for DIY crystal sets.

Most modern telephone earpieces I've seen were somewhere around 140Ω. This is close enough to the now rare as rocking horse manure 150Ω speaker used in the Philips EEkits of many years ago. This was the non-isolated collector load in various audio projects, driven by a BC148 with a small heat fin, or an AC126 in the early kits.

Archive of user manualsfor the Philips EE electronic experiment kits and related kits can be found here:

https://ee.old.no/library

Trying to use a 140Ω earpiece on a crystal set would be optimistic but a general-purpose transistor with simple bias and a 9V battery and you're good to go.

Ian Field
Letchworth

Morse Boot Camp Success

Dear Don,

I obtained my Class A licence as it was then in 1995 when I somehow passed my 12WPM Morse test having been self-taught and haven't used it since.

I recently became aware of a 'Morse Boot Camp' being organised by the Essex CWAR club at Witham within easy travelling distance of my QTH. I felt that I would like to find out how much had stuck so signed up.

On arrival, I was welcomed and could see that the room was arranged into areas for the different speeds, something that must have taken some time. Getting their priorities right, tea, coffee, cake and biscuits were freely available during the day with hot sausage roll for lunch.

I was rightly in the beginners' group with another person who had knowledge gaps like myself plus a complete beginner. It was good to go back to basics and we could move to another group if we felt we were 'up to speed'. I really enjoyed the day and learned a lot. There was no pressure because we could break off if we wanted to. It was also interesting to see the variety of keys in use plus a selection brought for display. I think I was the only one with an American key in the room. **Andy** our tutor also demonstrated a live QSO, having been originally trained while in the Royal Navy.

At the end some small prizes were awarded courtesy of Martin Lynch and Sons. The fastest speed was 31WPM and the person who had travelled the furthest came from northern Holland. The fact that he wants to return next year says it all about the event.

My thanks to the Essex CWAR Club team and especially Andy for his patience and his wife's cakes! I don't know how they do it all for £10 a head.

I have considered going back to my old callsign of G8JBK but opinion varies over the 'value' of a 'G' as opposed to 'M0', especially where Morse is concerned. What do you think?

John Sones M0AA0
Ipswich

*(**Editor's comment**: Thanks John. Readers will have read about these Boot Camps in **Roger G3LDI's** regular column so it's great to have such positive feedback. I know the concept is becoming well established with Boot Camps springing up all over the place!)*

PW Inserts

Dear Don,

Have just been looking through some old issues of *PW* I have here, having a clear out because I have a house move coming up. This then got me looking through my junk for some of the datacards that used to come free with them. In fact, I think the first issue of *PW* that I bought had a free prefix map (May 1982), which I feel I still have somewhere within a box or file.

These used to be handy items that adorned the shack wall and always came in handy when trying to find relevant information in my SWL days. Maybe it would be a good idea to run a series of these now for our newly licensed colleagues, or even us old timers, bringing them right up to date. And maybe run the *PW* Morse Oscillator construction project from the January 1982 issue using modern parts. All good stuff and got me thinking about a new rig!

Thanks for the memories,

Chris Colclough G1VDP
Nuneaton

*(**Editor's comment**: Thanks Chris and good to hear from you. I well remember the old datacards and similar - I still have a rather natty units converter, probably from the early 70s, and a resistor and capacitor colour code chart. Prior to those, many older readers will recall the Blueprints, with a nice large circuit diagram, chassis drilling templates and more. Sadly, the resources to put such things together are probably beyond the magazine nowadays, with a circulation that, while still strong, is well below those halcyon days. Your idea of a modern Morse oscillator would be good. I don't recall that particular article (I'll look it up!) but I have a couple of volunteers to update some of the **George Dobbs** articles with modern components – watch this space in the coming months – and a Morse oscillator would be a great project too.)*

New Look PW

Dear Don,

I love the new cover. So different that I nearly missed it in my local W H Smith's. Like the refurb inside too. Not so keen on all those glossy ads though. But there again, no ads, no mag!

One last thing. Although I commend those (Like **G4ZRL**, *Letters*, December) who take the time and patience to pump out Morse sessions for practice, practice and more practice, with due respect to **Harry**, starting off slow is not the best place to start learning CW. Begin at the higher speed such as 15WPM, for example. But, of course, leave longer gaps between words once each letter is instantly recognisable. Besides, recognising whole words in CW does become easier over time by using this approach. Beginning slow is a big mistake. Well, I think so anyway.

Ray Howes G4OWY
Weymouth

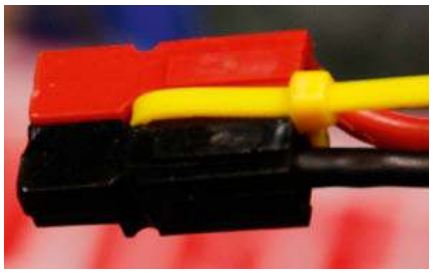
Powerpole Connectors

Dear Don,

It was interesting to read your article on the topic of Powerpoles (*Practical Way*, November). Here in New South Wales W.I.C.E.N. (the Oz equivalent of Raynet) have been using them for quite some time.

Using the welded-pair variant of the 15 to 45A shells (which don't need a retainer pin) gets over the *"is it red on the right?"* problem. I've found the strain-relief problem fairly easy to overcome too. I use a narrow cable-tie through the unused retainer hole and around 50mm of 16mm (dia.) double wall 4:1 heatshrink tubing over the top.

Terminate the cable as usual, then run the cable tie through the retainer hole and tighten it to leave a tail alongside the cable for the glue of the heatshrink tubing to grab. The photo was taken just after the cable-tie is tightened. I'd run out of the heatshrink. The tubing itself is wide enough to slip over the



Cable tie used for strain relief.

connector after making sure the contacts are properly home in their shells.

Keeping the tubing behind the retainer hole as it is heated will make sure that it doesn't stick out far enough to stop mating, and a careful squeeze on the hot tubing with gloved fingers or pliers will spread the glue to under the tie, making the whole thing quite secure and moisture resistant.

Brian Conner VK2NQ
Newtown, NSW

Band Use

Dear Don,

When I read the absurd letter from **Ross G4DTD** in the December 2019 *PW* (*Letters*) I felt that I should reply. I agree that sometimes the 2m band appears dead, but saying that it can be reduced to just 145 to 146MHz would not be reasonable because some of the repeater inputs are below 145MHz as is APRS, which is designated 144.800MHz, and also VHF beacons. The data modes activity channel and ATV talkback are there, as is the SSB section. Last evening, I had a regular sked on FM and while listening on 145.5MHz from 1930 to 2000UTC I heard no fewer than seven stations call and made QSOs with some of them after moving them to a working channel. In the SSB sector there were several stations in QSOs. I must admit that I haven't heard any activity in the 146 to 147MHz band, but I notice that Ross quotes the limit as 148MHz so that may explain why he has never heard signals between 147 and 148MHz.

Now to the HF bands. Ross claims that 160m band is dead both day and night. This I cannot agree on. There are quite a few nets that take place during the day on 80m e.g. RAFARS, RSARS, and several nets with just friends over the years and a lot of these nets also have an evening session on 160m. I personally have a regular net on 160m every Saturday afternoon, I have been licensed for 60 years and during all those years I have not missed more that about ten sessions. I then move to 2m to carry on the net on FM.

The 5MHz band has to be split up into segments because it is still allocated to and used by the MoD, which for obvious reasons has precedent. So until they vacate the band we can never have the continuous coverage. We are extremely lucky to have it at all. You get very good DX openings on this band at times. I find it is an improvement on 40m. Ross states that the 24MHz allocation is too small. Well it is really meant for amateur satellite and data modes so it is sufficient for the designed modes. Then his next contention is the 28MHz band, he says that *"Due to conditions and lack of use"* it could be cut to 28 to 29MHz and do without the 29 to 29.9MHz section. But what about the FM section around 29.6MHz that some repeaters occupy, does he oppose these ? Once agai,n he has got his band limits incorrect. The upper limit is 29.7MHz. I cannot really agree about his findings. I have recently had several European contacts both on SSB and data on this band. Obviously you will get some very short QSOs such as UR RST 59 73 when the station is just looking for a reports, and also language problems may come into it, but you can get involved with quite long chats even on the higher bands, which I do. I never use CW mde, only SSB, FM and several data modes such as PSK31, 63 and 128 also the newer ones (FT4, FT8 etc). Practically anytime during the day and evening even with the 11-year cycle now at the lowest I manage to have some QSOs on most bands. Ross possibly does not realise that the bands will be least active until the next cycle improves, hopefully.

I only run very modest equipment here, Yaesu FT-991 at 60W mostly into a G5RV at 30ft for HF and 20W on 2/70 into a Discone in the loft space, so not a high power station.

Lastly just to sum up, I do wonder if Ross, with all his talk about selling part of the bands to other users, has some vested interest in OFCOM and trying to boost their income!

Derek Bemister G3OBX
Romford

*(**Editor's comment**: Thanks Derek. I daresay some of what Ross had to say was intended to be tongue-in-cheek but you make some good points. The so-called WARC bands (10, 18 and 24MHz) are all narrow but we are lucky to have them at all and they allow us to learn about propagation – I well recall hearing a Pacific DXpedition coming through for hours on end on 24MHz when they had no propagation to Europe on 28MHz. And I agree that FT8 and its various cousins have given a new lease of life to many bands, with QSOs going on at times when propagation would not support other modes. I do think there is a problem to be addressed on the VHF and above bands, where we have lots of bandwidth but relatively little activity for much of the time. However, it would surely be an act of folly for the amateur radio world to give up hard-won allocations, especially when, over the years, we have continually found new ways of using them.)*

Rallies & Events

Plan your visits with our list of forthcoming events. Warners (Practical Wireless & RadioUser) will be attending events marked with an asterisk (*). Club secretaries/ event organisers: Please send full and accurate details of your events, affiliations and clubs as early as possible if you would like to be mentioned here: **wiessala@hotmail.com**

December 29th (Sunday)
YEOVIL ARC CHRISTMAS RALLY: The rally will take place at Davis Hall, West Camel, Yeovil, BA22 7QX. Open 10 am to 2 pm. Entry £3. Wheelchair-friendly. Light refreshments. There are more than 25 tables. Free parking. The event is sponsored by Lindars Radios
01963-440 167
wjh069@gmail.com
FB: Sparkford Wireless Group

February 2nd (Sunday)
SOUTH ESSEX ARS CANVEY RADIO & ELECTRONICS RALLY: The 36th Canvey Radio Rally takes place at the Cornelius Vermuyden School, Dinant Avenue, Canvey Island, Essex SS8 9QS. Talk-in is on 145.550MHz. Free car parking, and easy level ground floor access to two large halls. Doors are open at 10 am, disabled visitors can come in from 9.45 am. Admission cost is £3, children under 10 go free. Tea, coffee and soft drinks will be available, as well as bacon butties.
tony@tonystreet.net
07986 070 040
thowchen@hotmail.com
www.southessex-ars.co.uk

February 7th to 9th (Friday to Sunday)
ORLANDO HAMCATION : The Orlando Amateur Radio Club is hosting the 74th Annual Orlando HamCation at the Central Florida Fairgrounds and Expo Park. HamCation is the second-largest ham radio convention in the United States, with the inaugural event dating back to 1946. The 2019 convention saw 23,700 attendees, a record number for the event. This convention is a celebration of ham radio, also known as amateur radio. Amateur radio use in the United States dates back to the early 1900s and continues to be used today for both emergency situations and as a means for daily communication between ham radio operators. HamCation is a great opportunity for both those in the ham radio community and those interested in learning more about ham radio to come together.
With almost 90 vendors being hosted this year, there will be something for everyone. The HamCation website has undergone several updates for this year, with more easy to use features and ticket purchasing system.
(+31) 633 016 551
pmeijers@hamcation.com
www.hamcation.com

February 9th (Sunday)
HARWELL RADIO AND ELECTRONICS RALLY: The rally is at the Didcot Leisure Centre, Mereland Road, Didcot, Oxon, OX11 8AY (3 miles from Milton Interchange on the A34). Doors are open 10 am to 3 pm – admittance £3.00 (under 12s free). Free car parking. Disabled parking and facilities. Talk in on 145.550MHz, using G3PIA. Local and national traders, Special Interest Groups and RSGB Bookstand. Home-made refreshments will be available.
01235 816379
rally@g3pia.net

February 16th (Sunday)
RADIOACTIVE RALLY: The 2019 RadioActive Rally will take place at Nantwich Civic Hall, Cheshire, CW5 5DG. Free car parking; doors are open at 10:30 am. There will be a bring-and-buy, as well as traders, and an RSGB bookstall. A single raffle ticket is included with the entrance programme; additional tickets are available, and catering is provided.
07880 732 534

February 23rd (Sunday)
BREDHURST RECEIVING AND TRANSMITTING SOCIETY (BRATS) RADIO RALLY 2020: The BRATS Rainham Radio Rally 2020 is at the Victory Academy, Magpie Hall Road, Chatham, Kent ME4 5JB (Main Hall). There will be well-known traders, a talk-in station on 145.550MHz (Callsign GB4RRR), an interactive zone for kids, a BRATS kitchen, and much more. Open 10 am to 3 pm. Adults £3, children free.
07825 838 877
Rally-coordinator@brats-qth.org
www.brats-qth.org

March 1st (Sunday)
EXETER RADIO & ELECTRONICS RALLY: The rally will take place in the America Hall, De la Rue Way, Pinhoe, Exeter EX4 8PW. Doors open at 10.30 am (10.15 am for disabled visitors). Admission £2 (under 16s free). There will be trade stands, a bring-and-buy (book-in from 10.15 am), and catering will be available.
07714 198 374
g3zvi@yahoo.co.uk

March 15th (Sunday)
WYTHALL RADIO CLUB HAMFEST: The 35th Wythall Radio Club Hamfest is at the Club HQ, Wythall House, Silver Street, Wythall B47 6LZ. Doors open at 9.45 am (9.30 am for disabled visitors). Free on-site parking.
Admission £4. Four halls of traders including a bring-and-buy, and a club stand. A selection of refreshments will be available all day, and there will be bar facilities within Wythall House from midday.
Tel: 01386 839 655
wrc4hallsradio@outlook.com
www.wythallradioclub.co.uk

March 29th (Sunday)
DARC HAMZILLA: The Dover Amateur Radio Club Rally will be taking place again, at last year's wonderful venue of Discovery Park, Sandwich Kent CT13 9FF. There will be offers, talks and demonstrations. Admission, (Early Bird 9:30 am) is £5; general & disabled (10:00 am) is £3; under 16s and carers for disabled visitors go for free. Hot and cold drinks and food will be on sale. Lots of big-name traders already booked. RSGB-licenced exam venue, exams are available on the day. Find us, buy tickets or book a table here:
https://www.hamzilla.uk
https://darc.online

April 19th (Sunday)
WEST LONDON RADIO & ELECTRONICS SHOW (KEMPTON RALLY): The West London Radio and Electronics Show will take place at Kempton Park Racecourse, Staines Road East, Sunbury on Thames, TW16 5AQ. A talk-in station will be on air. Car parking is free, and doors open at 10 am, with disabled visitors gaining access 10 minutes earlier. There will be trade stands, bring-and-buy and special interest groups and lectures. Catering available on site.
08451 650 351
info@radiofairs.co.uk
www.radiofairs.co.uk

May 8th (Bank Holiday Friday)
DARTMOOR RADIO CLUB RALLY :
This event is at The Butchers Hall, Pannier Market, Tavistock PL19 0AL. Doors open at 10 am. Admission is £2.50. Traders and a bring-and-buy will both be present and refreshments will be available.
07854 088 882
2e0rph@gmail.com

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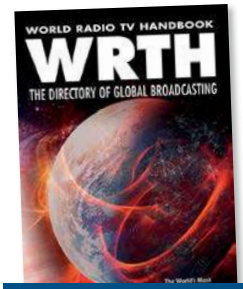

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SEE THE BOOK STORE ON PAGE 23

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Bargain Basement adverts now cost £5 per advert (subscribers still free) and will also be published in *RadioUser*, our sister magazine, unless requested otherwise.

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X-LOCK VFO STABILISER KITS the last few kits of this classic design are available at £25 including uk shipping. **Payment by cheque in pounds sterling to R Taylor. Ron.g4gxo@gmail.Com**

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Email: mikegiddings1@yahoo.com

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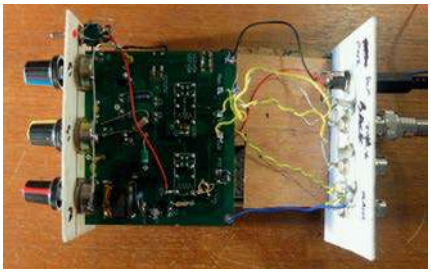
Geoff Theasby G8BMI
geofftheasby@gmail.com

From RA0SMS, a kit rather more expensive than usual at £22+ (a ready built equivalent is about £150). The PCB is good, but some components do not seem to match the circuit. A 100mH choke is supplied as 1000mH and a 330Ω LED resistor is supplied as 33kΩ – there is no LED. The parts are a mixture of surface mount and through-hole, with occasional provision for both! The relays are energised when the unit is 'On', which means that if the transmitter 'Press to Talk' is activated, or when the unit is 'Off' they disconnect the circuit from the transmitted power, and the RF will not harm the small semiconductors. Assembly instructions are not provided, so you are on your own. Hours of fun and entertainment lie ahead! This is not a kit for the faint-hearted. Photos, components list and brief instructions for use are on the website below. My main antenna is a 40m dipole, and the noise pickup is from an end-fed, random length of wire down the garden. It works really well! See **Fig. 1**.



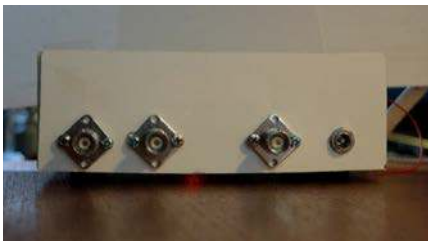


Fig. 1: About to be boxed up. Fig. 2: False rear panel.

Do note that the potentiometers, relays, TR1 (transformer) and the odd component are fitted on the underside (with fewer tracks). In the sales information, TR1 is shown at right angles to the front panel, whereas mine is parallel. I found it easier this way to connect the ends of the wires to the correct PCB pads behind the potentiometer. In the circuit diagram, with reference to TR1, '1' is the primary winding and '2' the secondary. The two-turn winding goes to the AUX terminal and chassis, and the eight-turn winding goes to either side of potentiometer R9. I used a Plastikard panel for the prototype and had 'hand capacity' effects. This was cured by connecting all the potentiometer cans together, and to chassis negative. Null points are easily audible, without watching the receiver S-meter. The location of the potentiometer next to the input transformer is R9, 'Phase', and the others are R3, 'Main' and R8, 'Aux'. https://tinyurl.com/yx7hdjl8

I built it into a steel case, bought for £2 at a rally. It is a Data Switch with three D connectors on the back and a rotary switch on the front. Remove the contents, make false front and rear panels (again I used Plastikard) and you will find that the cut-outs for D connectors are such that two BNC sockets will fit each without further chassis drilling. The rear panel is shown in **Fig. 2**.

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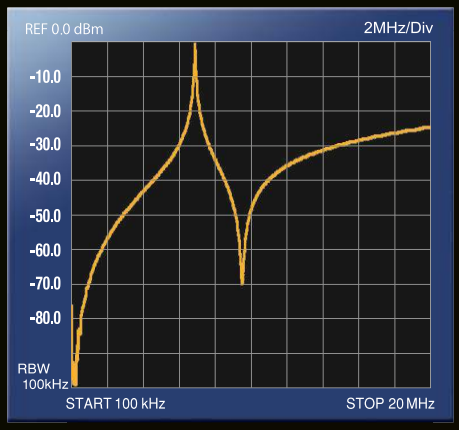
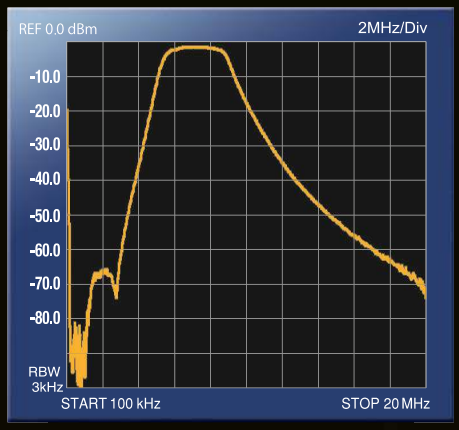


7MHz, Span 20MHz

Band Pass Filter



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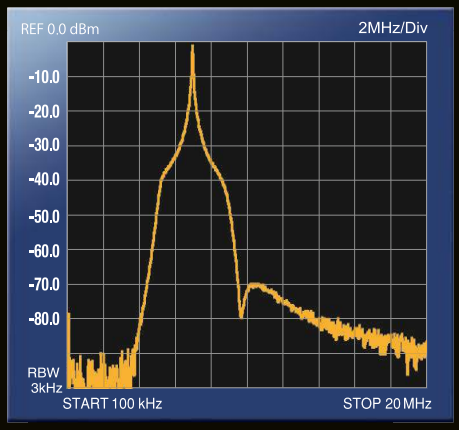

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