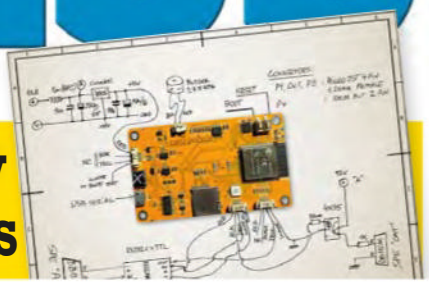
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PRACTICAL WIRELESS REVIEW



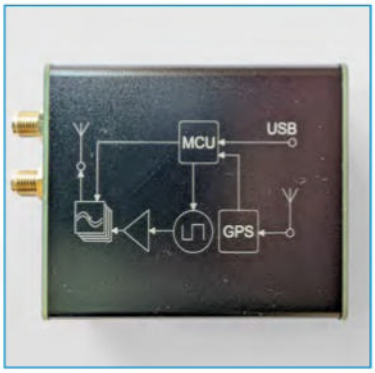
COULD THIS BE THE FUTURE?

This month, we explore the latest innovative products from Chinese manufacturer Choyong



TV and Radio History

Join us for an amble through the broadcasting archives



Radio on a Budget

A rather reasonably priced, and very useful WSPR beacon



REVIEW When a digital display is much more useful

We check out the Nissei DG503MAX Digital Readout Power/ SWR Meter

ANTENNAS How to build your own Wave Caster

Constructing a Vertical Multiband HF Antenna for Portable Operations

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Keylines

Well, it would be nice to have an improvement in the weather! Having sorted out my antenna (see last month), a storm moved it on the mast again! I'm planning to be back in Uganda for the RSGB Commonwealth Contest, with some operation before and after the contest too. This contest, I find, is always more fun from outside the UK. And I sit here waiting for the delayed Bouvet Island operation, with very little news appearing as I write.

The forgotten bands?

For the most part our reports in *PW* focus on the nine main HF bands and the VHF bands 6m through 23cm. That's because that's where most of our readers seem to be active. But let's not forget that there are many other bands available to us as radio amateurs. Above 23cm there are plenty of microwave bands, for example. It never ceases to surprise me how little activity these seem to attract (other than the QO-100 satellite, which appears to be quite busy). I was playing with 10GHz semiconductors back in 1970 during what would nowadays be called a gap year, so the technology isn't exactly esoteric. I guess the main problem is lack of commercial equipment for those bands. And the same no doubt applies to our LF and MF allocations (136 and 472kHz). 5MHz gets a reasonable amount of use but there is still a lack of harmonisation across the world which, recently, has led to a number of UK amateurs receiving letters from OFCOM advising them that they have been transmitting (inadvertently no doubt) outside the UK allocation. This appears to be a particular problem with FT8 operation, unless care is taken to choose a suitable transmit frequency within the FT8 bandwidth.

But it would certainly be great to have some reader reports on operation in any of these 'forgotten' bands.

Logging

Roger G3LDI, in this month's *Morse Mode*, argues for continuing to keep a paper logbook, in which you can include comments, information about conditions, equipment in use at the time, whatever. I fully understand this but, in my case, have taken the alternative view, which is to log exclusively electronically. Like Roger, these days I use Logger 32 as my main logging program, but for contest logging have used many programs over the years – CT (from K1EA – remember that one?), SD by EI5DI, Win-Test, N1MM and, latterly, DX Log. All generate ADIF files that can be imported to Logger 32. But I then upload to Club Log and to Logbook of the World, Club Log to ensure that I have a back-up and LoTW for awards purposes, both for me and for



anyone who wants online confirmation of a contact with me. I do this for all my overseas operations too – for smaller (holiday-style) operations I sometimes still log on paper but then use Fast Log Entry by DF3CB to generate an electronic log.

The biggest challenge was when I first started to upload my early logs – I have a big pile of traditional RSGB logbooks, with 2500 contacts (if I recall correctly) in each. It was a major undertaking, spread over several months, but one I have never regretted as I find it so useful to be able to check for previous QSOs

Online petition

There is an online government petition (URL below) to allow unrestricted development of amateur radio antennas (within certain constraints). It seems highly unlikely it will receive the 100,000 'signatures' that are needed but, in any case, it has generated some controversy within the amateur radio ranks. Should we be drawing attention to ourselves in this way? Is the request reasonable? On the other hand, getting planning permission does seem to be much harder than in years gone by, if only because of the ease with which anyone and everyone can register objections online nowadays.
https://petition.parliament.uk/petitions/755657

This month's Letters

We have a great selection of *Letters* this month – please keep them coming!

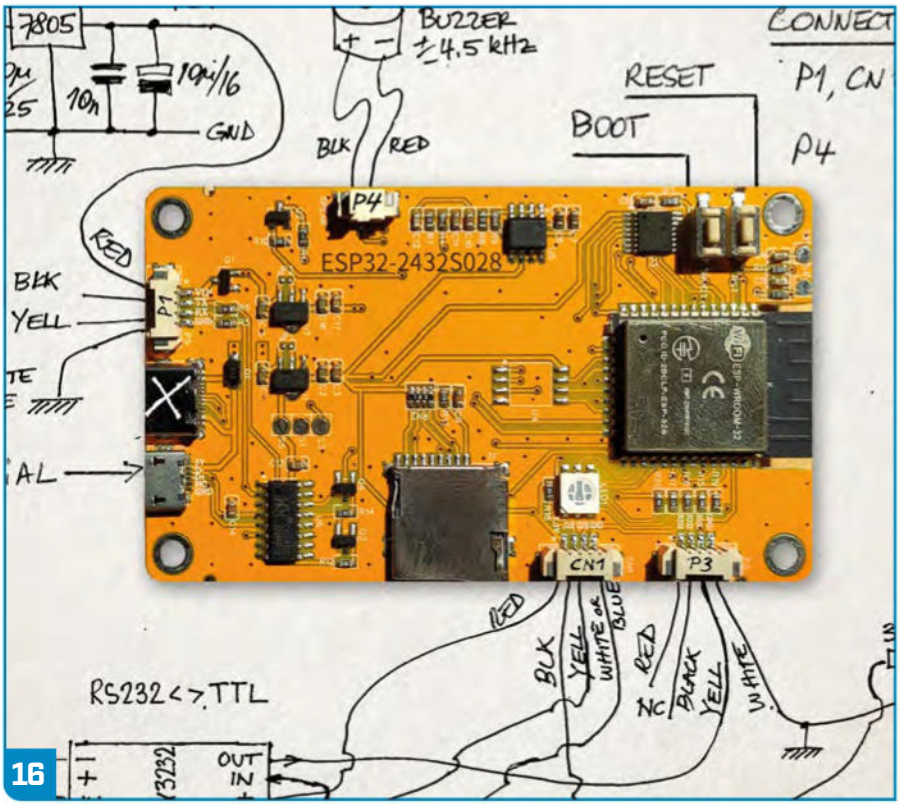
Icom IC-7300 Mk 2 Review - correction

Unlike the IC-7300 Mk1, there is no USB-B connector on the rear panel of the Mk2. Icom has changed the USB-B to an Ethernet for connecting to a LAN. **Steve G4JVG** says *"should have gone to SpecSavers"!*

Don Field G3XTT
Editor, *Practical Wireless* Magazine

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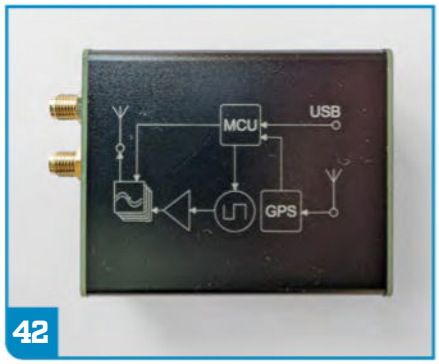
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Newsdesk

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(PW plans a review in the next month or two)







HONOURING THE TITANIC: Amateur radio operators worldwide will have an opportunity to honour the passengers and radio crew of the *RMS Titanic* that sank in the early hours of 15 April 1912.

A Spanish special event station, EG1912T, will be on the air from 0000 UTC on 10 April, the date on which the Titanic set sail from Southampton, England, until 2359 on 15 April, the date on which it sank after hitting an iceberg. The callsign is unique for this event. EG identifies Spain, 1912 signifies the year the ship sank, and T stands for Titanic.

*"Radio station managers and telegraph operators **Jack Phillips**, **Harold Bride** and **Harold Cottam**, who played a leading role in the telegraphic communications during the rescue, will also be honoured,"* said **Carlos Reboreda EA1PJ**, president of the Vigo-Val Miñor Amateur Radio Union, which is sponsoring the 2026 special event operation.

All amateur radio operators are invited to participate. Bands used will be HF, VHF, UHF, and SHF (amateur radio satellite). All modes will be available with special emphasis on telegraphy. All stations that contact EG1921T using CW will receive a special QSL card. All other stations making contact on any frequency or mode can receive a confirmation via eQSL and LoTW.

In the photo, from right to left: Jack Phillips, head of the Titanic's radio room. Harold Cottam, telegraph operator on the *Carpathia*, the ship that was first to arrive at the scene of the shipwreck. Harold Bride, second operator in the radio room. [Photos courtesy of the Vigo-Val Miñor Amateur Radio Union]

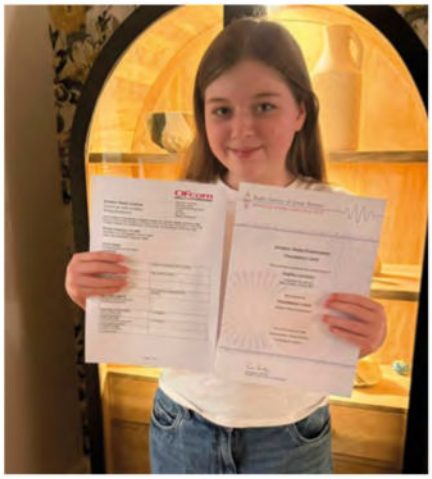
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FURNESS AMATEUR RADIO SOCIETY: The club was pleased to learn that 11 year old **Sophia Leviston**, daughter of club chairman **Chris Leviston M0KPW** has passed her Foundation Exam and now has call sign **M7WKG**. Sophia's interest in radio stems for her time at St Peter's Primary School, Ireleth, where she was a member of the Radio Club her dad Chris encouraged the school to form. He regularly participated in radio activities with the school; direction finding around the school playing fields was a firm favourite with the club members. One of Sophia's early highlights was listening in to the **Duchess of Edinburgh's** QSO with the international Space Station. Now she will be able to have her own QSO if she chooses.



SINGLE BAND DXCC: (From ARRL Board Minutes) The ARRL Board of Directors has authorised the CEO to direct Staff in establishing a Single Band DXCC Honor Roll Award for qualifying operators for the 160m-6m bands (excluding 60m). This should include a single-band DXCC Honor Roll certificate for the qualifying band(s) with the option for the operator to purchase a plaque. Feasibility of implementation to be determined by CEO and Staff.

BBC RADIO JERSEY AND BBC RADIO GUERNSEY WILL STOP BROADCASTING ON MEDIUM WAVE FROM 31 MARCH 2026: In an FAQ published alongside the announcement, the BBC said it had reviewed coverage across FM, MW and digital platforms, identifying duplication between medium wave and other services following the roll-out of DAB across the islands in 2021.
It added that medium wave transmitters are *"unlikely to be value for money in the longer term"*.
The corporation said newer platforms provide an improved listening experience and confirmed the medium wave estate will continue to be reviewed periodically. Coverage of the States of Deliberation will remain available on BBC Guernsey Extra on DAB and through the States of Deliberation website.
BBC Radio Jersey will continue on 88.8 FM, DAB, Freeview channel 711, online and via BBC Sounds and smart speakers. The BBC has been turned off AM services across the UK over the last few years, especially in the local radio network. BBC Radio 5 Live is expected to lose its AM network in the next couple of years too. Further information on retuning is available at:
bbc.co.uk/reception/help-guides

BELARUSIAN HAMS ARRESTED: The Belarusian government is threatening three ham radio operators with the death penalty, detained at least seven people, and has accused them of *"intercepting state secrets"*, according to Belarusian state media, independent media outside of Belarus, and the Belarusian human rights organization Viasna. The arrests are an extreme attack on what is most often a wholesome hobby that has a history of being vilified by authoritarian governments in part because the technology is quite censorship resistant. The detentions were announced on Belarusian state TV, which claimed the men were part of a network of more than 50 people participating in the amateur radio hobby and have been accused of both *"espionage"* and *"treason"*. Authorities there said they seized more than 500 pieces of radio equipment. The men were accused on state TV of using radio to spy on the movement of government planes, though no actual evidence of this has been produced.
State TV claimed they were associated with the Belarusian Federation of Radioamateurs and Radiosportsmen (BFRR), a long-running amateur radio club and nonprofit that holds amateur radio competitions, meetups, trainings, and forums. WhatsApp and email requests to the BFRR from 404 Media were not returned.
On Reddit, **Siarhei Besarab**, a Belarusian amateur radio operator, posted a plea for support from others in the hobby: *"MAYDAY from Belarus: Licensed operators facing death penalty."*
"I am writing this because my local community is being systematically liquidated in what I can only describe as a targeted intellectual genocide," Besarab wrote. *"They have detained over 50 licensed people, including callsigns EW1ABT, EW1AEH, and EW1ACE. These men were paraded on state television like war criminals and were coerced to publicly repent for the 'crime' of technical curiosity. Propagandists presented the Belarusian Federation of Radioamateurs and Radiosportsmen (BFRR) as a front for a 'massive spy network'".*
"State propaganda unironically claims these men were 'pumping state secrets out of the air' using nothing more than basic $25 Baofeng handhelds and consumer-grade SDR dongles," he added. *"Any operator knows that hardware like this is physically incapable of cracking the modern AES-256 digital encryption used by government security forces. It is a technical fraud, yet they are being charged with High Treason and Espionage. The punishment in Belarus for these charges is life in prison or the death penalty."*
The Belarusian human rights group Viasna and its associated Telegram channel confirmed the detention and said that it spoke to a cellmate of **Andrei Repetsi**, who said that Repetsi was unable to talk about his case in jail: *"The case is secret, so Andrei never told the essence of the case in the cell. He joked that his personal file was marked 'Top secret. Burn before reading,'"* Viasna wrote.

UK CLUBS ASKED TO KEEP DATA UP TO DATE
If you are a member of an RSGB-affiliated club or society, the RSGB is encouraging you to check that your organisation's details are up to date on Club Finder. The RSGB Club Finder allows people to search for local amateur radio groups. Those people could want to join your club, find out more about amateur radio before taking their Foundation licence exam, or could perhaps need support for British Science Week activities. Updating your listing is easy. Just log into your club's Membership Services account and go to the 'UK Club Finder' section.
The form includes a section called 'Meeting details' where you can add helpful information about disabled access, as well as details about both physical and online meetings. The Society will update Club Finder with any new data between 4pm and 6pm every Friday afternoon. If you wish your latest information to appear before the weekend, please ensure you update your details before 3pm on Fridays. If you have any questions about the process, please contact
membership@rsgb.org.uk



G3PSM SK: I don't usually mention Silent Keys as there are, sadly, so many nowadays. But I did want to recognise **Colin Thomas G3PSM** who passed away on 17 February. I knew Colin quite well in years gone by – for example, he twisted my arm to join the RSGB Board when he was RSGB President. And I also worked with him at a couple of IARU meetings which I attended in a support capacity. Colin did a huge amount over the years in support of our spectrum, as well as helping UK amateurs in their dealings with OFCOM, and will certainly be missed. **Don G3XTT**

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Georg Wiessala
egwiessala@gmail.com



1

PoC-sy Radio or Quantum-Leap?

Georg Wiessala looks at an innovative product from Chinese manufacturer Choyong.

Of late, Chinese manufacturer Choyong has made waves in radio hobby circles because of its innovative portable devices, such as the flagship LC90 radio (**Fig. 1**; Review in: *Radio Kurier* 1/2026: 36-37), the smaller Voyager model and other more or less playful gadgets. The new Choyong WT2 handheld radio (**Fig. 2**) continues a growing line of receivers and transceivers combining the traditional with the more contemporary. In this case, AM and HF radio reception is mixed in with some aspects of amateur radio and internet radio. A novel approach, but can it ever work, I wonder?

At the time of writing, a few first reviews of the WT2 have appeared, and at least one user described the WT2 as a 'shack in a box'. That seems more than a tad over-optimistic. Posts on FB groups associated with Choyong are mixed, to say the least, and they reveal some teething problems, as with the LC90. Some testers comment on the build quality and others on the 'analogue intercom' and 'ChatGPT' functions, the lack of an audio output jack and of backlit keys, the performance on HF, and the absence of coverage for SSB and some air and marine band signals. A sample review is here:
https://tinyurl.com/2ezuxevz

As far as I can see, nobody has as yet focused on the 'elephant in the room': the security and privacy implications of a radio with a 'voice search' function.

There is also a larger point to be made, methinks, regarding radio and HF tech. Many of us are rightly worried that 'cramming' all the tools needed for this kind of multitasking into a diminutive radio must, by necessity, come at the expense of reception performance, at least on HF. For internet radio, this is not an issue, of course, but there are other problems here (see below). Several recent radios with SW and MW have, sadly, appeared to confirm these misgivings.

In short, where too many functions are joined in one package, and where smaller, lower-grade HF technology and cheaper components are used, it stands to reason that reception quality and the grade of possible DXing will suffer.

So, is it better to have several specialised radios in the shack, for different tasks or bands, or do we want an all-in-one solution that does it all? Let's see how the WT2 performed:

'Chip-Tune Radios': Keeping an open mind

I'd like to think that I can keep an open mind on this, and I was, therefore, interested when Moonraker offered to send me the new Choyong WT2 for a quick review (**Fig. 3**). I have occasionally mentioned the new breed of chip-based radios that have appeared over the last few years. A friend of mine calls them 'chip-tune-radios', referring to the cute music genre of that same name. Are these mere toys, or are they serious contenders?

In this category, you may find receivers mainly based on the TEF6686 or SI4732 architecture microchips. These chips may offer rudimentary DSP functions, and some radios may have both kinds of chip.

Those receivers appear under brand names such as 'ATS' and 'AMNVOLT'. But many more are 'no-brand' at all. They seem ephemeral, often in a state of fast-track metamorphosis from one model to another. There is a new radio every month – or so it seems – and they supersede one another just as quickly.

The story of their development is one of low quality, excessive speed of development, miniaturisation and increasing functionality. For example, many of the newer gadgets can now decode CW, RTTY, WEFAX, and FT8. These mini radios often come with the newly-popular 'doughnut' loop antennas – which can actually be half-decent. The majority of them, to my mind at least, offer nothing in terms of aesthetics and design. Can we really learn to love 'naked' PCBs, without proper casings and shielding, disguised as true radio receivers?

As far as I can see, few of these chip-based radios have so far reached the conscious awareness of serious DXers or radio amateurs. Reviews are sporadic and unreliable. There

Fig. 1: The Choyong LC90 is the current flagship of the company.

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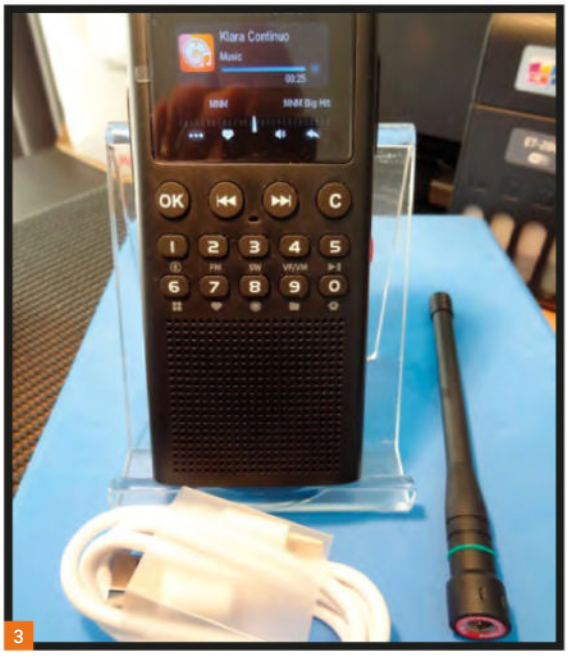
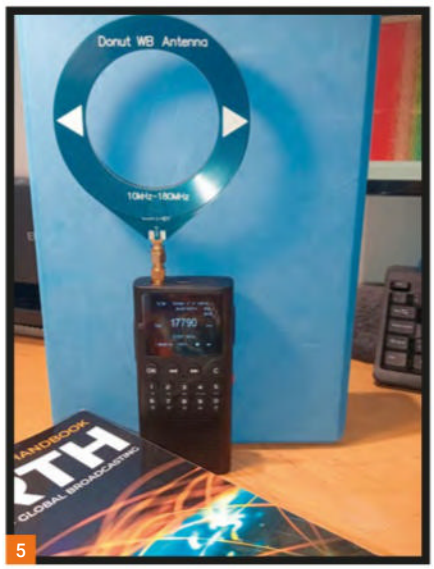


Fig. 2: The new Choyong WT2 is sold as an 'advanced multifunctional walkie-talkie. You can experiment with its various functions. Fig. 3: The Choyong WT2, fresh out of the box, has just a few accessories.

Fig. 4: Behind the protective top flap, you'll find the micro-SD card slot for a card of up to 32GB, and a USB-C port (for charging only). Fig. 5: With a mini 'doughnut' antenna, you may pull in more stations, which is useful when experimenting and travelling.





are exceptions, of course, and, in some cases, the quality, appearance and performance of these radios on FM or HF have been judged to be somewhat better. The *Deepelec DP 666, RX260-A,* and the *NXP ESP 138* radios are among the most recent examples of those.

ATS MINI ESP32-S3 SI4732:
https://atsmini.github.io

DEEPELEC:
www.facebook.com/groups/dp666

TEF6686:
www.facebook.com/groups/808591781087998

Global comms and easy listening

Some have commented that, among these innovative but often flimsy devices that come out in fast succession to one another, the WT2 stands out through its build-quality and functionality. More significantly, some major radio traders are now taking the brand on board.

The WT2 has also been receiving news coverage on account of its voice-search function, which delights some and concerns others. You used to listen to your radio, and your radio listens to you – much like your phone, car and smart speakers now.

Against this backdrop, the WT2 is marketed as a 'dual-mode', 'all-in-one communication companion', a 'multi-functional walkie talkie', an 'on-the-go' outdoors companion, an 'emergency radio', a useful tool for professional team communications, and a device for wider radio exploration (Does this mean 'DXing'?). Furthermore, the WT2 is advertised as a multimedia player and a small (internet radio) recording device.

As a transceiver, this small portable allows you to communicate, both 'locally' and 'globally'. Last but not least, the WT2 receives some modulation types typical of 'traditional' radio, but not SSB (Single Side Band) or DAB (Digital Audio Broadcasting).

Listening and recording

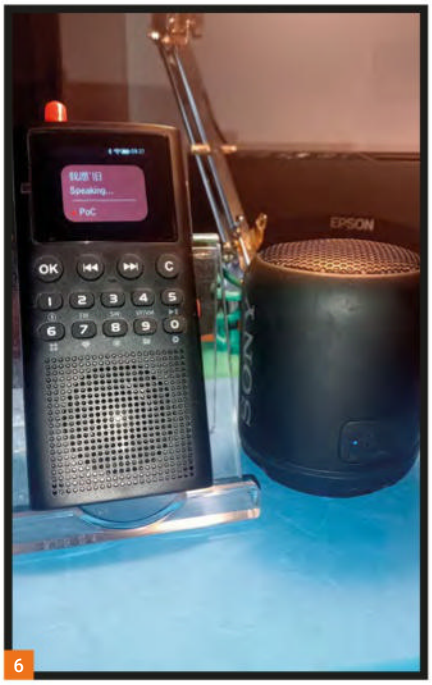
FM (alas, without RDS) and Short Wave reception are achieved via the TEF6686 chip (see above), and the novel feature, as far as the advertising hype is concerned, is the (internet radio and podcasts only) voice-search function. This is being described as 'ChatGPT-powered'. It is no such thing, in fact; the term is here used as more of a generic denominator, rather than as an accurate technical denomination.

'ChatGPT powered' seems to denote here that the WT2 is sold with firmware that uses cloud-hosted ChatGPT/ Whisper style services, or some third-party ChatGPT provider, for the functional purposes of voice-search, voice-to-text, and music or station searching::
https://tinyurl.com/2ezuxevz

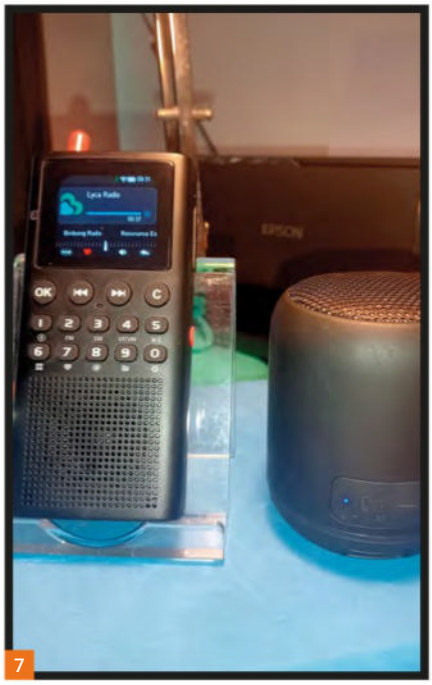
To be clear, the WT does not have a voice recorder ('dictaphone') function, but it does offer a time-saving voice-search function, in limited areas, as described above. The radio features a mini-SD card (TF card) slot (**Fig. 4**) and a 2,500mAh battery, which is claimed to charge fully in less than one hour. It does.

My review model came with firmware version *WT2G_CYOS_V1.1_251114_1459*. I had no

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6



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Fig. 6: The PoC function opens up a 'Global Group' and any others that you may wish to initiate or be part of. Fig. 7: Listening to Internet Radio: *Lyca Radio* is the former *Asian Network*. Bluetooth is the only way to use an external speaker with the WT2. My Bluetooth Speaker is the Sony SPS-XB12.

problems using this radio straight out of the box, with no recourse to the instructions leaflet, which is, in any case, minimal. You can update to the latest firmware via the 'Settings' menu.

The radio is built into a plastic casing with rubberised keys and no IP67 (waterproof) rating. There was no carry case, carry pouch or external stand.

Key functions and FM broadcast reception

The WT2 offers the following primary functions:

- Local transmit over UHF (440-470MHz analogue; max.: 2W)
- Push-to-Talk-over-Cellular (PoC) with 4G/Wi-Fi/ e-SIM (Choyong Global Group/ New Groups)
- The FM broadcast band (from 64 - 108MHz)
- Shortwave (2300 - 26100kHz AM only) and Internet Radio (45,000-50,000 stations)
- USB-C (charging only), Wi-Fi and Bluetooth connectivity
- Multimedia player with micro-SD (TF) card slot.

FM Broadcast reception with this radio, including a fast ATS (Automatic Tuning System) function, is one of the WT2's best features – the lack of the RDS (Radio Data System) service notwithstanding. An initial FM scan resulted in a much-larger-than-anticipated number of stations, with just a few duplicate frequencies. Selection, listening and filling memory channels were all straightforward, and the TEF6686 chip was very sensitive. The strong performance of many TEF6686 chip radios, in terms of FM reception and even FM DXing, has been noted in radio hobby circles, and the WT2 is no exception.

I kept this radio on my favourite FM broadcaster (BBC Radio 3) all day, with only a negligible dent in the battery life. At the moment, Bach's choral *Jauchzet, Frohlocket* (*Rejoyce and Be Glad*) is sounding out of the radio at full blast. The sound is adequate, if not room-filling. By pressing the No. 8 key, you can use Bluetooth to stream to an external device/ speaker and record live radio broadcasts in low quality (128kb/s, 8,000Hz, 16bits, 1-channel PCM) onto a micro-SD/ TF card (max. 32GB). Sadly, this currently *only* works with the internet (streaming) radio function. There is no dedicated audio/ line out/ headphones output socket, which will be a big drawback for many.

Just to re-emphasise, you cannot record from AM and FM radio, and there is no provision for resolving DAB mode, nor an *Electronic Programme Guide (EPG)*. You can transfer your internet radio recordings elsewhere for analysis and further audio processing. I found two timer functions: 'Schedule Power On/Off' (~ Sleep) and 'Play Time Limit' (~ Eco mode). I could not work out whether owners of the WT2 can pre-set timers for unattended, timed recordings, for instance, at inconvenient times.

On the Medium and Short Waves

Having used this receiver in many locations for a few weeks now, I'd have to say that the WT2 is not a 'DX machine', not by any stretch of the imagination. Nor would one guess that its designers intended it to be one. Overall, reception on the MW and SW bands did not impress. By the way, similar comments have been made by other reviewers for the current Choyong flagship receiver, the LC90. The WT2 is clearly more of a handy, ad-hoc, on-the-go radio or travel alarm.

I quickly replaced the proprietary telescopic aerial with a doughnut-style mini-loop (**Fig. 5**), a medium-sized passive loop (Deshibo WV-601), a Wellbrook ALA 1530LN, and some long-wire, to try and receive more than the strongest stations on HF. This met with varied success. I was able to catch more and clearer stations outdoors and at night.

However, most daytime HF reception, let alone DXing, remained well below average. For this reason, I would conclude that HF signal hunting or DXing is not among the reasons why you would buy this radio. I am also not sure the device is sufficiently shielded from domestic IF interference (noise).

Analogue UHF and PTT over Cellular (Network Radio)

Next, the 'analogue intercom' mode: Here, the WT2 covers from 406.1 to 470MHz in NFM. This is wider than the officially allocated amateur radio frequency band in the UK (70cm; 430 to 440MHz). The lower limit of the WT2 (406.1MHz) is still clear of the 401MHz Satellite Distress frequency. Using firmware and the Choyong website, the WT2 can be populated with simplex channels, repeater frequencies and CTCSS tones. At the time of writing, there were still software bugs here. I feel certain a future firmware update will deal with these.

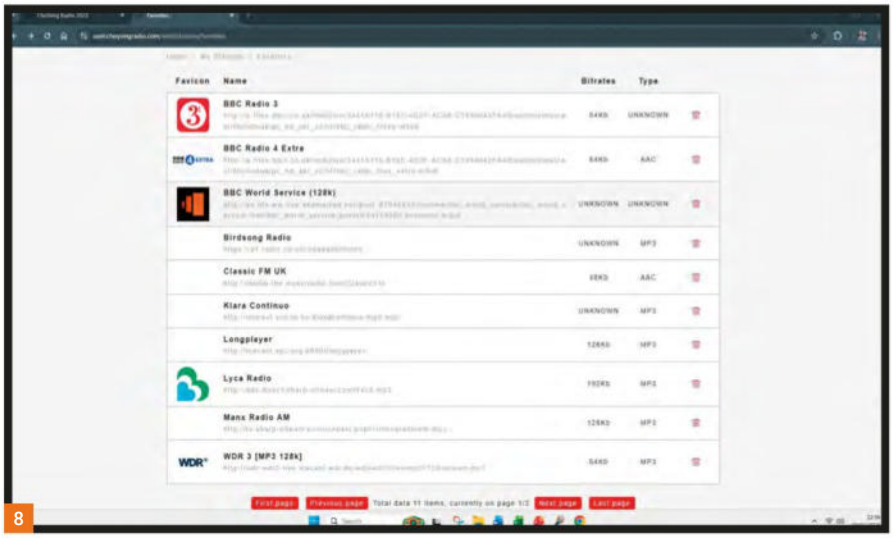
The radio includes several features that more experienced operators will appreciate: direct connect mode, repeater mode capability, and both analogue CTCSS/DCS and digital sub-audio encryption.

There is also a search function, a 'compander', for enhanced audio quality, and programmable frequency jamming. In terms of amateur radio, the Bluetooth function allows you to use (wireless) headsets. The built-in recording function is very handy for logging and catching radio programmes, albeit from internet radio stations only: **https://tinyurl.com/2swnzn48**

Internet-Linked Talk Group function

The WT2 is also a PoC (Push To Talk Over Cellular) transceiver. This means, I think, a dedicated hotspot radio. There is a modem inside (with e-SIM and 4G support) that allows the WT2 to ping off a mobile phone tower, much like your smartphone. The WT2 comes with a proprietary PoC network. It searches for other WT2 radios (and *only* WT2 radios at present, *not* other PoC devices) in two ways: either via the 'Global Group' of all WT2 users out there (around 1,000 at the time of writing) or via other talk groups you may wish to join or create. You can always check the Choyong Facebook pages and website for newly-

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Fig. 8: You can add many live streams from internet radio stations via the *Choyong* website.
Fig. 9: The Choyong WT2 is, perhaps, best understood as a small travel companion with added internet-radio functions.

created groups.

At the time of testing, most voices I heard here were from China (**Fig. 6**), but there was some 'sporadic E' conversation, i.e. some English voices could be heard. There is a growing global Choyong users community.

It is important to know that, under UK Law, if the network you are using *is not connected to an amateur RF network*, then you *do not need* an amateur radio licence to transmit with this radio. If a future version of the WT2 would allow users to mount Android apps on it, then you could install the very popular *Zello* tool and use the broader radio channels available in its 'Network Radio' groups (URL below). In the USA, too, my impressions from researching other reviews are that this radio is not quite legal at present, in terms of FCC certification. One reviewer has described the situation as one of 'moderate legality'.

https://zello.com

I did not use the PoC feature very much, and I was left to wonder whether 'PoC' can, in fact, be said to be some form of (amateur) 'radio'. I tend to think that, on balance, it cannot, because this facility requires a live internet connection. The 'PoC' function is, of course, rendered useless if the internet is down, censored or switched off, as it regularly is by the world's repressive governments.

I remember we had lively discussions about 'Network' and 'PoC' Radios in the 'Network Radio' column in *RadioUser* magazine from 2017 to 2022. Once again, I feel I would perchance not get this device for the PoC function in any case and rather invest in a more 'traditional' HF transceiver. However, the PoC capability may well be handy for some emergency communications.

A dive into internet radio

For me, the online (internet) radio feature (**Figs 7** and **8**) and the listening to, and recording of, internet radio streams and gazillions of podcasts, are the key reasons for me to acquire the Choyong WT2. My older internet radios, such as the Roberts Stream 107, are now rapidly showing their age: plus, they are about three times the size and five times the weight of the WT2, and I do love exploring new music genres worldwide, literally in the palm of my hand. Almost more importantly, the internet radio takes you away from the East Asian ideological dominance of the (HF) airwaves and opens up many other channels of global news and sport.

You can add your own customised internet radio streams by entering the respective URLs for the station in question (Fig. 8). I often listen to the UK Longplayer 1000-year radio stream, for example, and adding it was a breeze, either via the Choyong website, below (with a session-specific verify code), or by scanning the relevant stations' QR codes. You then 'synchronize' your WT2 via the Choyong website. This is very easy and comfortable, and the receiver is open to Spotify and Apple podcasts.

www.choyongradio.com

Yes, there are plenty of religious nutters, fake news purveyors and hate propagandists on internet radio too, but the general pool is so much larger; on balance, there are also many more sources of reliable and relatively unbiased news here. This in itself is enough for me to acquire this radio.

All in all, using the internet radio function to listen to, save and record internet radio stations and podcasts is easy and intuitive. But keep in mind that doing all this also means someone and their algorithm always know what you listen to and like. This may be part of our new era of 'surveillance capitalism': we get nice gadgets and are bribed into putting up with how they open us up to prying.

Duo say: I am always listening ...

While I am being a bit paranoid, let me finish with a little anecdote: A radio friend of mine, known for using his smart speakers and *Duolingo* (foreign language learning) software quite liberally, now has a car that knows more about him than his wife does. A little while ago, he was surprised by how what he said to his speaker eventually turned up in his algorithmic eBay/ Amazon buying suggestions.

But this same friend also commented: *"So, you now have a radio with which you cannot only listen to endless Chinese state propaganda on hundreds of HF frequencies, but which also listens back to you, for voice-cloning by government agents and hackers?"*

Well, I am a 'debunker', rather than a 'conspiracy theorist', but does my friend have a point, or is this too far-fetched? After all, she works in SIGINT. And the very fact that we actually even have to worry about this does say a lot in itself, doesn't it? This is where predatory technology takes us.

Personally, I am not sure we need to fret too much about our privacy with radios like the Choyong WT2. But you need to make up your own mind. SW radio doesn't observe or track you and does not send you cookies either. Meanwhile, I think I'll keep using the 'normal' (scroll-down internet stations) search function on the WT2.

Conclusion: a useful travel companion and news source

One of the strong points of the WT2 is the supplied aerial with an SMA-M (male) connector. The antenna looks akin to a 'rubber-duckie' type of telescopic antenna and extends to 48cm in length. This is OK for what it has been designed for, but you would naturally connect other aerials to the radio if your interest in signals is more than superficial.

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The aerial port on the WT2 is SMA-F (female), so you might need adaptors. I connected a Deshibo WV-601 loop, which action resulted in a small improvement in HF reception.

Besides aerial flexibility, I liked the fast-charging time and long-lasting 2500mAh battery life of the WT2, as well as the fact that the firmware is updatable via a micro-SD card (TF-card; max. 32GB). The Bluetooth function (*outward* only, i.e. *to* a speaker, etc., not to the device) is a bonus. The 1.8in screen is crystal-clear. I found it to be easily readable under most light conditions, including in bright light. It shows approximations of signal strength and Signal-to-Noise Radio (SNR), as well as a number of other functions. I most liked the (internet radio only) recording function, which allowed me to 'tape' my favourite radio plays on *BBC Radio 4 Extra*, without a PC, 'virtual' soundcards, cables, and software such as *Audacity*.

On the debit side, the WT2 has a cheap, non-weatherproof case that does not stand up reliably on its own (3D-print a stand if you like). The telescopic aerial is 'unhinged' (as it were). What weighs much more is that there is no SSB or LW coverage and no RDS on FM. The 'ChatGPT' and PoC functions are open to abuse and intrusion. Plus, there are no audio-out, line-out or headphone sockets, and no assistive key markings for disabled or sight-impaired users.

All in all, I feel that the Choyong WT2 still has some way to go, both in terms of its physical construction and its features. I will most likely use this radio as a neat internet and FM radio, to record off (internet) radio, to stay in touch with global news, escape the increasingly indistinguishable pulp of UK private radio content, and as a handy, connected, travel radio (**Fig. 9**).

It is good to know that analogue and digital comms, Medium and Short Wave radio are on board; however, in my view, these are reserve functionalities rather than stand-out features for this device.

At the time of writing, the Choyong WT2 retailed for ca. £119 in the UK. My warm thanks are due to **Justin Godefroy 2E0JSG**, at Moonraker UK, for the extended loan of the review model, and to my *PW* colleague **Tim Kirby GW4VXE**, for answering many of my additional questions.

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Resources and Further Reading

Choyong Radio:
https://shop.choyongradio.com
Choyong Radio Official Facebook Group:
www.facebook.com groups/1079141346520659
Helmut Matt:
https://tinyurl.com/3eubyj9k
Innovations-Inventions-Developments (Review):
www.youtube.com/watch?v=bqtUfxPtVN0
Moonraker (UK):
https://tinyurl.com/4t2sdxed
SWLing Post (Michael Ye, BD4AAQ):
https://tinyurl.com/yjhfvrjb
Techminds (Review):
www.youtube.com/watch?v=jYoSutHk1AE
User Manual (Choyong WT2):
https://tinyurl.com/bdd886nf

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David Howard M0BGR
practicalwireless@warnersgroup.co.uk

Starting Hobby Radio for Free (Pt III)

David M0BGR continues his series introducing hobby radio.

In the first two articles I showed you how to access and control online SDR receivers. These are free to use so you do not need to invest in equipment or antennas to start exploring the radio hobby. I also talked about why you, or someone you might know, might be interested in this subject. To recap, it is a great hands-on way to do some real practical science, so if you know someone who is studying STEM subjects, do share these articles with them. But there is more to it than that. You can also gain cultural insights, improve your language skills and get local news from all over the world unfiltered by the technology giants.

So far, we have used the KiwiSDR platform [**1**]. This is a great way to start -as it has high-quality receivers in most places in the world and is easy to use. It has one major drawback – the receivers mostly only cover Long, Medium and Shortwave frequencies and there is much to explore on VHF and UHF so, in this article, we will look at a couple of other SDR platforms that do cover the higher bands.

TX-RX SDR Index page [**2**] lists the three most common SDR platforms. Open the web page and select the 'Map' tab. Then click the OpenWebRX' check box below 'SDR Type' and 'Apply'. This will give you access to FM, DAB and higher frequency amateur radio stations that you can't get on KiwiSDR. The map will show you the OpenWebRX receivers that are available round the world should you want to venture outside your own back yard.

You can refine your search by using the right-hand drop-down menu to filter by frequency or band (this step is optional). If you are interested in listening to FM Broadcast stations, then select VHF and stations that (usually) have receivers for this mode will appear. Let us select KX4TH, which is in Colorado Springs, CO, USA which you can search for on the map, if you want to brush up on your geography of USA, or type 'KX4TH' in the TX-RX SDR search box. You can also access the receiver directly [**3**]. Don't worry if this station is not available, just select another one.

How to operate

The basic layout of the OpenWebRX is similar to KiwiSDR but there are differences in how to operate. You will be familiar with the waterfall, frequency banner etc. but the control panel operates somewhat differently. OpenWebRX sites usually have multiple receivers so you have to select the right one for the service you want to hear. There is a drop-down menu at the top of the Control Panel, **Fig. 1**, that lists all the receivers available. If you can't see the Control Panel, click 'Receiver' on the top right of the web page. Select 'PlutoSDR FM Broadcast 2' then Wide FM mode (WFM) in the mode selection, just below the drop-down. You should see several strong stations on the Waterfall. Drag the yellow trapezium, on the frequency bar, along to 95.1MHz and you should start hearing 'Cat Country (KATC)'. If you don't get any audio, check the volume slider at the top of the 'Controls' section of the Control Panel. If the slider is not active, then click on the speaker icon. Also check the 'Squelch' slider is fully left.

A handy tool, at the bottom-right side of the Control Panel, is the 'REC' button. This enables you to record what you are hearing as an MP3 file. Be careful not to leave it on for too long as it produces large files!

Try the 2m band

Many of the shortwave (HF) bands we discovered on KiwiSDR in previous articles are available through OpenWEBSDR but you will need to select the right receiver to use from the Control Panel as described above. But as we are looking for new things to listen to, let's explore the UK 2m amateur radio band which, in Europe, covers 144MHz to 146MHz.

This band offers a wider variety of services to the HF bands so its plan is more complex [**4**] and a summary is in **Table 1**. 'Repeaters' are relay stations, usually in good locations, that licensed amateurs can use to extend the range of their transmissions [**5**]. (As you are listening through a Web SDR you don't need to worry about CTCSS tones – this is done for you.) The repeater outputs are usually on 145.6 to 145.8MHz.

A good SDR for 2m is G0XBU, located near Manchester, so search for this on the TX-RX map page, or click the link [**6**]. Once you have opened this, select 'RTL1 2m' from the receiver list. You may not hear much activity during the day but in the evenings people chat or radio clubs run 'nets'. On the first Tuesday of each month, in the UK between 2000 and 2230, there is the RSGB 'Activity Contest' on SSB so you may hear activity in the SSB section of 2m mostly between 144.200 and 144.400MHz. You may also find conversations on the repeater outputs, between 145.6MHz and 145.8MHz. You may need to hide the Control Panel to see these (click on 'Receiver').

Some repeaters are internet linked, for example 'Echolink' can sometimes be heard by the G0XBU SDR receiver on 144.9620MHz. So don't be surprised if you hear foreign stations on VHF!

Before we leave amateur radio I should mention that there is an amateur radio satellite in geostationary orbit that you can listen to on 10GHz [**7**]. This enables radio amateurs to talk to each other from the Middle East, Europe and Africa without the vagaries if HF radio. It is a repeater in the sky so let's try it. On the TX-RX map, select OpenWebRX and SHF in the band drop down. Then search for LX0XP. From here, chose the 'QO-100 (Narrow Band)' receiver and a screen like **Fig. 2** should appear. I slid my yellow trapezium over a strong signal, which was a voice conversation using Upper Sideband mode (USB). As we found, when USB on HF, tuning needs to be exact. If voices sound like Donald Duck, reduce your frequency slightly. If they sound muffled, increase your tuned frequency. I suggest you use the 'Zoom In' control at the bottom of the Control Panel to make tuning easier.

Many conversations are not in English; amateur radio is an international hobby.

Other transmissions

Aircraft use VHF frequencies for voice communications more frequently than they use HF frequencies which I talked about in the previous articles. The Air band is found on VHF between 118 and 136MHz and uses Amplitude Modulation (AM). Most commercial aircraft also use a data transmission system (ACARS) for route updates etc. that air traffic controllers monitor but they use voice more as they are arriving at or departing an airport so there is lots to listen to if you can find a VHF SDR receiver near a major airport.

Some OpenWebRX stations offer receivers for Citizens' Band (CB) radio. CB became very popular after release of **Sam Peckinpah's** film *Convoy* in 1978 and was legalised in the UK in 1981. Today it is still used, but much less popular than in earlier years. UK/EU frequencies are in **Table 2** but vary in other countries. You can find CB receivers by putting

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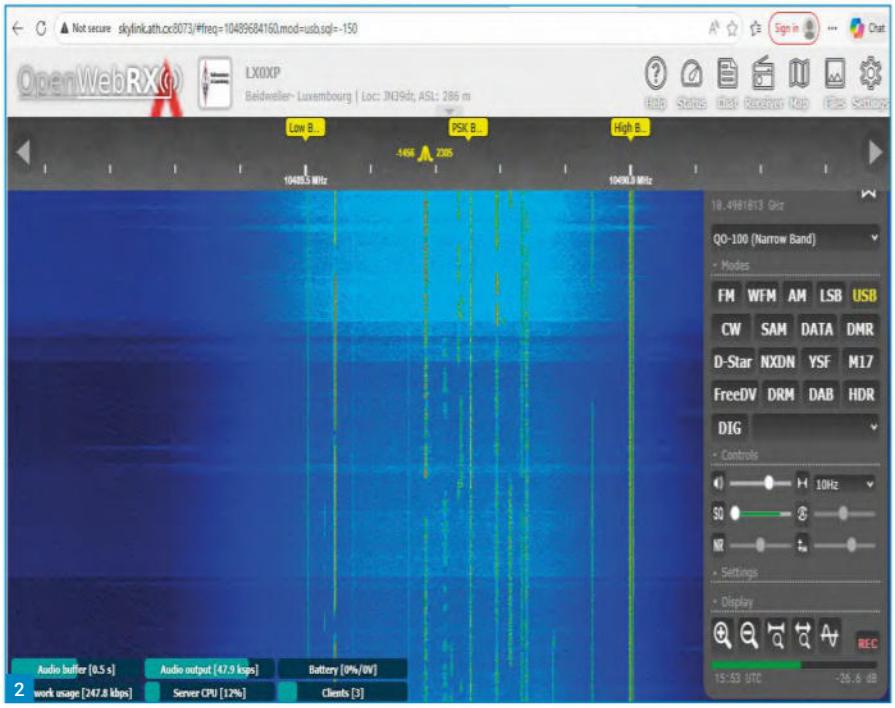


Fig 1: KX4TH Control Panel. Fig. 2: A screenshot from the QO-100 amateur radio satellite.

'CB' in the TX-RX search box or putting '11' in the frequency box (don't forget to check the OpenWebRX box).

PMR 446 is also available in the 'Public Two-Way Radio' category for some stations. This is a very short-range mode used by low-power handheld radios between 446.0 and 446.2MHz FM so you may not hear much on the SDR receivers that cover these bands. You can find receivers that do this by putting 446 into the TX-RX search box.

WebSDR

Now let's move on to take a brief look at WebSDR receivers. You can select these from the TX-RX map page, but WebSDR's own index page [**8**] is clearer. Most WebSDR receivers cover the amateur radio bands but you can find other activities on here as well. The index has filters to help you narrow down what you want to listen to and at the bottom of the index there is a world map so you can home in on a particular region.

The WebSDR receiver pages are not standardised but as you have already used other SDR sites you should be able to find your way around. There is usually a 'Start Audio' button that you need to click. This may be marked 'Chrome Audio Start', but I found this works with other browsers as well. The frequency scale and your old friend, the yellow trapezium, for tuning, is generally near the bottom of the screen and you can also edit the frequency box, if there is one, if you know the exact frequency you want. Some sites use MHz and some use kHz for frequency input (1MHz = 1000kHz).

Many of the amateur radio things I described under OpenWEBSDR are also available on WebSDR, including the QO-100 satellite and the G0XBU station, so use whichever platform you prefer.

Spend some time trying out some of the many SDR receivers that are available to you and try listening to what is available on receivers in other parts of the world. Remember that they will be in different time zones with will affect which radio bands are open, particularly on HF. Some stations will shut down during the local night time and most radio amateurs do sleep!

While exploring analogue signals you will have heard various whistle, cheeps and chirps while you are tuning. These may be digital signals, some of which you can decode, so we will take a look at these next time. **PW**

Lower Frequency MHz	Upper Frequency MHz	Type of Station
144.000	144.050	Morse Code
144.150	144.400	Single Sideband (Voice)
145.200	145.600	FM Voice
145.600	145.800	Repeater Output (FM)
145.800	146.000	Amateur Satellites (all Modes)

Table 1: Rough Guide to Amateur 2m Band Plan

	Start Frequency (MHz)	End Frequency (MHz)	Modes	Notes
UK CB Channels	27.60125	27.99125	Narrow FM (NFM) Only	40 Channels. UK Only
CEPT/EU Channels	26.965	27.405	NFM, AM and SSB	40 Channels. Can be used in UK.

Table 2: CB Frequencies, UK and EU (OFCOM Document: OF364)

References

[1] Kiwi SDR:
kiwisdr.com/.public
[2] TX-RX SDR Index page:
https://rx-tx.info
[3] KX4TF Web SDR:
https://sdr.fomitchev.net
[4] 2m UK Band Plan:
https://tinyurl.com/43kk5nvy
[5] Repeaters Explained:
www.essexham.co.uk/repeater-basics
[6] SDR Receiver at Jodrell Bank:
http://g0xbuwebsdr.ddns.net:8073
[7] AMSAT QO satellite frequency plan:
https://tinyurl.com/3swjs4cj
[8] **websdr.org**

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A Mixed Bag

Rather than looking at just one topic in depth, **Colin G6MXL** covers a number of topics which readers may find helpful.

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While adjudicating the *PW* 144MHz QRP and *PW* 70MHz contests, I encountered a few entries that hadn't logged the time correctly. By convention amateur radio operators log contacts in UTC (Universal Co-Ordinated Time) – indeed it is part of the rules for the contests. This means that no matter where on the planet stations are located, everyone records a contact with each other with the same date and time. As a result, they can each find their contact in their logs to check if they exchange QSL cards. Likewise, electronic log matching systems, such as Logbook of the World (LoTW), eQSL, Club Log, QRZ.com, rely on stations using the same date and time to match logs. These systems usually have a small tolerance on time differences, but certainly not an hour or more.

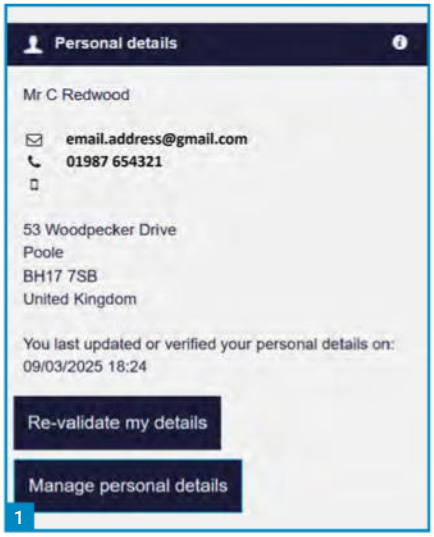
If you use a computer program for logging, including contest, main station logging programs as well as logging built in to data mode programs, they will either allow an off-set to be made in the settings so that you can leave your computer's time to local time (in the UK this is BST in the summer and UTC in the winter) or they will pick up the offset from the computer's operating system. My preference is to set the computer that I use for amateur radio purposes to UTC throughout the year. If you take this approach, you'll need to be careful if you use any calendar reminder facilities in the summer months!

Pre-issued callsigns

In Autumn 2025 Ofcom started to allow amateurs to change their callsigns to new callsigns or ones that had previously been issued to amateurs who have relinquished their callsign. There are a number of reasons why someone might relinquish a callsign such as upgrading to a higher licence level or had become Silent Key or the previous owner had failed to periodically re-validate their details with Ofcom (see below).

It seems that quite a few amateurs have decided to change their callsign to a pre-issued ('second-hand') one. While this process is reasonably straightforward in respect of making the change on the Ofcom system, careful consideration needs to be given if you use systems such as Logbook of the World (LoTW), eQSL, Club Log, QRZ.com and the QSL bureau. I've not changed my main/home callsign since I was first licensed in 1982.

I've recently received an electronic confirmation of a contact I made some 35 years ago. If I had given up my callsign and obtained another, I am not sure what would have happened to the confirmation from 1990!



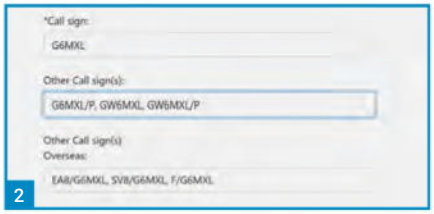


Fig. 1: Revalidation on the Ofcom website.
Fig. 2: Callsign data in the member's portal of the RSGB website.

It is a good time to remind readers to revalidate their details with Ofcom. Ofcom are likely to cancel and re-issue callsigns which have not been re-validated in the last five years, **Fig. 1**. Don't forget that the password you use to log on to the Ofcom website must be at least **14** characters in length and contain a mixture of upper- and lower-case letters, numbers and special characters.

https://tinyurl.com/2dvvyu59

RSGB Membership data

While on the subject of revalidation of data, RSGB members should make a point of checking that their data is complete and accurate on the RSGB members services page on the RSGB website. Besides the more obvious data, make sure that you include all additional callsigns you have or have used at home or abroad, including any special event callsigns for which you hold the Notice of Variation, **Fig. 2**. This will be particularly important with the changes to the QSL Bureau arrangements (see below).

https://tinyurl.com/4pn98pet

RSGB QSL bureau changes

The RSGB have changed the way outgoing QSL cards are handled. These will now by handled by the Deutscher Amateur Radio Club (DARC) - the German national society. Outgoing cards from RSGB members must be posted either to a new UK address in Bedford or directly to DARC in Germany. Cards still need to be sorted into DXCC prefix sequence, with an elastic band (or paper wrap) around bundles for the same DXCC entity, although this isn't needed for small numbers of cards to a country. Later this year, RSGB members will also be able to use the DARC Direct QSL Print service with a 20% reduction on the list price. To do this you'll need to submit an ADIF file with details of QSOs that you wish to be printed and despatched by DARC into the bureau system. At first glance the system from DARC appears to be broadly similar to the QDure system from the Spanish National Society which I looked at in the June 2024 *What Next* column. I'll look at the DARC system in more depth in a future *What Next*. Behind the scenes incoming cards will be sorted by DARC and sent every three months to the current RSGB QSL bureau sub-managers to be distributed to members as at present. More details can be found at

https://tinyurl.com/nekpdh66

International Reply Coupons

Do you have any International Reply Coupons (IRCs)? Since its introduction in 1907, IRCs have enabled the holder to pay for postage of an unregistered international airmail letter between the Universal Postal Union's (UPU's) 192 member countries. These used to be a common way for amateurs and shortwave listeners to pay the postage for a QSL card requested direct from abroad. The UK Post Office stopped selling them over ten years ago.

The Universal Postal Union announced on 15 December 2025 that post offices worldwide will no longer accept them to pay for stamps from the end of 2026. Any IRCs with an expiry date printed on them of 31 December 2025 will be accepted up to 31 December 2026, **Fig. 3**.

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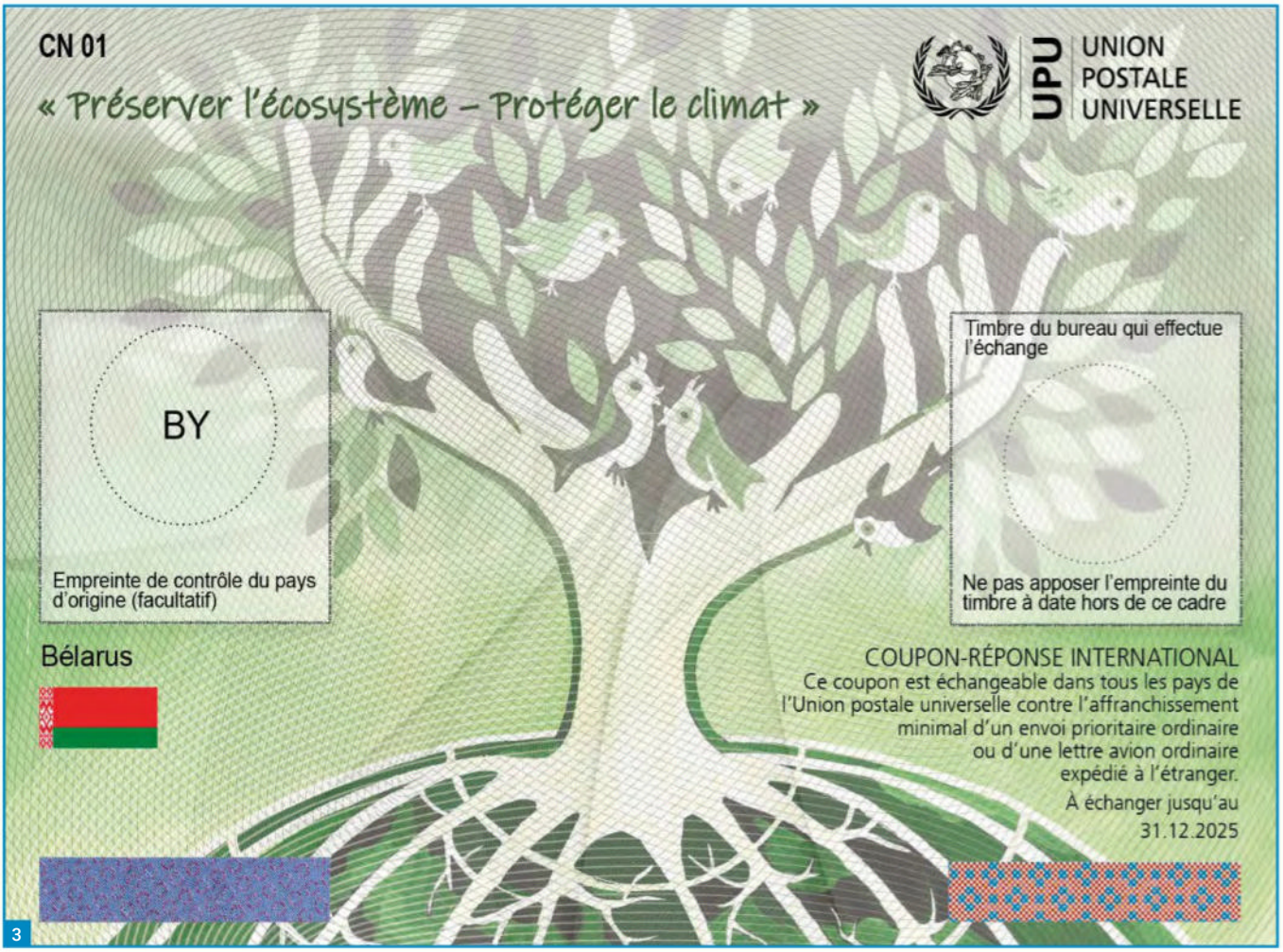


Fig. 3: The current and final design of International Reply Coupon.

These days amateurs wanting a direct QSL card usually pay for return postage either by enclosing US Dollar bills with their outgoing QSL card or increasingly by PayPal through an OQRS request system via Club Log, M0OXO or similar. That said, many amateurs are now using Logbook of The World (LoTW) as their main way of obtaining confirmation of contacts for award purposes.

Attitudes to the hobby

I recently saw a Facebook post from an amateur who had decided to quit the hobby. He didn't like several things about the hobby. He complained about the lack of voice contacts that extended beyond the exchange of reports and perhaps names and QTH. He'd joined some of the international internet-linked nodes and found some of the contacts he made through these nodes with amateurs in the USA contained what he considered 'proper' conversations with topics discussed in depth.

Previously the same amateur complained about some of the terminology used in amateur radio – for example, he objected to the term 'working a station', which is a well-established term in use for many decades by amateurs. He also objected to the digital aspects of the hobby – it wasn't clear whether he meant data modes such as FT8, digital voice modes such as DMR and Fusion or the use of digital technology in radios such as software defined radios.

Amateur radio is a very broad church of interests, probably broader than many other sports and hobbies – think motor racing, rugby, wood-working and fishing to take four examples.

Each of these is multi-faceted, and there are enthusiasts that follow one of these facets, such as Rugby Union or Rugby League, or woodturning or carpentry. Neither is right or wrong, better or worse than the other, indeed some enthusiasts follow both. Some amateurs like to work DX, while others like to natter with local amateurs. Neither is right or wrong, better or worse than the other. Perhaps the amateur in question hadn't found his 'place' in the wide-ranging amateur radio hobby?

Out of band

In our enthusiasm to work a particular station that we've seen spotted on the DX Cluster or heard while tuning around on the bands, it is always wise to make sure that you don't reply out of band. Some regions and countries have different frequency allocations to the ones we are used to in IARU Region1 (Europe and Africa). For example, in Region 1, the 80m band extends to 3.799MHz and the 40m band to 7.199MHz, while in Region 2, the 80m band extends to 3.99MHz and the 40m band extends to 7.299MHz.

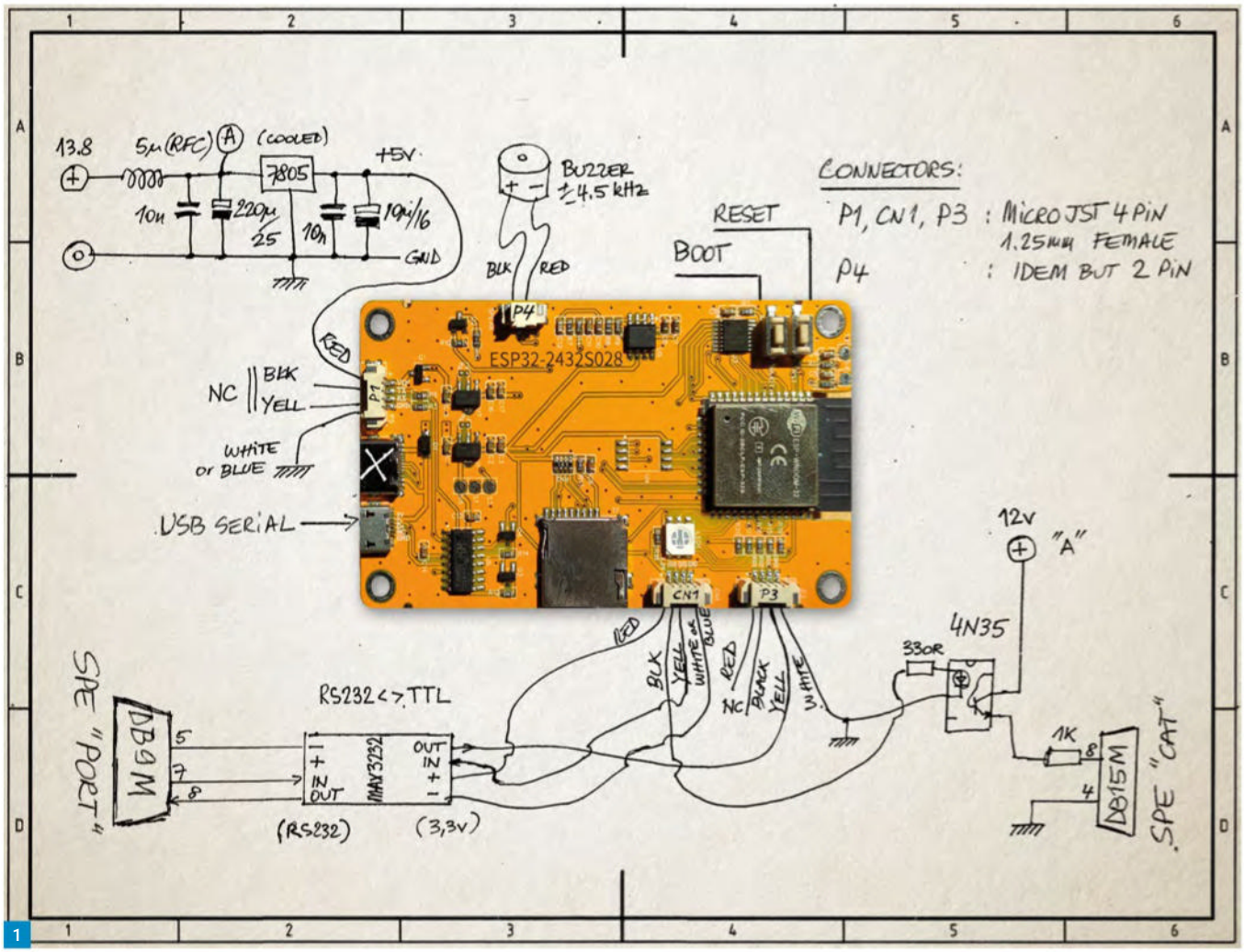
HF propagation

It appears that we may have a second peak of the current sunspot cycle, having passed the first peak about a year ago. I'm making a point of seeking out DX while HF band conditions are still good, as I know that in a few years there will be far less real DX on the higher HF bands.

What Next?

I'd welcome any suggestions from readers of topics you would like to see covered in future *What Next* columns. **PW**

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Steve Clements G1YBB
practicalwireless@warnersgroup.co.uk

Remote Control for Expert Amplifiers

Steve G1YBB offers a handy accessory for owners of Expert amplifiers.

I recently treated myself to a new HF amplifier for home, an SPE Expert Taurus. Like most modern amplifiers there is PC software available for controlling it without having to use the buttons on the front panel. This is convenient when you can't reach (or see in my case as the lighting in the shack is not great) the buttons and also helps prevent the membrane keyboard from wearing out, which does seem to be an issue.

However, in my shack I have an issue with RF when the beam is pointing towards the house (it's only 8 feet from the house) or on 40m using the vertical (only 20 feet from the house). Despite me having chokes everywhere, on the radio side and the PC cables, radiated RF gets in and crashes the PC software in such a way that I cannot kill the task other than with a PC restart, which is most inconvenient indeed. I had the same issue with the previous amplifier's software. With CAT control now on the new amp, I don't need to manually change much but to change power or put in standby needs some input. It gets tiresome having to switch on the phone torch to see the buttons.

So when **Jean-Jacques ON7EQ** posted in the SPE Expert groups.io group that he had made a small hardware based remote console to do this and was sharing his project it was the perfect answer to my issue and I was VERY interested indeed and keen to make one myself.

Jean-Jacques has a web page describing the details and parts to use with circuit diagram etc. You can see this here: **https://tinyurl.com/5363vj2p**

Reading through his page I noted that he had used a 3D printed housing from one of the 3D model download sites but he had to make several modifications to make it suitable for the job, making slots and enlarging holes with his Dremel. I decided that for such a great and useful project it deserved a better option, and while of course you could use a standard box and drill/saw/file it out to suit, the 3D printed option is very neat and easier so I decided that I would draw up a similar housing that is specifically suited for Jean-Jacques' great project.

The controller is based around a CYD (Cheap Yellow Display), which is something I had never heard of before. This is a TFT

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Fig. 1: Remote console circuit. Fig. 2: 3D model front view. Fig. 3: 3D model interior view. Fig. 4: Stripboard layout. Fig. 5: MAX3232 PCB. Fig. 6: Remote console wired for testing. Fig. 7: Rear view with cables.

touchscreen 2.8inch display LCD with an ESP32 PCB as part of it and is suitably cheap enough for a radio amateur's budget, coming in at approximately £17 online. The full unit circuit is in Fig. 1, taken from ON7EQ's website. A better PDF version is available on the ON7EQ page by clicking his image. ON7EQ has specified the CYD spec on his page that you need to look for to buy.

Building the unit

My complete shopping list is in **Table 1**. I had no suitable parts for this so this is worst case cost and includes left over parts. So, total cost not including the enclosure was £52. Screws are not included in this as I do have those.

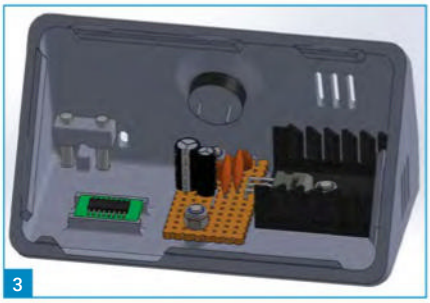
For the CYD I used 4 off M3 x 6mm socket cap head. I chose these as they have a smaller head diameter than a pan head and they are easier to keep straight when first fitting as the front panel has a hole size designed to screw them straight in like self-tapping screws. For the PCB and 7805 I used M3 x 12mm countersunk pozi with nuts and for the cable clamp M3 x 16mm countersunk pozi, again screwing directly into the plastic clamp.

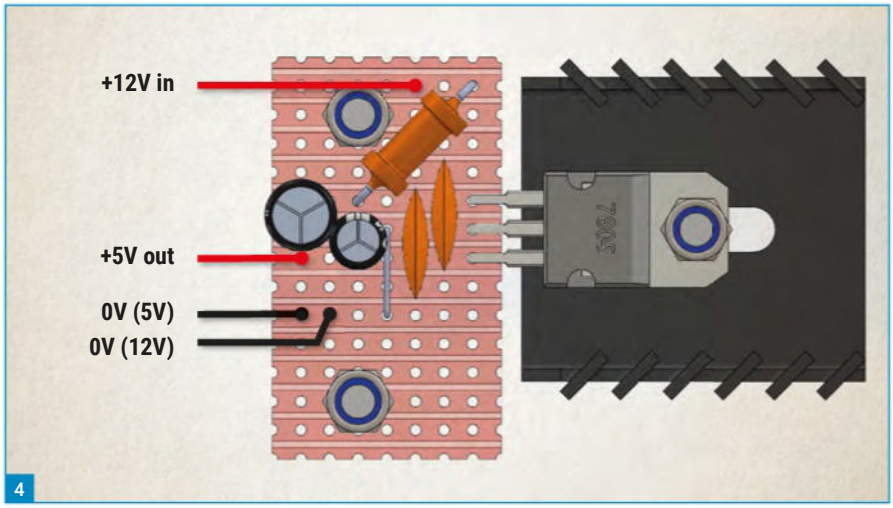
Also of note here is that I did not require the parts for the remote console to power up my SPE Expert amplifier as the radio CAT cable does this, so they are missing. I had a TO-220 heatsink lying around; this one measures 31mm long, 30mm wide across fins and 12mm high (from mounting point to top of fins). Something close to these sizes is recommended although a longer one can be accommodated by changing the PCB size.

Firstly, I decided that unlike on the enclosure ON7EQ used, the Cheap Yellow Display would be better fitted into the front panel, then you could wire up the unit easier. I also made provision for a light pipe rather than drill a hole and use an LED body. Also, my prototype, based on the one ON7EQ had used, was showing the silver borders around the display window so I tweaked it to cover those and make it look neater.

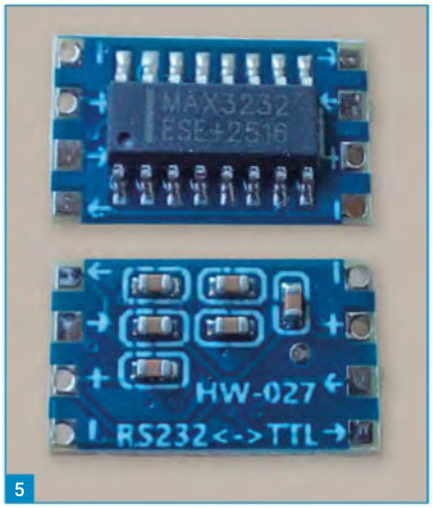
I made the cable exit to the rear rather than the sides as I thought this would be neater for most shacks and included a cable clamp. I made integral standoffs to mount the regulator on a small heatsink and a small PCB made from Vero style stripboard. Also, a mounting position for the very tiny RS232 PCB and a place for the piezo buzzer and a speaker grill for that.


2

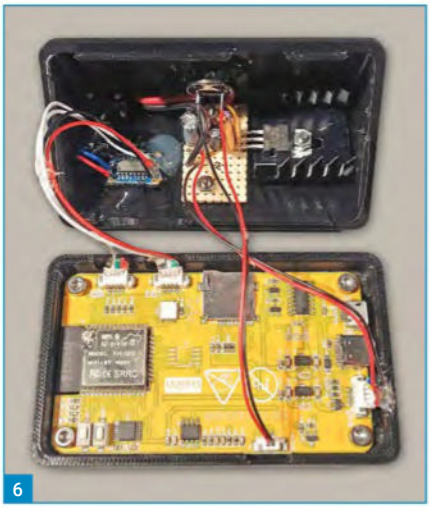

3

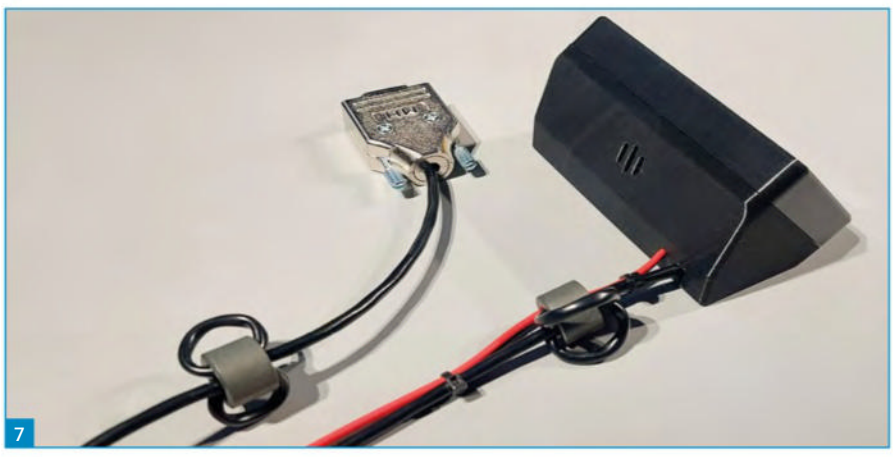


4



5


6


7

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The front panel snaps onto the body without fixings so all fixings are hidden under the base. Also some ventilation for the regulator as although the current drain on 5V is about 200mA average, the glass transition temperature of the PETG I planned to use is approximately 80°C (PLA would be even less) and as I am using a printed spacer mounting I wanted a little bit of airflow around the 7805 and heatsink. I will add that I thought of this after I made mine and mine is working OK without. I decided it is too much bother to disconnect all the wiring to swap mine for the current design.

I like to 3D model everything up including electronics and screws etc to ensure things fit. Very often you can find 3D models online already made and shared as was the case for the CYD. I then just had to check that against the real thing I had purchased. Here are some views of the virtual remote console: **Figs 2** and **3** show the front and interior views of the housing.

All versions of my housing design files are available on the thingiverse link below, with several different options for cable exits as well as vented and unvented versions. As I have a cable from my IC-7610 to the amplifier, which powers up the amp, I didn't require the power up circuitry so I didn't need a cable hole for that. I brought the 12V DC in on the speaker wire style twin wire so have a separate entry for that. I printed all parts with no support required:

www.thingiverse.com/thing:7247780

Before fitting the CYD to the front panel you will need to connect it to a PC using a USB lead and follow the instructions on the ON7EQ page for downloading and installing the firmware. Once this is done once you can do any further updates over the air using WiFi (see **Fig. 8**).

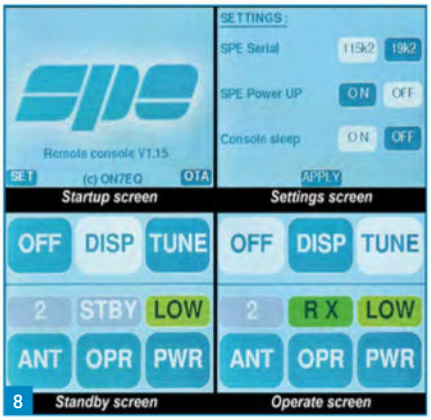


Fig. 8: Remote console screens.

The circuit is very basic but as a guide here is my layout from which you can copy the PCB size should you wish. The case mountings in my design are spaced to match the 0.1in pitch of the stripboard. (The stripboard, **Fig. 4**, is shown transparent so you can see the tracks underneath.)

There is not a lot of wiring but it is quite fiddly, mostly the RS232 PCB as it is quite tiny at only 16mm long and the data connections are only surface mount pads so care is required not to stress those and rip them off.

The recess for the RS232 PCB, **Fig. 5**, is a nice fit, check the PCB goes in OK before wiring. I ran a file over the break-off edges to smooth them off but not too much to make it loose. The recess is designed to take the PCB with the IC upwards and the RS232 side towards the cable exit. This should mean the surface mount capacitors on the rear are towards the clearance pocket in the PCB cradle.

The piezo buzzer was a press fit into the recess I'd drawn for it but I also used some hot glue to keep it in place.

Testing and use

Be sure to unplug the USB lead from the amplifier before testing.

The remote port will not work with the USB cable attached and the amplifier manual states damage is not impossible if both are in use.

I tested it works before finally fitting the RS232 PCB into the enclosure. During testing I hadn't checked the bold statement above so it wouldn't work. After swapping the input and output data lines (chatting to ON7EQ for help) I then swapped out the PCB for another with no progress.

Then ON7EQ asked the killer RTFM question about the USB lead, and then I had it working. However, I had not test fitted and smoothed off the edges of the second PCB to my cradle so it wasn't as nice a fit but the wires were on and I wasn't taking them off, so mine has a hideous pile of hot glue to make up for my oversight. You will know when it is working as the console will either say *"SPE Expert not online"* or you will see the buttons screen (Fig. 8) when you start everything up.

Three of the micro JST connectors to my CYD PCB came out straight and needed a 90° bend so to provide some strain relief for the tiny wires during assembly and testing I used some hot glue. Also a tiny dab of hot glue instead of cable ties to keep pairs of wires together as seen in **Fig. 6**. ON7EQ's CYD PCB also had the two-way connector coming out straight so I had added some front panel clearance for those PCBs as well. I snipped off the unused wires to save space and mess.

Description	Source	Link	Qty	Cost
ESP32-2432S028R	Amazon	https://www.amazon.co.uk/dp/B0CG2WQGP9	1	£16.98
MAX3232 PCB (pack 10)	Amazon	https://www.amazon.co.uk/dp/B07XM6RNZG	1	£5.49
Light pipe PLP2-215	CPC	https://cpc.farnell.com/bivar/plp2-215/light-pipe-single-5-5mm-panel/dp/SC20656	1	£0.59
L7805CV 5V regulator	CPC	https://cpc.farnell.com/stmicroelectronics/l7805cv/v-reg-5-0v-7805-to-220-3/dp/SC08327	1	£0.49
ABI-001-RC Piezo buzzer	CPC	https://cpc.farnell.com/pro-signal/abi-001-rc/piezo-buzzer-12vdc-pcb/dp/LS03776	1	£1.85
Ceramic disc 0.01µF 100V (pack 10)	CPC	https://cpc.farnell.com/vishay/d103k43y5ph63l2r/capacitor-disc-100v-10000pf/dp/CA07956	2	£1.20
Electrolytic 10µF 16V (pack 5)	CPC	https://cpc.farnell.com/multicomp-pro/mcmhr16v106m4x7/capacitor-10uf-16v-radial-105/dp/CA08215	1	£0.24
Electrolytic 220µF 25V (pack 10)	CPC	https://cpc.farnell.com/rubycon/25yxj220m6-3x11/cap-220-f-25v-20/dp/CA09738	1	£1.32
RF Choke 4.7µH 1.6A (pack 5)	CPC	https://cpc.farnell.com/epcos/b82144a2472k/inductor-axial-4-7uh/dp/TF00566	1	£1.74
Vero type stripboard	CPC	https://cpc.farnell.com/kemo-electronic/e003/stripboard-fr2-100x160mm/dp/PC01601	part	£3.05
2 core screened cable	CPC	https://cpc.farnell.com/pro-power/pp5142/cable-7-0-20mm-2c-screened-25m/dp/CB25494	1.5m	£12.62
9 way D-type plug	CPC	https://cpc.farnell.com/pro-power/100-09m/plug-d-sub-9-way/dp/CN15860	1	£0.25
Diecast 9way D-type housing	CPC	https://cpc.farnell.com/mh-connectors/mhdm-9-k/backshell-d-diecast-9way/dp/CN15342	1	£3.58
Ferrite ring	CPC	https://cpc.farnell.com/ferroxcube/cst17-9-5-13-3s4/ferrite-core-cylindrical-90-ohm/dp/FT01493	2	£2.78
			Total	£52.18

Table 1: Parts list.

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For the RS232 cable to the amplifier I started at the amplifier end, fitted a ferrite ring that seemed to be the most suitable CPC had and wound the three turns I'd calculated would fit, fitted the metal D-type housing then routed the cable to my planned spot on the desk and fitted the second ferrite (I'm real keen on keeping RF out) and inserted all the slack through the clamped cable hole. Once the unit was working, I fed that cable back out to fit the RS232 PCB into its cradle and clamped the cable. The speaker wire style twin DC wire (2 x 0.5mm² spare from some reels I bought to make radials) is a nice sliding friction fit in the slot and I cable tied that to the clamped RS232 cable, as seen in **Fig. 7**.

It's then a case of looping the cables into the body and fitting the front panel to the body. This is a snap fit design so easy to fit and quite easy to remove if required. Everything is very compact as Jean-Jacques wanted as small as possible. Actual dimensions are 95.5mm wide, 52mm high max from table and 55mm front to back max. Of course you can use any enclosure you like instead.

Once you have it assembled and working on startup the remote console will got through a startup screen where you can adjust settings or select OTA (over the air) to update to new firmware. If neither is chosen you will end up at the buttons screen. Example screen views are shown in Fig. 8.

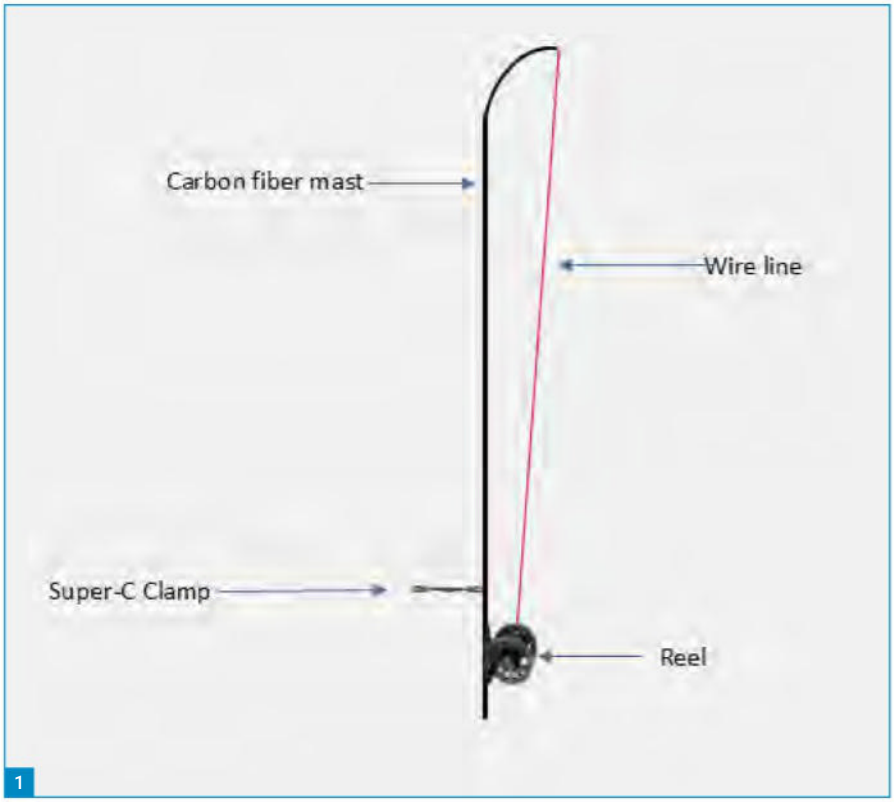
Your screens may look different to my image as Jean-Jacques is evolving this project as I type. He has already added CW ident firmware version for keypresses instead of a simple beep and if you use a small speaker instead of the piezo buzzer, there is a voice ident for the keypresses. These were added to enable access to this project for our blind operators.

I have also added a screen grid insert for my enclosure to assist in locating the button areas of the screen by touch only. There is also a drop on dust cover for the screen for people like myself who may not use the radio for some time.

There are other refinements in the pipeline in the functionality of the remote console.

You may also find that your screen colours do not match my images. This has been found to be a hardware difference in the supplied CYD units. There are firmware versions to correct this as well.

Many thanks to Jean-Jacques ON7EQ for his design of the SPE Expert remote console and especially sharing his work so we other SPE Expert owners can benefit from his efforts. It appears far more robust in terms of RF susceptibility and cured an annoying issue for me. This in turn aids household harmony as my long suffering YL has at least one less thing to hear me moaning about! **PW**



1

The Wave Caster

Frank Howell K4FMH returns with a Vertical Multiband HF Antenna for Portable Operations.

Frank M. Howell, PhD, K4FMH
practicalwireless@warnersgroup.co.uk

Catch a wave and you're sitting on top of the world was a popular song by the Beach Boys. Hams can certainly embrace the spirit of that hit tune! Amateur operators *cast waves*, too. We need antennas that cast radio waves efficiently and to faraway places. I describe a portable HF vertical antenna that uses a fishing pole and reel to 'hang ten' with an easy setup and pack down for portable operations. It is not very expensive to build after the inspiration given by **Chuck KK76USY** on his YouTube channel who used a small resin reel to hold flexible antenna wire. **Colin MM0OPX** was another inspiration with his use of fishing poles to make vertical HF antennas in innovative ways. Ease of use measured against adequate performance is a very desirable thing in portable HF operations.

The Wave Caster vertical fits the need for easy setup, take down, and packing for transportation for portable operations. It is inexpensive to build and can cover the popular POTA bands of 40, 20 and 15 metres. The use of separate reels can implement other bands, too.

Fig. 1: The basic design of the antenna.

The Wave Caster concept

Here is briefly how the Wave Caster vertical works in a portable setting. Put up the extendable carbon fibre 'squid pole' using the photographer's Super Clamp, attached to a table edge, railing or other similar sturdy object. The clamp is a brace attached above the bottom of the mast rather than a clamp at the base of the pole. Connect the loose end of the reel's wire line to the tip of the telescoping mast. Attach the reel to the pole's base using magnetic strips. Raise the squid pole so that the radiating wire is at its full length but ending the tip so the wire is pulled away from the carbon fibre pole. Lay out either wire or Faraday Cloth for the counterpoise field and the surf's up, ready for casting and catching HF radio waves.

I use a photographer's Super Clamp double-claw mount to brace the 31ft telescoping fishing pole to a table or other usable mount. Two clamps can be used if desired. Other

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2a


2b


2c

Fig. 2: Parts for Wave Caster Vertical antenna. Fig 2a: 31' carbon fibre telescoping pole. Fig 2b: small resin reel. Fig 2c: photography Super Clamp with ball joints.

usable mounts for the mast are possible so experiment to fit your needs. It can be set up as a 40m vertical using a 1:1 choke Unun with 15m available as a harmonic of 40m. It can also be used as a random wire vertical covering most HF bands with a 9:1 Unun but I have not used it in that configuration so it's an experimenter's delight! I also use a separate resin reel with 16.5 feet of wire for an efficient quarter-wave vertical on 20m by just shortening the telescoping pole to a suitable height.

I note below a trick to remove the debilitating effects that a carbon fibre pole


3a


3b

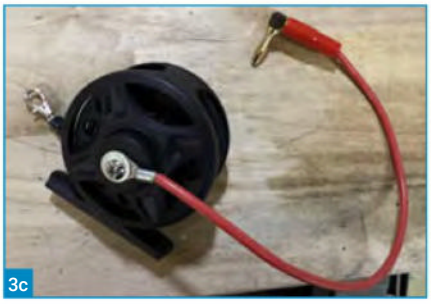

3c

Fig. 3: Assembling the small resin reel with the radiating element. Fig 3a: Reel loaded with #26 flexible stranded copper wire. Wire attachment shown on right. Note the small fishing leader clip used to attach to mast tip. Fig. 3b: Small hole for wire to enter shaft bushing. Round terminal wire connector rides on shaft. Fig. 3c: Completed resin reel with banana plug attached. This is my preferred connector for easy insertion and removal to an LDG 1:1 Unun. A neodymium magnet is attached to bottom of reel mount using

can have on a vertical wire connected too closely to its surface, based on research I've conducted with these conductive materials.

Here are the features and the construction steps I have used to build several of them for me and some ham friends.

Preparing the parts

The key parts are the telescoping carbon fibre fishing pole, a small resin reel, flexible stranded wire (I use #26 flexible stranded insulated wire from BNTechGo via Amazon), neodymium magnets with adhesive strips,


4a


4b


4c

Fig. 4: Assembling the Wave Caster Vertical. Fig. 4a: Neodymium magnets with adhesive strips on pole and reel mount. Easy to attach & remove by slight twist to a right angle! Fig. 4b: Super Clamp bracing Wave Caster to handle of BBQ grill. Two clamps can be used for a firmer brace with windy conditions or any alternate mount as desired. Fig. 4c: The radiating wire fully extended from the reel. Note that the carbon fibre pole can touch the Faraday Cloth used for the counterpoise system since it is not part of the radiating element. I later added a rubber cap to the bottom to reduce wear on the pole.

a fishing leader clip, a photographer's Super Clamp device for attaching ad hoc lighting, a sheet of Faraday Cloth for the counterpoise, an alligator clip and stranded wire for a ground cable, and banana plugs. I use a 1:1 Unun made by LDG which has banana plug connectors but any RF choke at the base

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of the vertical for connecting the radiating element and the counterpoise will suffice. A banana plug for the radiating and counterpoise leads can be used with a choke of ferrite beads on the coaxial cable if that makes it easier. See **Fig. 1** for a diagram of the overall arrangement.

Shown in **Fig. 2**, the 31-foot fibre glass pole I purchased on AliExpress is made by Bakawa, a popular vendor for fishing poles in China. It is about $1 USD per foot but resellers do vary their offering price.

The small resin fishing reel I obtained via Amazon is listed as a 'Fly Fishing Reel ABS 2.4inch(6cm) Mini Fly Wheel', which is very similar to what Chuck KK6USY used on his YouTube Channel for a different antenna design. It is light but very sturdy. It allows for a myriad of mechanical mounts to be accommodated. The Super Clamp marketed to photographers is alternatively sold as a 'Double Clamp Mount with 360°Magic Arm' on Amazon.

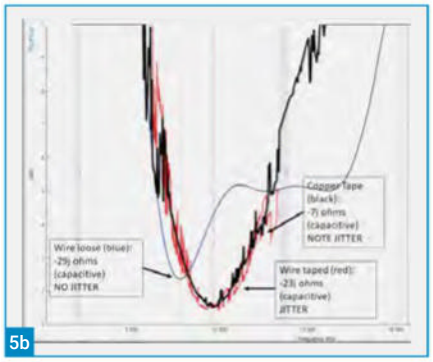


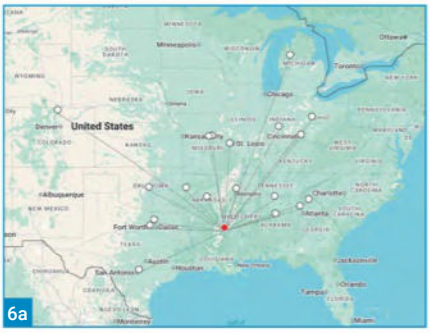
Fig. 5: Pulling the radiating wire away from the carbon fibre pole. Fig. 5a: With the resin reel pulled slight tight with the full radiating wire spooled out, it bends the flexible tip of the Wave Caster. This keeps the wire away from the distortions of being too close to the carbon fibre mast. Fig. 5b: Three RF sweeps using a RigExpert Analyzer. One is with wire taped to the mast (red). Another is copper tape applied directly to the mast (black). The third is with the wire loosely hung from the mast tip (blue). All elements were 17' in length.

Do some online vendor searching as there may be one style that fits your needs better than what I use here.

Assembling the wire reel with the radiating element

The key to making the reel hold the wire and spool it out without stressing the wire is to proceed as follows. In **Fig. 3**, I show how the radiating wire enters through a small hole drilled on the inside of the reel using a drill bit just slightly larger than the diameter of the wire. As per the instructions supplied with the reel, a small metal tab on one side of the reel shaft will allow that side cover to be removed, showing the shaft and the bushing in the main part of the spool (see pictures). The wire passes through to the spoke assembly. Use a steel (or other but not flimsy metal) ring terminal on the wire end that will fit over the centre opening for the reel shaft. Bend the ring terminal slightly as in the illustration. It should just fit over the shaft entry but allow the shaft to be reinserted. This allows an electrical connection without strain on the wire from the reel action. I got this brilliant idea from Chuck KK6USY after watching a video of his demonstrating the use of this reel for holding a radiating element.

Finish the reel assembly with a small jumper cable containing another smaller ring terminal inserted underneath a screw holding the shaft. The other end has a banana plug on it for inserting into the 1:1 Unun made by LDG or another connection terminal to suite the choke assembly of your choice.



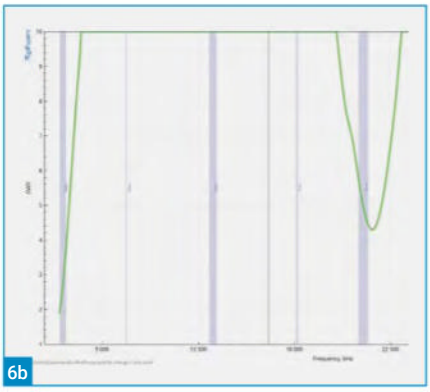


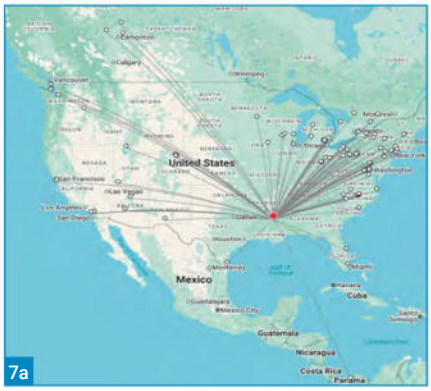
Fig. 6: WSPR and RF sweep of Wave Caster Vertical on 40m. Fig. 6a: WSPR spots on 40m for one hour from 9-10am Central Time. Fig. 6b: RF Sweep for 40 and 15m.

Putting the Wave Caster Vertical together

I like to use neodymium magnets to attach things that are removed frequently. With the right mechanical attachment, two of them make a very good temporary 'clamp' using magnetism! Twisting the two magnets toward right angles easily breaks the strong magnetic connection without stressing the adhesive strips holding each one to their respective surfaces. This is how I attach the resin reel to the carbon fibre pole. **Fig. 4** shows a close-up of this attachment toward the ground end of the telescoping pole.

The fishing leader clip attached to the radiating wire end is clipped to a similar clip tied to the very tip of the carbon fibre pole using a string protruding out of the very top section, usually supplied with the mast. In Fig. 4, I have attached the Super Clamp brace to the handle of my BBQ grill with the opposing clamp gently secured to the mast. Do not over tighten as carbon fibre can crack with too much pressure. The bottom section of the mast sits on or near the edge of the Faraday Cloth used as the counterpoise. The reader can see the two banana plugs fitting into the LDG 1:1 Unun just out of the frame. In the field, I use a plastic C-Clamp attached with double-sided adhesive tape that snugly fits onto the pole during deployment. These clamps are sold as pipe hangers, available on Amazon or eBay,

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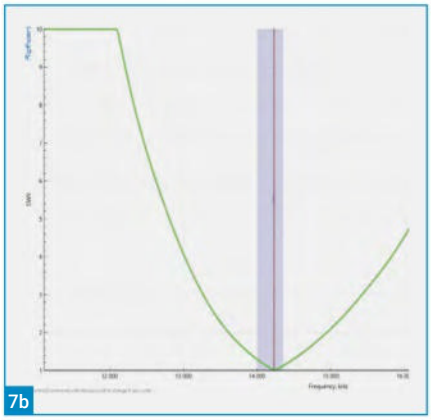


Fig. 7: WSPR and RF sweep of Wave Caster Vertical on 20m. Fig. 7a: WSPR spots on 20m from 4:40-5:00pm Central Time, 1 September 2025. Fig. 7b: RF sweep for 20m.





Fig. 8: Wave Caster packs down into a resin quiver designed to hold arrows. Fig. 8a: Quiver opening with telescoping pole in sheath covering. The accessories are stored around the insert. Fig. 8b: Full length of quiver for transportation. The quiver slide-locks longer or shorter to suit the length of the carbon fibre pole. The insert, designed to hold arrows, is modified by removing rubber fingers to securely hold mast and place accessories between the two wheels inside the quiver.

but measure the diameter of the mast section carefully before purchasing one so it will be just snug enough. In the bottom picture, I point out that the radiating wire leans away from the pole for a good reason explained below. After using the Wave Caster a bit, I added a rubber cap over the metal portion of the bottom section to reduce wear over time.

Here is why I recommend pulling the radiating wire away from the carbon fibre pole. We do not yet know very much about the RF characteristics of carbon fibre material. It can conduct electrical current but some amateurs say that a wire antenna attached to one can affect tuning. Others say it affects their wire antennas not at all. **Fig. 5** summarizes some tests I made on this issue.

The RF sweep graph illustrates three radiating elements. One is copper tape directly placed on the carbon fibre pole shafts, aligned so they make connection at each joint. A second is a wire taped in several places up and down the shaft but not making continuous mechanical connection to the pole. The third is a wire attached to the tip but only draping down near the pole with only that single mechanical connection. All elements were 17 feet in length (I used a smaller 17-foot carbon fibre mast for this test).

With direct contact in two of the RF sweeps using my RigExpert Stick Pro with 1,000 data points, there is a noticeable jitter in the sweep. **Dave G3PVH** speculates the *"pole has both conducting and dielectric properties. The jumpiness when using a conductor close coupled to the pole looks like imperfect conduction by the fibres touching together. The lowering of frequency looks like dielectric loading. Your characteristic for a spaced wire, where it tends to show a double hump, is rather like the plot for a broadband open sleeve dipole. The capacitive reactance at the frequency of lowest resistance is characteristic of antennas with fat conductors."* (RSGB Technical Group). Consequently, I use the Wave Caster with the flexible tip pulled slightly taught to move the wire away from contact with the length of the carbon fibre mast. This relinquished any 'jitter' or other observed aberrations in the radiating wire. The picture of the fully deployed Wave Caster in this figure illustrates the effect this has on the antenna.

Proof of concept for the Wave Caster Vertical

With 31 feet of wire in the air, this resonates on 40m (see **Fig. 6**). It has a harmonic on 15m that a tuner will match easily to a usable SWR reading. The SWR sweep show that getting the length into the 40m band can be adjusted for a low reading but I left mine so it was optimised toward the lower end of the band. The expected harmonic on 15m is just above an SWR of 3 or so, easily matched by a tuner.

The day I made these tests was 5 August 2025. The sunspot number was 86 (SSN for Aug was 135.8), K index was 3, SFI was 157.5, and there were no solar flares. The WSPR map for 40m was based on the test period of 9-10 AM U.S. Central Time, a period where this band is perhaps beginning to be short in distance. Even on a day with sunspots being much lower than the month's average, the Wave Caster appears to radiate effectively. From my patio in a suburban neighbourhood, these spots show that the antenna does radiate successfully using a 0.2W WSPR beacon.

I experimented with shortening the length of wire spooled out from the reel to about 17 feet, thinking that this would work reasonably on 20m. But this proved to be too fiddly to tune up reliably. The easiest choice was to just prepare a second resin reel with about 16.5 feet of radiating wire. For the 20m band, one of the most popular ones for daytime use, I just lower the carbon fibre mast, spool up the radiating wire and remove the reel. I replace it with wire cut for 20m and reverse the process. This tunes up nicely and radiates very well for a quarter-wave vertical (see **Fig. 7**). The WSPR beacon receptions for a 20-minute period on 20m in Fig. 7 shows that this vertical radiates like other quarter wave verticals do.

Packing and storing the Wave Caster Vertical

The Wave Caster is based on a 31-foot telescoping fishing pole at its full length. When reduced down to its smallest length, it fits nicely in an inexpensive archer's quiver. This case is illustrated in **Fig. 8**. I use a resin case with an insert composed of two sets of rubber wheels with fingers attached by a rod, designed to hold arrows. After cutting away one of the fingers on each wheel, the telescoping pole fits securely against the outer edge of the quiver. The sections above and below the rubber wheels are useful for storing RG-316 coax and such while the section between the rubber wheels contains the rolled-up sheet of Faraday Cloth, bound with a Velcro strip. The LDG 1:1 Unun fits here too.

Conclusions

This antenna is a design that optimises acceptable performance with ease of deployment. The measurements suggest that it is comparable to most commercial quarter-wave verticals. It is very competitive in price to those antennas plus is an experimenter's platform that can be modified for other bands, mounts, and so forth. For the portable HF operator, the ease of transportation, packing, and deployment will make you have *good vibrations* as you want to *do it again*. **PW**

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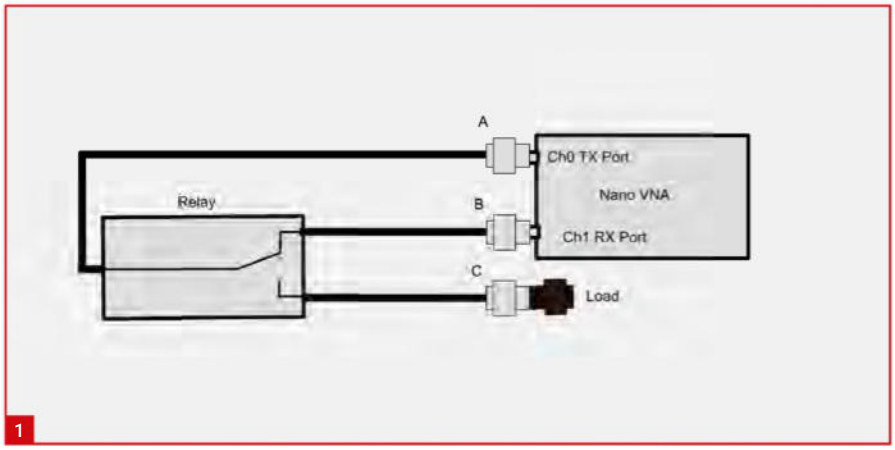
Keith Rawlings G4MIU
keith.g4miu@gmail.com

That I have been describing some of the interesting things that can be done with a NanoVNA for a year now (with breaks I admit) is an indication of just how versatile and useful these little gadgets are.

Indeed, judging from reader feedback over the last year there is appetite to learn more about them, and the numerous other similar models, and how they can be used in day-to-day tasks in an amateur's shack. Although I say in the amateur's shack, feedback demonstrated that they are being used by field engineers around the world for various tasks.

I guess that the compact size, remarkable accuracy and low cost of this type of VNA must make them a good choice for use where engineers may not want to risk a more expensive analyser if they don't have to.

Continuing the theme this month I will look at characterising RF relays.



1

Yet more things you can do with your NanoVNA

Keith G4MIU finds yet another use for the versatile NanoVNA.

Relays (RF)

We can test a relay with a NanoVNA to evaluate its performance at RF frequencies.

Characterisation such as measuring insertion loss, isolation between ports, and VSWR may be done quite easily when the device to be tested is on the bench (not always as easily if the device is in circuit). While we can use a multimeter to check DC continuity, the NanoVNA will show us if the relay introduces any anomalies into the circuit at RF.

Here I will use the VNA3G (NanoVNA variant) to evaluate two relay types out of my junk box.

The first type is a coax relay which is ex-equipment and has flying leads terminated in BNC plugs. They were originally supplied by RS and are part number 349-686 12V DC 170Ω types known to have a rating of 50W up to 1GHz. These relays have been sitting in a box along with a few others, untouched for over 20 years. While the VNA won't tell me if it is capable of handling 50W or not, it will tell me what its insertion loss will be like after all of this time sitting in a bit of a damp garage and also what the isolation between ports is like as well.

The second relay types are Hamlin HE431A8415. Again, I have a box with a number of these relays in but I have no data for them nor can I find any. They are I suspect a reed relay type and are likely to be just make or break. It will be interesting to see what the insertion loss of the Hamlin devices is like and what frequency they are going to be good for.

Before we start measuring, I think it is worth mentioning Sweep Points again.

The NanoVNA does not sweep continually over the set range; it actually steps from one point to the next. Some Nano's can sweep up to a maximum of 101 points; others or those with modified software can sweep more. In some cases, this can be 201, 301, 401 or in the case of the VNA-3G 1001 points.

If we were to sweep up to 1MHz with the sweep set to 101 points, we would get a measurement every 9.99kHz. At 100MHz this would be every 99.9kHz. As you can see if we set the sweep width too low, or try to sweep too wide a range, then we will miss any data between these points. This is something to bear in mind when sweeping over a large range.

Testing

The RS relays are going to be the easier ones to look at as they have 'flying leads' terminated in BNC plugs and will just need hooking up to the VNA by using the appropriate adaptors.

A diagram of the test setup may be seen in **Fig. 1**.

RS349-686

Starting with the RS relays I took two examples from the box and found them to be in indifferent condition, the cables were grubby and the screws holding the connection covers on were corroded. After disassembly I found both were in good condition inside although the relay contact on one relay had come adrift. The relay coils were switching OK at 12V but on both devices the little plastic plungers that the relay coil actuates to move the relay contact inside the device were stuck solid.

I freed these by gently working the plunger in and out while using a little drop of switch cleaner

I set up the VNA to sweep from 10kHz to 1GHz with sweep points set to 1001 giving me a resolution of 999kHz. For the sake of this description I expect the response of the relay to be flat over the range and this should be acceptable but, if there are any anomalies in between the points, they will not show on the trace. To counter this, if using the VNA-3G standalone, I would make a number of smaller sweeps stepping through the wanted range to get a realistic measurement and I suggest this is a better way forward using Nanos only capable of fewer steps.

That said when using the NanoSaver software application it should be possible to select enough points to run a continuous 10kHz to 1GHz sweep.

So, having set the sweep range the next task is to select a trace on the VNA and then set this to read S21. This will enable a Through Measurement. Next, we need to set the Format of that trace and for insertion loss (in dB) this needs to be LogMag.

The next bit is optional; if required you can set other traces to measure S11 so we can check for impedance, mismatch/VSWR, and also Phase to set an Electrical Delay.

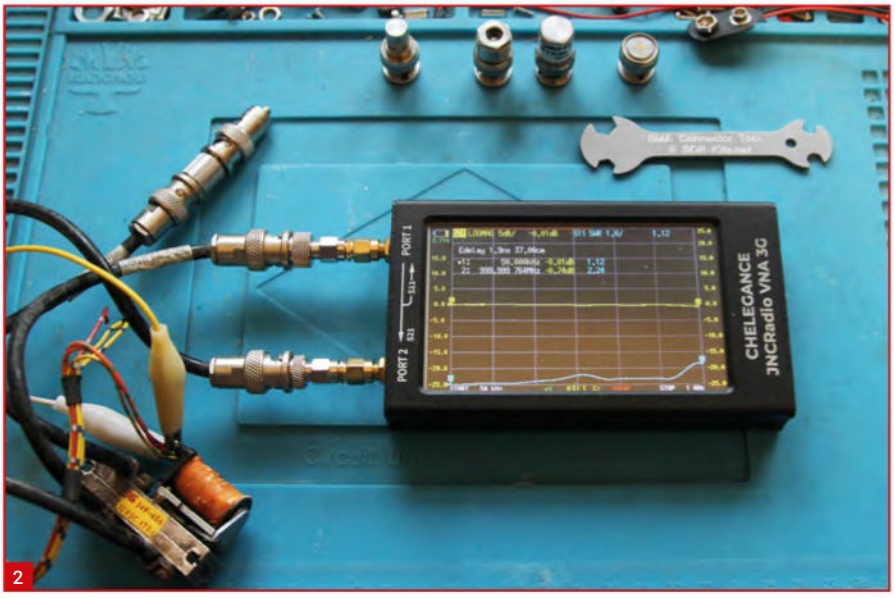
With everything set we now need to perform the all-important SOLT (Short, Open, Load, Through) calibration on the cables you intend to use.

In the case of the coax relay I have used BNC adaptors mounted directly on the VNA so they match the BNC plugs on the flying leads of the relay. I don't intend to put any strain on the VNA connectors otherwise I would have used flying

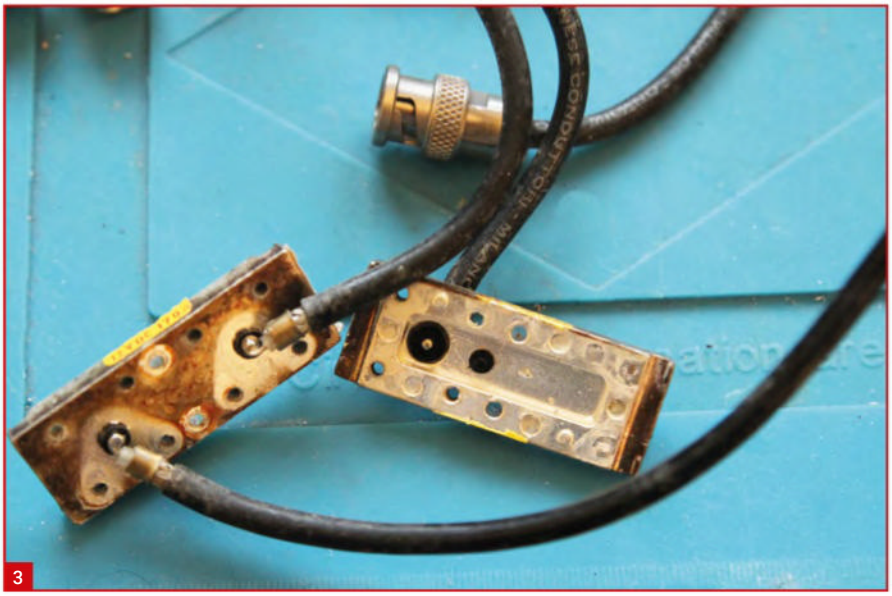
Fig. 1: Diagram of the coax relay measurement.

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Fig. 2: Coax relay under measurement.
Fig. 3: Internal view of the broken relay.
Fig. 4: Connections to the Hamlin relay.
Fig. 5: Hamlin relay response. Flat to around 368MHz. Fig. 6: Corrected Fig 3 from last month!



2


3

leads on the SMA connectors directly.

I fitted the Cal kit to the BNC adaptor on the VNA so the calibration point is now effectively at the BNC connector on the relay's flying lead. If I were only measuring say to 30MHz, I might have left the calibration as is but as I'm going to 1GHz the length of the lead will have a significant effect on the measurement.

To take this lead out of the equation I will use an S11 trace to read Phase and then select Electrical Delay from the menu and shift the measurement plane to the contact point of the relay to electrically bypass the cable.

With the relay contacts open look at Fig. 1; here I connect point A to Ch. 0 and then adjust the delay time to get the Phase trace to below 1º of phase error at 1GHz.

The Phase value will be displayed numerically on the screen and the S11 trace should also be flat along the display axis.

In my setup I found I needed 1.9ns of delay.

Now one of the flying leads, B in **Fig. 3** is connected to Ch1 on the VNA and the other lead C is terminated in a 50Ω load. The S11 PHASE trace may now be de-selected if required. See **Fig. 2** for the test setup. Note here the Edelay is set at 1.9ns.

Ensure the relay contact is in the 'make' condition i.e. the contact is closed as in Fig. 1.

Now run the sweep and the results should be shown on the S21 LogMag trace.

In my case the insertion loss through the first relay A to B was 0.74dB at 1GHz. See Fig. 2, where the insertion loss and VSWR response can be seen to be flat over the range. Swapping leads A to C returned an insertion loss of .82dB. Isolation between ports was 33dB and connecting the VNA across ports B and C showed an isolation of some 37dB.

Relay 2

The relay innards devoid of the broken contact spring can be seen in Fig. 3.

I repaired this relay by removing the small spigot that the contact was affixed to and then I forced a Vero pin through the plastic insulator so that just enough of the pin sat proud enough to resolder the contact to. Heating the pin with a soldering iron helped it through the insulator. After assembly I was happy to find it worked perfectly.

Measurements on this relay were similar to the first one. It returned 1db A to B and .91dB A to C insertion loss at 1GHz, 33dB isolation between ports and 41dB. across ports. I guess that this is OK for devices that have been stored in less than ideal conditions for 20 odd years.

Incidentally they have now been moved to a better environment to await refurbishment.

Hamlin HE431A84152

The Hamlin devices will need connectors soldering to them and in this case I used a couple of SMA PCB sockets that will be soldered directly to the SMA flying leads, **Fig. 4**.

The Hamlin relay dimensions are 29x9mm and the pins on it are quite close together so this relay was going to be trickier to test.

I have used some of these devices before on an M0AYF HF Active loop. Then I took an educated guess on the devices' pinout in that the three pins on one end would be DC on the two outer pins and the relay contact on the middle pin with the single pin at the other end being the other relay contact and this proved to be the case.

On test the relay activated at 6.2V DC and dropped out at 4.5V DC. At 12V DC it drew 20mA and barely got warm so I took it to be a 12V device. What the contact current rating of the device is I don't know.

To keep the strain off the lightly soldered connectors I used thin patch leads terminated into SMA plugs.

I performed a SOLT and the end of the patch leads.

With an (optimistic) sweep set from 50kHz to 1.3 GHz the response on the VNA may be seen in **Fig. 5**. The useful frequency range looks to be 0-368MHz maximum where at the latter frequency the insertion loss reached 3dB (yellow trace). Above this things go downhill

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very rapidly. The blue trace is the VSWR and is also very poor above 368MHz. Insertion loss below 368MHz was 0.55dB maximum and isolation between the contacts was -74dB at 50kHz and -23dB at 368MHz.

These devices look to be suitable for HF and VHF use.

Reader feedback.

I received an email from *PW* reader **Fraser** regarding the use of a Nano VNA, in his case a NanoVNA H4.

Fraser tells me, *"I found a use for my NanoVNA when repairing a Kenwood TL922 linear amplifier. I bought this immaculate amp cheap as a non-worker some years ago. A couple of years ago I decided to see if I could bring it back to life. Inside everything was very clean but, on inspection, I observed that the anode choke had been burnt out. Tedious story short, I decided to wind another one myself.*

"Using a pick a sensor loop like you used in your article I used the NanoVNA to check for resonances on the new choke. I suspect that this amp may have been used on CB hence the burnt choke!"

Thanks for the info Fraser. The TL922 is a beautiful amp and using a pair of 3-500Z valves should tick along quite nicely at its rated output.

I had a linear that used a single 4-400A and, into a dummy load I might add, could be pushed to 1kW output on 80-40m with 4kV on the anode! (400 watt limit in those days!)

It does not bear thinking about if Fraser's amp had been used on 27MHz or not!

Please feel free to email me and pass on how you have used your NanoVNA/VNA

Correction

I made a couple of mistakes in last month's column. Fig. 3 should actually have been the one now seen in here **Fig. 6**. Last month's Fig. 3 was a plot of a LoG not on ground but actually modelled a few inches above it.

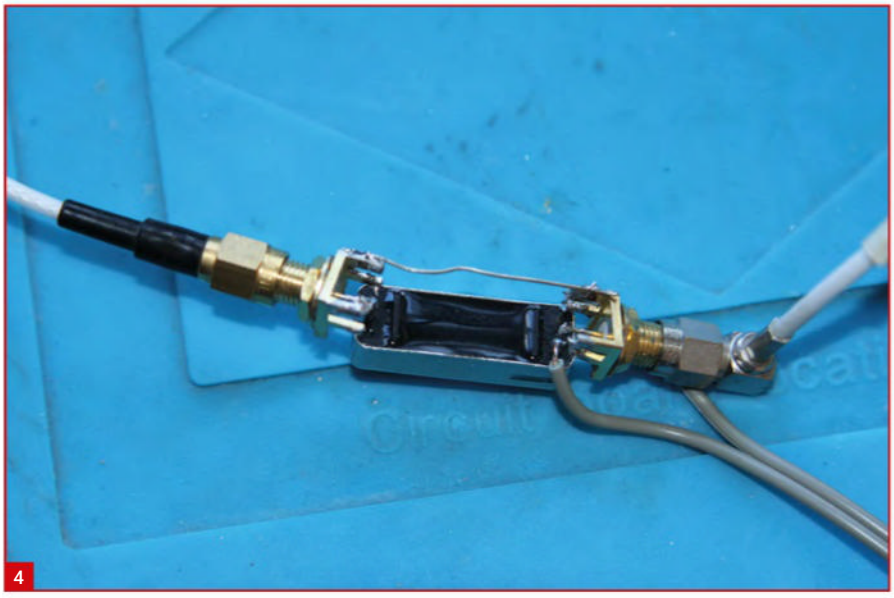
Under 'Conclusion' this paragraph should have read:

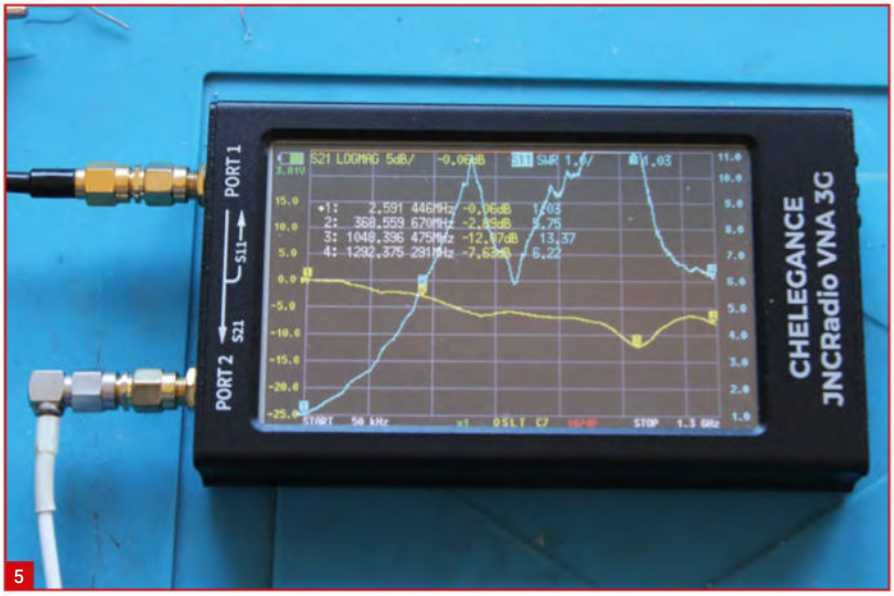
The antenna plots are provided as a guide. With the antenna sitting on the ground and probably with other objects nearby it will be difficult to say definitively that the actual radiation pattern will exactly match the antenna model although AN-SOF is pretty good in this respect.

The original KK5JY article used EZNEC+ which used the NEC 2 engine and AN-SOF is known to produce more accurate results with antennas close to the ground.

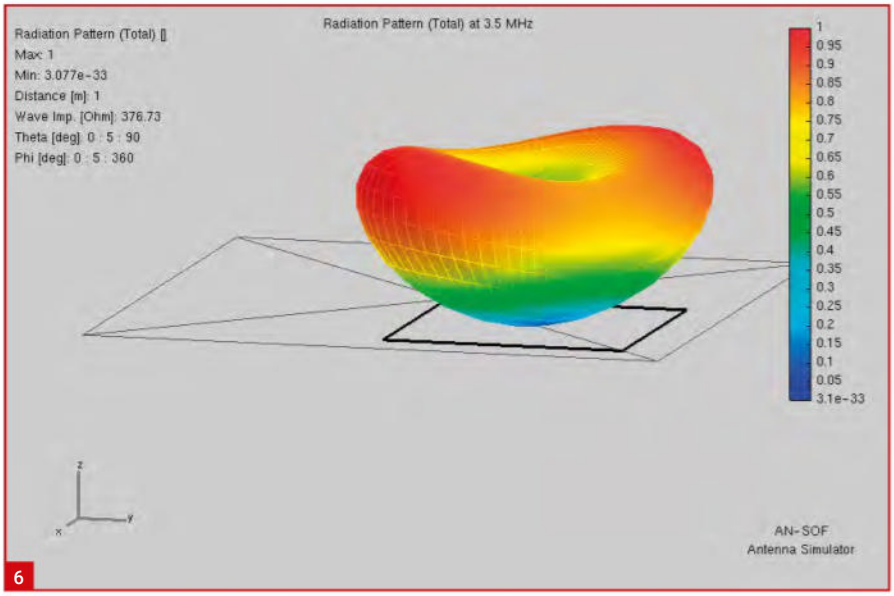
The latter error was the result of using one PC to write the column and another to submit it from only for me to realise, too late, that my OneDrive had not updated to the modified text by the time I sent it.

My apologies! See you next month! **PW**


4



5



6

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Broadcasting history

Keith and **Garry** invite you for another amble through their archives.

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Keith405625.kh1@gmail.com
Garry Smith
Garry405625.gs@gmail.com

BBC Broadcasting House, London: Part VIII

The physical shape of *Broadcasting House* in London enabled the BBC to ensure the isolation of the studios from external noises by a simple, but at the same time, ingenious design. The studios were separated from the streets adjacent to the site on all but the north side by a 'buffer building'. They were, in effect, contained within a vast brick tower that occupied that portion of the site. The building outside the central tower was steel-framed and mainly housed administrative and executive offices.

In 1932, the publication, *Architectural Review*, described the building as the *"new Tower of London"*. It had to be asymmetrical because the first design needed to be amended when local residents complained about the shadow that the building would cast on houses in Langham Street, and their loss of natural light. The building featured an accentuated front section. The south end of the premises, facing down Regent Street, suffered from the same difficulties as the Langham Street front regarding the loss of natural light. The various parties concerned made certain concessions and the design was altered to have a symmetrical façade to Portland Place which would dominate the whole building. To emphasise the main doorway facing south, a *Clock Tower* was installed above it.

Vintage battery advertisement

This month's ramble through vintage copies of bedraggled newspapers and magazines has unleashed a rather unusual advertisement by *Lissen* for their *High-Tension Battery*, **Fig. 1**. The advertisement dates from 24 September 1932.

The text has been left in its original format to reflect the spelling, grammar and punctuation of the time.

Following the February and March columns detailing how the BBC produced their special effects for radio productions, we're not quite sure how an h.t. battery process, exclusive to *Lissen*, could provide *"power of remarkable purity"* and remain *"noiseless and abundant always"* in order to enhance the BBC's original efforts in the studio.

The advertisement is also somewhat curious because there is no mention of the company's address. According to Lissen, listeners simply went to any radio dealer and asked for the battery "*firmly by name*".

100 years ago: April 1926

This series presents some of the events, technical achievements and personalities associated with the world of broadcasting from exactly 100 years ago this month.

On 18 April 1926, *Polskie Radio* began regular broadcasts from studios in Warsaw. Previously, a temporary station was established on 18 August 1925. From 1931, Polskie Radio broadcast their national channel from one of Europe's most powerful long-wave transmitters, situated at Raszyn, just outside Warsaw. The transmitter was destroyed in 1939 when Germany invaded Poland.

A regular, albeit experimental, exchange of radio programmes between the UK and the Netherlands began on Monday 19 April. Broadcasts were beamed via the transmitters at Daventry and Hilversum.

On the 27th, **Thomas Thorne Baker F.C.S., F.R.P.S., A.I.E.E.** of 15, Grosvenor Gardens, Cricklewood, demonstrated his *Wireless Picture Transmission* apparatus at the *Hotel Cecil*. His invention was later renamed *Izon*. Previously, in 1910, he succeeded in sending what he called *"a telegraphic transmission of photographs"*. Also in 1910, the Postmaster-General gave him permission to attempt sending photographs across the Wash via wireless telegraphy using the experimental radio stations at Hunstanton and Skegness.

In focus: The BBC Crystal Palace transmitter – Part I

28 March 2026 marked the 70th anniversary of the *BBC Crystal Palace* transmitter being brought into service, initially operating using a temporary installation. Back in 1956, the television station was designed to provide increased coverage to a large swathe of London and the Home Counties. The transmitter, now operated by *Arqiva*, is located atop a 109m (358ft) hill, which makes it the highest structure above sea-level in London. It is installed on the site of the former television station and transmitter operated by **John Logie Baird** in 1933.

The footprint of the transmitter meant designers and engineers had to build a special lattice-style 'tower' (rather than the traditional British lattice 'mast') which was tall and thin.



*"**HOW STUDIO SOUNDS ARE PRODUCED***
Here's your radio railway train
Shrill whistles, hissing steam, the clank of wheels, the gathering speed ... all these noises are produced in the Effects Studio by means of simple mechanical devices like the roller skate and the compressed air cylinder you see above. The result is amazing!y realistic ; and that realism you can retain in your reproduction by using the pure power of a Lissen Battery in your set. There is a process used exclusively in this Lissen Battery which produces power of remarkable purity ; power so sustained that over prolonged periods of time it remains steady, noiseless and abundant always. Every radio dealer sells the Lissen High Tension Battery : ask for it firmly by name
LISSEN
H.T. BATTERY
lasts longest and provides a pure high tension current that will give stage realism to your radio drama!"

1

Some people compared it to the *Eiffel Tower* in Paris because of the similar design, **Fig. 2**.

Since the opening of the *BBC Television Service*, 20 years earlier on 2 November 1936, programmes had been broadcast across London from a transmitter installed on a tower at *Alexandra Palace*. In 1956, the installation at 'Ally Pally' was switched off and not destined to operate again as a regular transmitting station.

For many years, 'live' programme production from Alexandra Palace had suffered from interference because of the close proximity of the transmitter to the studios. A solution to this problem had been found with the opening of the Crystal Palace transmitter. Stable and more reliable pictures could be sent from the new state-of-the-art transmitter. The site was also a safe distance from the BBC studios at *Lime Grove*.

The official opening of the Crystal Palace television station on 21 December 1957, meant that the BBC was well placed to face commercial competition from ITV, which had opened nearly two years earlier with their outlet located in Croydon.

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Fig. 1: An advertisement from 24 September 1932 by *Lissen Limited* for their *High-Tension Battery*. (Photo: Keith & Garry)
Fig. 2: The *BBC Crystal Palace* transmitter was brought into service 70 years ago on 28 March 1956. (Photo: Brian Manley, Greenwich)
Fig. 3: Artist, Desmond Marlwood, drawing the two BBC-2 kangaroo mascots, *Hullabaloo* and *Custard*, in 1964. (Photo: Keith & Garry)

Swiss saga supplement

Following the conclusion of our in-depth series covering the development of Swiss radio and television (*PW*, December 2025), **John M0JXT** has written from Hythe in Kent with some nostalgic memories of Switzerland.

John writes: "*Dear Keith and Garry, I really enjoy reading your 'Broadcasting History' articles in* PW. *I was sorry to learn that the Swiss section has come to an end. My wife, though born in Brazil, lived in Switzerland for many years - she has both Brazilian and Swiss passports and settled status to live here in the UK. I have been a big fan of Swiss trains and trams for some time, but now I will re-read your Swiss broadcasting articles to add to my knowledge and visit one or two of the still-existing sites next time I'm in the country. Best regards, John M0JXT.*"

Thanks for writing, John. We have visited Switzerland well over 50 times and always discover something new. You certainly have a lot to re-read; the 34-part saga began with the March 2023 issue!

60 years of BBC-2: Part XXV

In the previous column, we mentioned that the *BBC-2 Information Service* devised two memorable mascots for the start of the new service. The kangaroos, *Hullabaloo* and *Custard*, were soon incorporated into advertising by many of the larger manufacturers of television receivers.

All the retailers (around 5,000) within range of the Crystal Palace transmitter were issued with posters, leaflets and newspapers bearing images of the two lovable animals.

The kangaroos were even produced as vinyl toys by two leading toy manufacturers and a children's book was published (probably a collectors' item now). One firm was so impressed by the success of the two kangaroos at the *British Toy Fair* that they were exhibited at the *Nürnberg Fair* in West Germany where BBC-2 could hardly have been heard of.

The original drawings of the two kangaroo mascots were designed by **Desmond Marlwood**, **Fig. 3**.

Service information, Iceland: Part IV

The station operated by the *American Forces Radio & Television Service* (*AFRTS*) began broadcasting on medium-wave with a power of 25W in November 1951. It was subsequently authorised by the Icelandic government to be a 24-hour service from May 1952. At the same time, the power was increased to 250W, which made it one of the most powerful outlets in Iceland. The radio station broadcast continuously from 1952 until it closed in 2006.

In 1954, AFRTS applied for, and were granted by the Icelandic government, a licence to broadcast television programmes. The station went on-air using channel A8 (181.25MHz vision, 185.75MHz sound). These were the first television broadcasts in Iceland, some 11 years before the national television service, RÚV, began broadcasting. The conditions attached to the licence were that the power of the transmitter was limited to 50W and an attempt had to be made to ensure that reception was possible only at the airbase because the Icelandic government perceived that the American influence could harm indigenous interests.

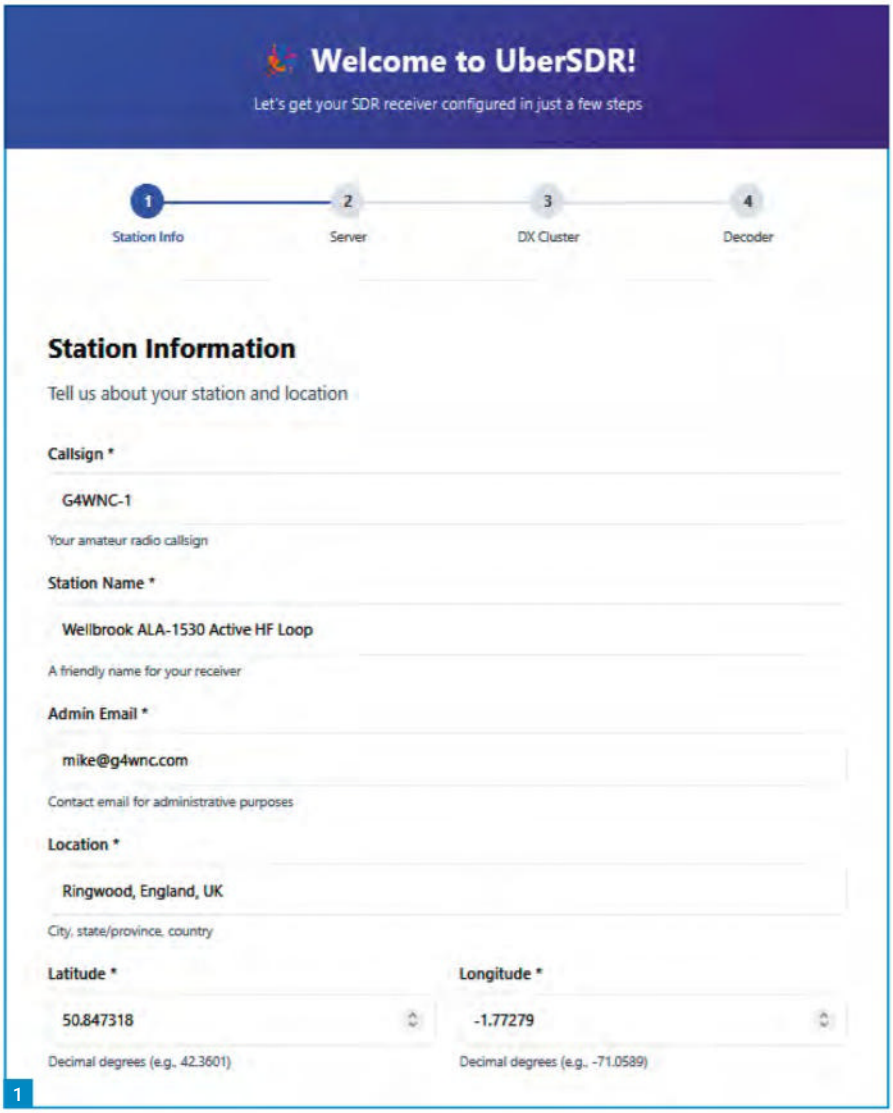
However, it soon became clear that the AFRTS television signal was being received well outside the airbase in various locations such as Suðurnes, Hafnarfjörður and even Iceland's capital, Reykjavik. Several people bought television receivers and aerials to view the American programmes. Equipment was rather expensive at the time, so few households could afford such a luxury.

Stay tuned!

Please send archive photographs, information or suggestions for future topics via the email addresses shown at the top of this column. **PW**

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Mike Richards G4WNC
practicalwireless@warnersgroup.co.uk



1

More on UberSDR

Mike G4WNC continues to look at this powerful new software.

This month, I'm continuing coverage of the new UberSDR. This server is a great way to utilise your RX888 wideband receiver. Even if you don't own an RX888, there are a growing number of shared UberSDR stations online, so you can still make use of the system's advanced facilities. My own receiver is usually available online 24/7, and you are very welcome to use it. You will find my receiver and the other shared stations at this URL:
https://instances.ubersdr.org

At the time of writing, there were 19 stations online, mainly in the UK and the USA, but that number is steadily growing.

UberSDR configuration

Last month I ran through how to set up your basic UberSDR installation, so this month I'll take a more detailed look at how to use this fascinating new application. UberSDR is certainly one of the best ways to utilise the RX888 wideband SDR receiver module and is great for building a data modes monitoring and reporting station. Once the installation is complete, the Admin panel gives access to the configuration options. You access this panel by adding /admin to the url for your receiver. On a local installation, the URL would normally be
ubersdr.local:8080/admin.html
When that page opens, you will see an Admin logon page prompting you to enter your admin password. You should have noted this password during the original installation process. Once logged in, you will see the Admin panel. This is packed with information and controls and may seem a little daunting at first.

The first tab, titled Active Sessions, provides visibility of everyone accessing your receiver, and is mainly useful if you share your receiver online. The bottom part of this screen also shows summary information about system performance. This includes processor loading (I'll explain this later) and Internal sessions, which are the audio and spectrum sessions used to feed the internal decoders. The Network Summary also provides useful information about data demands across your network.

The next most important tab is the Config tab. As the name suggests, this is where you complete or amend the configuration of your UberSDR. For a new installation, I recommend using the link to the Setup Wizard at the top of the page, **Fig. 1**. This begins with your station information, where you can enter your name, call, and location. You can also set your precise position using the supplied map. Next comes the Server Settings. I suggest you leave these at their default. Next comes the DX Cluster Integration, where you opt in to receive real-time DX spots and enter your callsign. The final section lets you update the station details used when sending receive reports to online databases such as PSKreporter and WSPRnet. You can also use the tick boxes to turn reporting on/off. When you complete the wizard, the server will automatically restart to activate any changes made during the configuration.

Probably the next most important config tab is Monitor, where you can see how the receiver and server are performing. I've shown the frontend status in **Fig. 2**. The top section summarises the RF settings and shows the receiver stability. An important parameter to watch for in all wideband SDRs is overrange. This is where the input power exceeds the ADC (Analogue-to-Digital Converter) range. That results in clipping, which is a total breakdown of the receiver linearity. The Historical Tracking graphs provide a view of signal levels and any clipping events over the past hour and 24 hours. Ideally, you don't want too many overrange events, but some are inevitable. You can control this by adjusting the front-end gain/attenuation, but the gain setting is always a compromise. If you reduce the gain or increase attenuation to avoid overrange events, you'll probably end up missing weak signals elsewhere in the spectrum. You'll often find that strong medium-wave broadcast signals in the evening are the main culprits of overload, and these can be fixed by including a moderate medium-wave band-stop filter ahead of the receiver.

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Fig. 1: UberSDR configuration, setup wizard.
Fig. 2: UberSDR frontend status report, including ADC clipping.
Fig. 3: UberSDR signal levels and clipping events.

System loading

UberSDR uses the standard Linux method for measuring system load. However, for those new to Linux, I ought to explain how this works. The system load is shown as three numbers, each marked with a time of 1min, 5min, and 15min, respectively. The system load numbers show the average number of processes that are either currently running on the CPU or are ready to run but waiting for CPU time, disk access, or other I/O devices.

The loading figures are directly related to the number of processor cores available. For example, my UberSDR uses an HP ProDesk mini-PC with an i7-6700 processor and 8 cores. So, a system load of 8 means the PC is working flat-out with no holdups. If the number goes above 8, it indicates that some processes are waiting for a core to become available, so things will start to slow down. It's OK to exceed 8 for short periods, but for longer periods, the system will begin to slow down noticeably. The three numbers help indicate whether the system is experiencing brief overloads or a more persistent slowdown, **Fig. 3**.

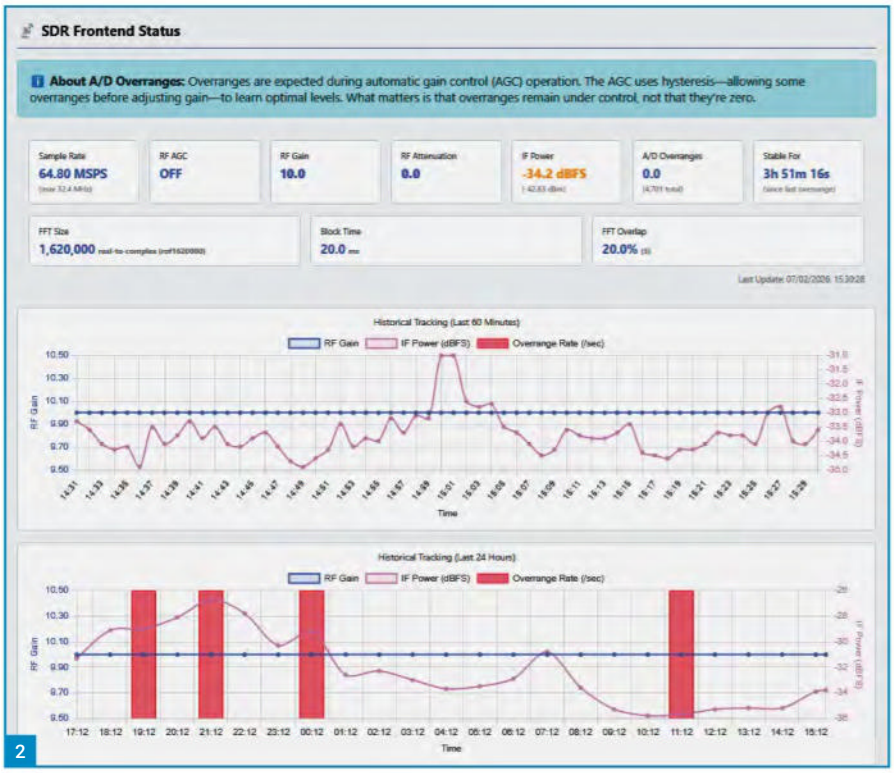
The 1 min number reports the immediate situation, while the 5 min average provides the short-term trend, and the 15 min average shows the longer-term trend. If you see the 15min figure consistently exceeding the number of processor cores, you ought to take action to reduce the load. In my experience with the HP ProDesk mini-PC, it runs the basic server very comfortably with multiple shared users.

My system also has the capacity to run all-band noise analysis, plus 32 simultaneous data decoders covering all bands from LF to 30MHz, using FT4, FT8 and WSPR decoders, and reporting the results to the appropriate online databases! However, I need the FT8/4 decoder depths set to 1 (fast) and the WSPR set to 5000 cycles (fast). In quiet periods with this setup, the load is generally around 5, but rises to close to 8, or occasionally exceeds 8, when the bands are busy at weekends or during a contest. If you want to run a different configuration, it's easy to selectively activate/disable individual decoders. However, the decoder depth is a global adjustment.

Decoders

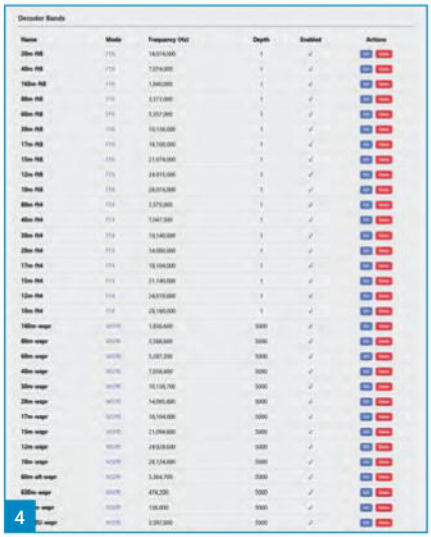
One of the benefits of the ka1q SDR receiver software at the heart of UberSDR is its efficient code and multicast data distribution, which enable the use of a large number of simultaneous decoders. Decoder configuration is done via the Decoder tab in the Admin panel, **Fig. 4**. At the top of that tab, you will see a host of powerful analytics and reports. The Live Spots Map displays the current spots from all active decoders. Decode Rates is particularly interesting because it provides a graph for each active band and mode showing decodes per 15 minutes over 24 hours. I've shown an extract for FT8 on the 10m band in **Fig. 5.** Here, you can see that the band is at its best between 10am and 2pm, but drops rapidly after that. Thus, decode rates can be a useful tool for propagation. The display can be filtered to show a single data mode over all bands or focused on a single mode and band.

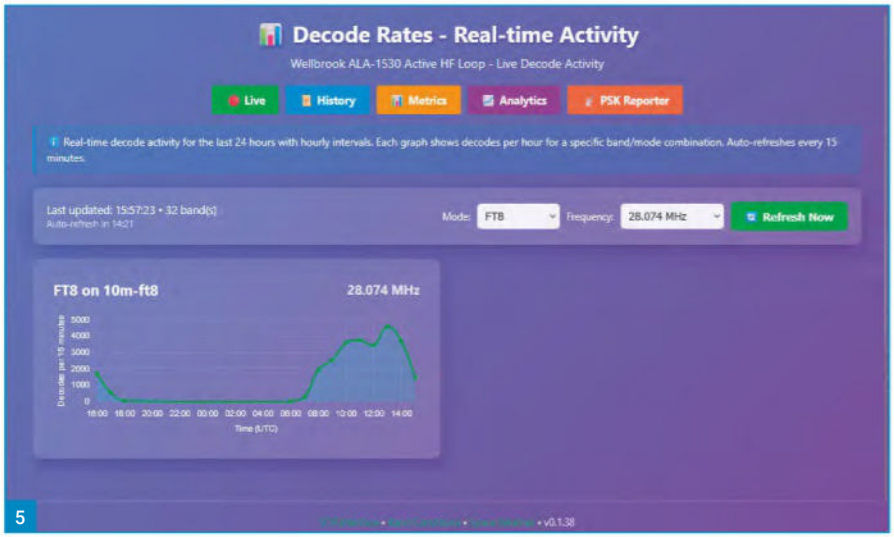
The Spots Analysis, **Fig. 6**, is another very handy tool. It lets you specify a target destination and displays the number of spots on each band where spots have been received. It will also list the best times on





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each band, making it another valuable tool for working that elusive country.

Receiver access

UberSDR offers two ways to access local and internet shared receivers. The simplest and most versatile is to use a web browser. Just head to UberSDR.org, look for Instances, and select the one you want. In addition to easy access, this method is entirely machine independent, so you can even access receivers using a web browser on your phone or tablet.

To access a wider range of features, the authors have provided downloadable clients for Windows and Linux systems. These clients provide a native application experience and look and feel quite different, **Fig. 7**. The clients also provide audio routing and CAT control so you can integrate the online UberSDR with your local copies of WSJT-X and FLDIGI. The routing is handled using virtual audio cables and serial ports. You could quite easily use a local rig to transmit and an UberSDR to receive! The receiver client displays a separate panel that shows all public receiver instances. You just double-click an entry to start the connection and open the receiver panels. I've included a screenshot of the main panel in **Fig. 8**.

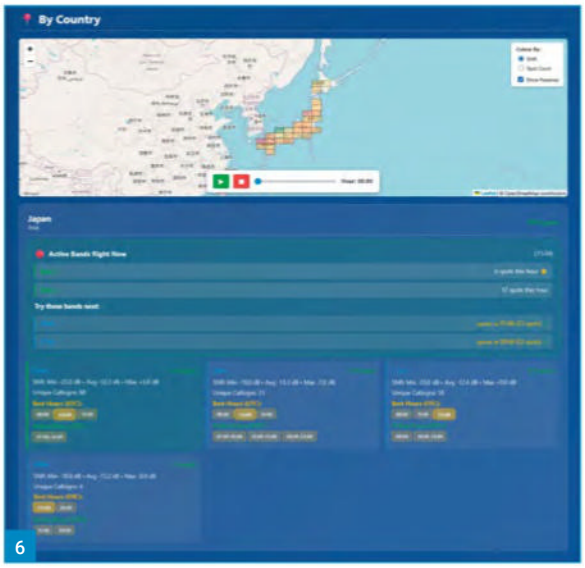


Fig. 4: UberSDR decoder setup.
Fig. 5: UberSDR decodes per 15 minutes. 24-hour result for FT8 on the10m band.
Fig. 6: UberSDR spot analysis.
Fig. 7: UberSDR Windows client.



Rare propagation

During a call with my good friend **Victor G3JNB**, I discovered that there's some unusual DX to be found if look in the right places. Victor recently discovered the 10m band wide open to the US and beyond in the middle of the night! That's very unusual, but only discovered because he went looking and was beaconing CW on that band, just in case.

It struck me that, as data mode operators, we tend to follow the bulk of activity around the bands, using information from DX clusters, PSKReporter, etc. As a result, we are following each other around the most likely bands. We could therefore be missing a trick by not spending time testing out unusual band/time combinations. One way to reveal these openings would be to increase the number of active WSPR beacons. As you may have noticed, wideband SDR receivers are very good at spotting and reporting these signals, but there seems to be a reducing number of 24/7 active WSPR transmitters. It is very easy to build your own WSPR transmitter, so next month I'll show you a design for a simple, low-cost DiY system. **PW**

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Desecheo and more

Steve G4JVG's column this time includes a report on the surprise operation from rare DXCC Desecheo Island.

Steve Telenius-Lowe G4JVG
teleniuslowe@gmail.com

The photo of the aurora in **Fig. 1** was taken here in Exmouth, Devon, on 19 January. Visual auroras are a rare occurrence as far south as the English Channel coast but, according to the Space Weather website, it was also seen as far south as Spain!

The aurora was caused by a series of solar flares emanating from sunspot group 4341, starting with an X2-class flare on 18 January, **Fig. 2**. The flare led to a severe G4-class geomagnetic storm with the K-index at 8 (9 is the highest level), 'dead' bands and spectacular auroras. Solar activity remained high: no fewer than a dozen sunspot groups were recorded on the 23rd with a sunspot number of 195 leading to the solar flux rising to 194sfu. Then, from 1 February, massive sunspot group 4366 produced at least 17 M-class and six X-class flares in a week, the biggest of which was an X8.3.

www.spaceweather.com

The X-class flares led to a complete radio blackout in VK / ZL for several hours. *PW* reader and regular contributor to this column, **Martin Burch VK4CG**, near Brisbane, Queensland, said *"DX on HF was about as far as 5km down the road but there have been fresh blackouts that come and go since then"* and that there were times his IC-7300 sounded *"like it's got no coax attached!"*

RSGB QSL Bureau changes

Following the retirement of QSL bureau manager **Richard G3UGF**, the RSGB has agreed with DARC, the German national amateur radio society, that it will process all incoming and outgoing QSL cards for RSGB members. This has resulted in changes to the way UK amateurs must sort their cards and there is a new postal address that must be used for sending cards. For full details see:

tinyurl.com/8hkcdhk6

QSL from yesteryear

My 'QSL from yesteryear' this month is almost 30 years old and is from CY0XX, **Fig. 3**, from Sable Island. This DXpedition was active in October-November 1996 and my contact was made on 14MHz SSB at 1939UTC on 28 October. The operators were **Craig AH9B, Ken V73C, Murray WA4DAN, Atsu VK2BEX**, and **Will AA4NC** (SK). Coincidentally, I had operated with Ken, Murray and Atsu on the VK9MM Mellish Reef DXpedition in 1993, along with **John G3WGV** and others. The reverse side of the QSL card credits me and 44 other individuals for providing *"support and assistance"* but I must admit I no longer remember precisely what assistance I gave to the DXpedition!

Sable Island is about 180km south-east of Cape Canso, Nova Scotia, and is a separate DXCC entity, being administered by the federal government rather than from any of Canada's provinces. The 1996 CY0XX DXpedition made 25,652 QSOs.

The island is a massive sand bar, about 43km long but only 1km wide, **Fig. 4**, and is a major hazard to shipping. It is known as 'The Graveyard of the Atlantic' due to the 350 shipwrecks around the island, frequently caused by the dense fogs for which Sable Island is notorious.

Murray WA4DAN has already operated from Sable six times and, 30 years after CY0XX, is returning yet again: he is one of the operators on, and the QSL manager for, the CY0S DXpedition in March (see below).

The month on the air

KP5/NP3VI was a surprise operation from the rarely-activated DXCC entity of Desecheo Island (IOTA NA-095), **Fig. 5**, off the west coast of Puerto Rico. This was an entirely remote-operated DXpedition (once the equipment had been set up on the island) using 'Remote Deployable Units' and was solar and battery powered. The station started activity on 12 January and was originally scheduled to be active for 30 days but shortly before the expedition was due to close down it was announced that they would continue until 3 March.

Polish priest **Darek TJ1GD** was active as TL8GD from the Central African Republic in November last year. From 1 December he moved on to Chad, from where he has been active as TT1GD, mainly on FT8 and CW.

The World Wide Award (WWA) special event (see last month's *HF Highlights*) continued until 31 January. The final QSO total, made by all the WWA stations from around the world, was 5,194,430, with 174,161 amateurs in 230 DXCC entities chasing the WWA stations. The next WWA will be a one-week event, from 29 June until 5 July.

https://hamaward.cloud/wwa

What to look for in March-April

In January it was announced that the ship chartered to take the 3Y0K DXpedition team to Bouvet Island required *"additional maintenance to ensure it is fully prepared for the demanding voyage"*. This has led to a two-week delay to the DXpedition meaning that 3Y0K should be on the air for around three weeks during March, but this is also weather-dependent, so check the website for more information:

https://3y0k.com

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Fig. 1: The visual aurora as seen in Exmouth, Devon, on 19 January (photo: Nick Ward).
Fig. 2: The X-class solar flare on 18 January (photo: NASA's Solar Dynamics Observatory).
Fig. 3: CY0XX Sable Island QSL from 1996.
Fig. 4: Sable Island from space. Fig. 5: Desecheo Island, KP5 (photo: US Fish and Wildlife Service).
Fig. 6: Jacek SP5EAQ with your columnist at Friedrichshafen.

A team of six experienced operators from Germany and the Netherlands will be operating as TX5EU from Raivavae Island, IOTA OC-114, in the Austral Islands, South Pacific, between 13 and 25 March. They will be using CW, SSB, RTTY, FT8 and FT4 on all bands from 3.5 to 28MHz. On their website, of their FT8/4 operation they state: *"MSHV only, no WSJT-X. Hunters can call us in normal mode with locator / grid and stay on their frequency even for answering. All FT8/4 stations are manned. We will strive to give weak stations a fair chance. Digital QSOs will only be logged after having sent RR73 or 73."*

tx5eu-2026.topdx.de

CY0S is scheduled to be on the air from Sable Island between 19 and 31 March with a highly experienced team of eight US operators. More information and photos are at:

t-rexsoftware.com/cy0s

DJ4MX, DK6SP, DL3ON, M0SDV, S21ABO and S21TV of the Next Generation DX Club plan activity as S21WD from Bangladesh (IOTA AS-140) from 20 March to 1 April. Activity will be on all bands 1.8 to 28MHz CW, SSB, RTTY and FT8 (MSHV).

next-generation-dx.com/s2

DX-World reports that **Jacek 'Jack' SP5EAQ** (**Fig. 6**) will be active as 5W0AF from Samoa for three weeks starting on 22 March. Jacek operates SSB only and will be active on 7 to 28MHz and possibly also 3.8MHz.

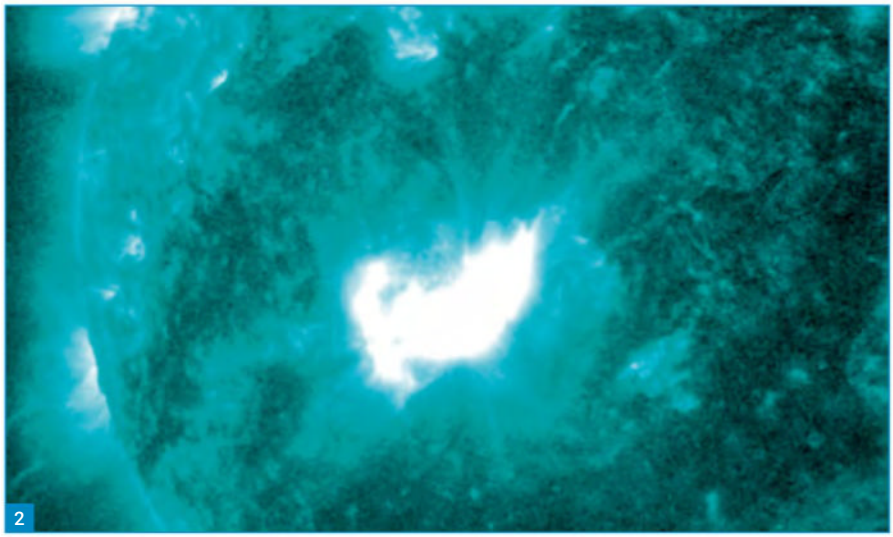
dx-world.net/5w0af-samoa

Members of the Italian DXpedition Team led by **Silvano I2YSB** plan activity from Abokwa Island (IOTA AF-084) in Ghana, 9G, in March – April. More details at:

i2ysb.com/joomla5

Readers' news

As regular readers of this column will know, **Etienne Vrebos OS8D** enjoys operating portable and, for the third year in a row, received the Belgian castles 'Activator King' award for 2025, **Fig. 7**. However, he wrote: *"I had to change the dipole, the coax of it had worn out after 50,000 QSOs, 530 castles, 210 bunkers, 50 POTAs and 50 ONFFs. I have to wind it up twice every activation and unwind it too of course. It worked OK for three years now but I got suddenly a very high SWR, started to check everything and saw the outer braid wasn't attached any more to the balun. I've always spare antennas with me and I carry two batteries, two microphones, short coax pieces to connect the transceiver to the tuner, and so on. I could cry when something gets broken in the middle of a forest and you won't be able to repair or replace."* From home, Etienne was pleased to work an amateur in New York state who was using 3W to an indoor antenna on 10m.


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Jim Bovill PA3FDR said that January was a rather poor month for him when, after two days, *"my antenna collapsed under the weight of snow and ice, and conditions up to now have not allowed me to get it repaired"*. He said he is a little too old to climb ladders these days and normally asks his son to do this but he is on an overseas assignment *"so I will be without my antenna until he gets back"*. We hope you're not QRT for too long, Jim.

Martin Burch VK4CG recently visited *HMAS Diamantina*, a decommissioned Royal Australian Navy frigate that is now a museum ship in dry dock in Brisbane. *"This ship forms part of the Queensland Maritime Museum on the same site and for anyone visiting central Brisbane it is well worth having a look. The B40 / B41 radios* [shown on the right in **Fig. 8**] *weigh approximately 45kg each! There used to be a lot of these on the surplus market back in the 1970s / 1980s, you just need a second pair of hands to lift them. On another note I can remember one advertiser selling brand new AR88s still being in crates with the greaseproof paper back around 1980."*

wikipedia.org/wiki/HMAS_Diamantina

Owen Williams G0PHY wrote: *"Looking at my log, I can see that there has been more activity since mid-January than the previous three months; the reason being the WWA programme. I had 111 QSOs and found the whole thing strangely addictive; once started it's hard to stop. The bulk of the contacts were with European stations but I did manage contacts with participating stations in USA, Canada and Hong Kong. I have worked W1AW/1 operating from Vermont and Maine as part of the America 250 WAS activity. I know it's still early in the year but, looking back over my logs for the ARRL Centenary event in 2014, there seemed to be much more W1AW/P activity then than there is so far this year. There are some interesting DXpeditions coming up soon so let's hope conditions are conducive to DX."*

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Fig. 7: Etienne OS8D with his third successive 'Activator King' award. Fig. 8: The radio room on board *HMAS Diamantina* in Brisbane. Fig. 9: Tim, GW4VXE's, ATS-Mini receiver.





Last month, **Tim Kirby GW4VXE** operating as **GW4MM** on CW opened his report by mentioning that he had worked KH7XS in Hawaii on 10m. Well, Tim has subsequently found out that KH7XS is now resident in Florida! Judging by the pile-ups for him, not everyone has yet realised that! Tim has been pleased to work the Desecheo DXpedition, KP5/NP3VI, on 15m FT8 for a new one from GW and later on 20m CW. Although Tim has heard them on some of the other bands, these QSOs remain the only ones so far. What was impressive was that the LoTW confirmations were in Tim's inbox just a few moments after the QSOs. The majority of the remainder of Tim's activity during January was a gentle chase of the WWA award stations, which he enjoyed. That resulted in one or two new band countries such as UP7WWA (Kazakhstan) on 80m, and 8E1A (Indonesia) and TK4TH on 17m. Tim was away from home for the weekend when the CQ WW 160m CW contest was taking place, but he took his little ATS-Mini receiver, **Fig. 9**, with him and used a 40cm telescopic whip. To his surprise, he was able to hear quite a number of stations around Europe on topband with this tiny setup; the best DX was a UA1.

28MHz beacons

The 28MHz beacon report for the period 4 to 31 January was compiled by **Neil Clarke G0CAS**. In Europe Sporadic E continued throughout January, not only during daylight hours but also during the long winter nights, for example, during the evenings of the 5th, 6th, 8th, 13th and 14th, and around 0500UTC on the 17th and 21st. (Unfortunately, no observations take place between 2200 and 0800UTC; these late evening and overnight openings were noted on the ionospheric charts provided by Propquest at **www.propquest.co.uk/graphs.php**)

Back to the daylight-hour openings, which took place to Scandinavia when SK7GH 28298 was heard on the 6th and LA5TEN 28238 was logged on the 19th and 20th. On the 13th DB0UM 28279 was heard. A couple of good strong openings to Italy occurred on the 6th, 11th and 31st when a good number of Italian beacons were heard. ZB2TEN 28170 was logged on the 11th, 21st, 23th, 24th 29th and 30th; ED4YBA 28263 accompanied ZB2TEN on the 21st. Paths further afield suffered badly some days due to severe geomagnetic activity, for example paths to North America when W call areas 1 to 3 were only heard on 20 days. However, areas 4 and 5 fared slightly better and were heard on 25 and 22 days respectively, though call areas 6 and 7 proved very difficult to log. Further north in Canada VE3TEN 28175 was heard on 22 days while VA3XCD 28170 was logged on 13 days. Relatively new beacons from Brazil, PY2BBM 28198, and from Mexico XE1JAL 28276, were heard 22 and 13 days respectively.

Band highlights

Key: Q = <20W, M = 20 – 100W, H = >100W, S = Single-element antenna, B = Beam (see January *HF Highlights* for a more detailed explanation).

Etienne OS8D (HB): 14MHz SSB: VR2WAA. **21MHz SSB:** 4K3ZX, 5K6RM, BI4SSA, J52EC, TO2FY, UN7CFI, YN9H. **24MHz SSB:** C5YK, PJ2ND. **28MHz SSB:** 4M5DX, 8P5KM, BG0DXC, BV3VN, BX4AN, CE7VP, EX7CQ, HI8WWA, HS0ZMY, J69Z, LU1EAF/P, PY2MP, TY2AA, UN8PT.

Jim PA3FDR (MS): 14MHz FT8: C31LK. **18MHz FT8:** RX9T, ZS5HR. **21MHz FT4:** RU9CZ. **21MHz FT8:** 7X2RF, UA9JGS, YD0JHX, Z30WWA. **24MHz FT8:** KF9UG, RA9J, UN/OH7O, ZW5B. **28MHz FT8:** R9OFA.

Martin VK4CG (MS): 7MHz SSB: IW3IBK, S51DX. **14MHz SSB:** CE3KEY, JG1OUT, M0RDX, OR1X.



21MHz SSB: BX5AA. **28MHz SSB:** BI4SSB.

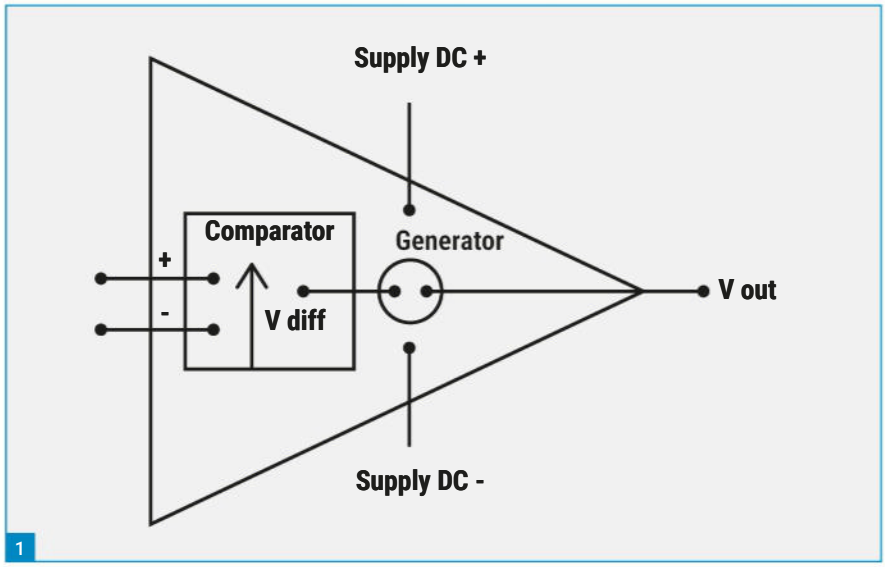
Owen G0PHY (HS): 14MHz SSB: TA0C, VR2WWA. **18MHz SSB:** W1AW/1. **21MHz SSB:** N1W, W1AW/1.

Signing off

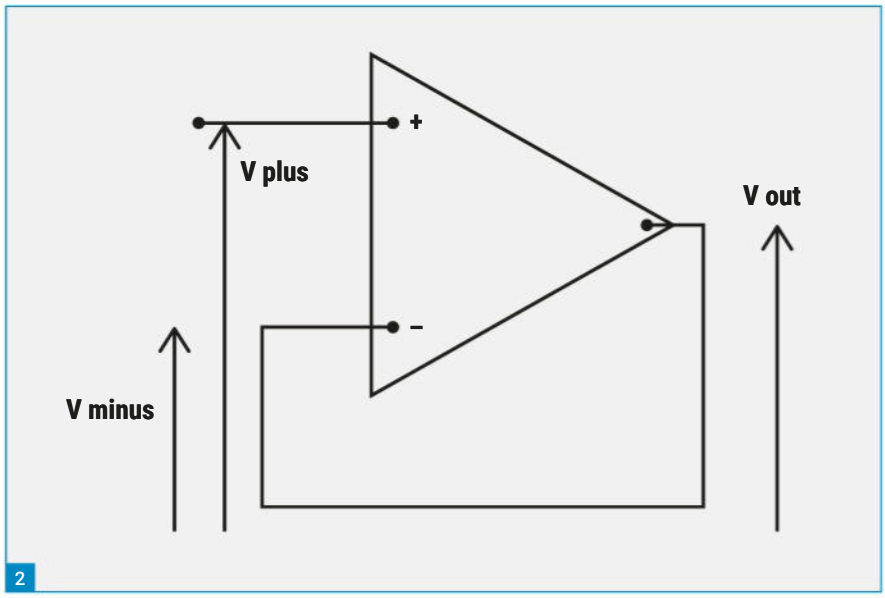
Thanks to all contributors. Please send all input for this column to teleniuslowe@gmail.com by the 11th of each month. For the June issue the deadline is 11 April. 73, Steve G4JVG. **PW**

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



1



2

Op Amps

Tony G7ETW explains the basics of operational amplifiers.

I set out to write about oscillators, to illustrate how good Operational Amplifiers, commonly known as Op Amps, can be for this application. But that article would likely have too many sidebars explaining things for good reading flow, so I've put oscillators on hold.

This piece will now cover op amp basics. When I do get to oscillators, I'll then be able to concentrate on design options rather than device mechanics.

Fig. 1 shows a conceptual op amp. Three connections govern its operation

- 'non-inverting' input, shown with a plus sign
- 'inverting' input, shown with a minus sign
- Output, which is a little misleading because it can source or sink current

Plus and minus here have nothing to do with to the DC supply, which can be 'single rail' (plus and zero Volts) or 'dual rail' (plus and minus Volts). The first op amps, notably the 741 (from Fairchild, in 1968), were dual-rail devices, but as new ones were developed, they became increasingly single-rail friendly.

The Comparator

The comparator measures the difference (V_{diff}) between voltages on the inputs. I'll name these voltages by their connections: V_{plus} and V_{minus}.

$V_{diff} = V_{plus} – V_{minus}$

V_{plus} and V_{minus}, and consequently V_{diff}, can be AC or DC, and any value.

Gain

Op amps have a huge amount of potential gain called the Open Loop Gain (Avo) which only applies when no feedback is employed. Figures upwards of 100,000 are common.

The output V_{out} depends on the gain and the comparator's output.

$V_{out} = Avo \times V_{diff}$

This is a good time to introduce the rules op amps live by

- An op amp does not accept current at its inputs
- An op amp sets V_{out} so $V_{diff} = 0$ if it can

Op amp voltage follower

Usually one input is used – this is called 'single-ended' operation. **Fig. 2** shows the most basic such circuit: a voltage follower. This uses feedback in the most simplistic way.

Only the non-inverting (plus) input has a voltage applied. The output is fed back to the inverting (minus) input externally.

On switch on, V_{plus} is some voltage, $V_{out} = 0$, and $V_{minus} = 0$.

The comparator compares the inputs. $V_{diff} = V_{plus}$.

The op amp wants V_{diff} to be zero, so V_{out} rises until it reaches V_{plus}. At this point, $V_{diff} = 0$ and the output is set to zero.

But if $V_{out} = 0$, $V_{minus} = 0$ again and $V_{diff} = V_{plus}$! An equilibrium arises, where V_{out} stays at V_{plus}. If V_{plus} changes, in either direction, so does V_{out}.

What's the point?

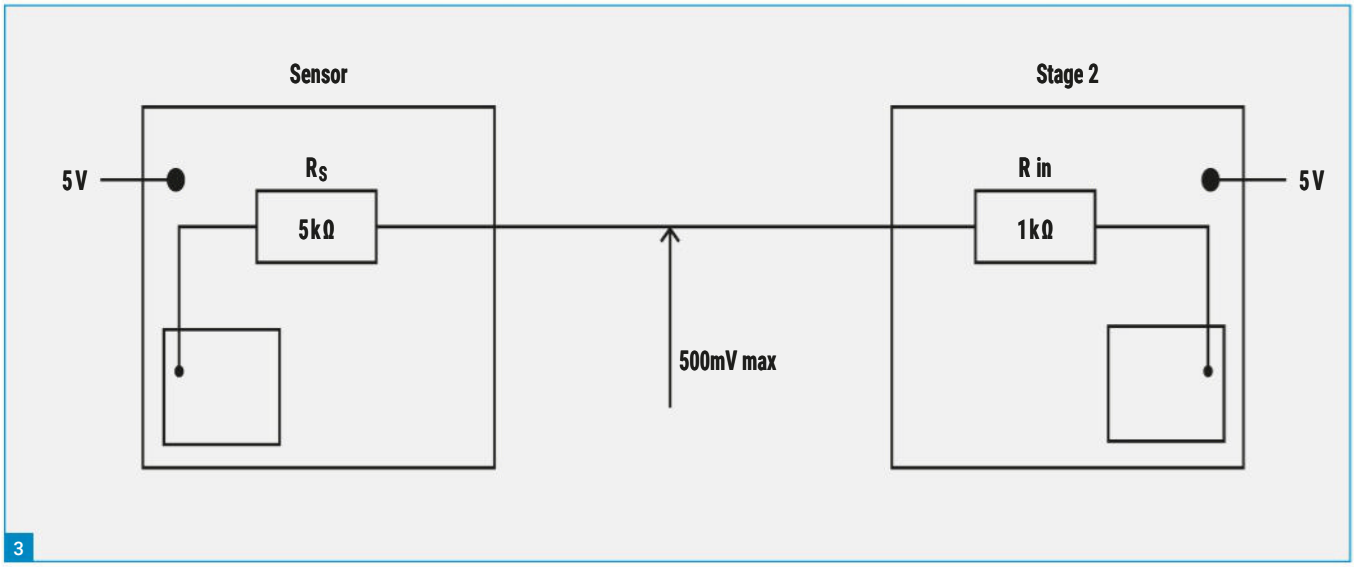
A voltage follower is a buffer circuit. I might have some kind of sensor device that I want to interface with a control mechanism. I test the sensor in isolation and see a plausible voltage appearing on the sensor's output.

I connect the sensor to the Stage 2 directly as shown in **Fig. 3**. The sensor's output falls off significantly and stays almost constant.

From the sensor's datasheet I learn that it has a high internal resistance, and the penny drops. Rs and Rin are in series. With the sensor producing its maximum 3.3V, only about 500mV can ever appear across Stage 2. Short of than replacing the sensor or Stage 2 circuit, I'm stumped.

Fig. 4 shows how a voltage follower fixes this. An op amp takes no current in, so the sensor isn't loaded. The op amp's output tracks the input quickly and accurately.

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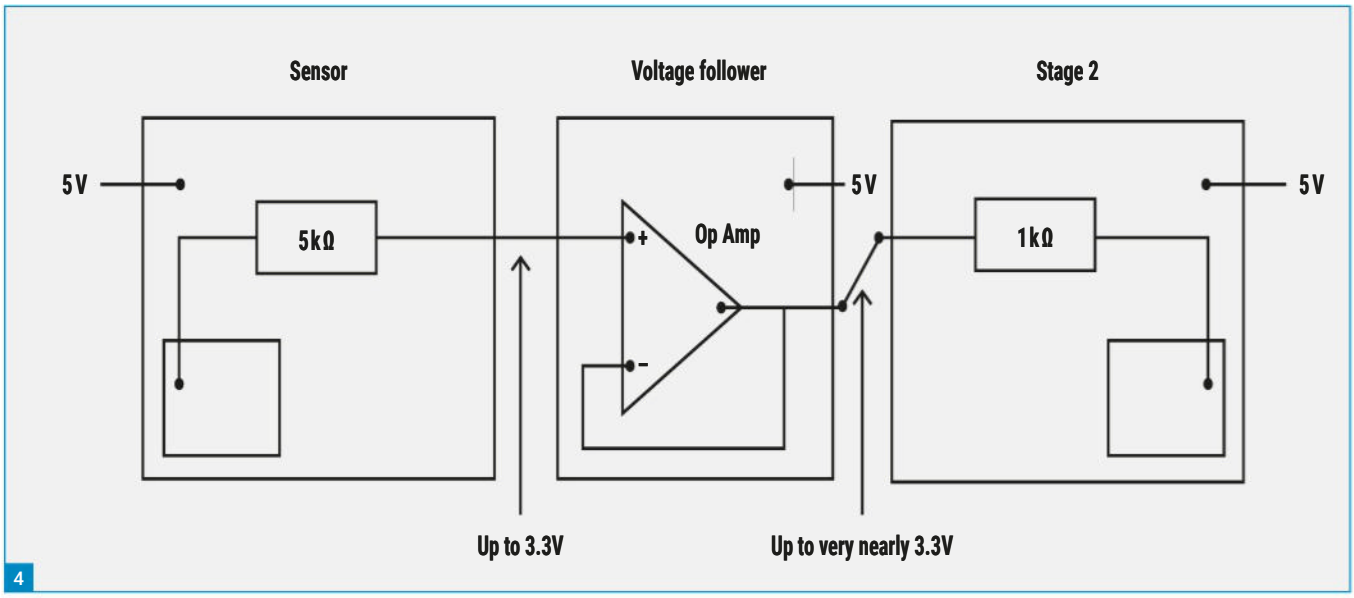


Fig. 1: A conceptual op amp. Fig. 2: Voltage follower circuit. Fig. 3: Voltage follower linked to a sensor. Fig. 4: How the op amp cures limitations with the sensor.

Op amps have a comparatively low output resistance (about 75Ω for an LM358) so Stage 2 sees almost all of the sensor's potential 3.3V.

This might work, but there is a problem. Any op amp has voltage 'headroom' which determines how close to the supply the output can go. For an LM358, this is 1.5V, which is not far off the 1.7V between the sensor's maximum output and the op amp's 5V supply. What if the DC supply sags a bit? I'd want to increase the supply voltage on both, if this was real.

A voltage follower is a current amplifier as well. In the above scenario, the sensor might only be able to put out microamps. An op amp can provide a much bigger current. For an LM358, 30mA is possible.

Op Amp as split rail PSU

Fig. 5 shows an elegant development of this concept. Ignore the two transistors for the moment. With the non-inverting input seeing half of the supply voltage, the op amp sets the output to the same half-supply voltage. This is a 'virtual ground'. The result is a cheap and cheerful dual-rail supply from a single-rail supply, e.g. a battery.

A problem arises if whatever this circuit powers requires currents which are unbalanced by more than the few tens of milliamps an op amp can handle. Hence the push-pull BJTs. These bump up the currents available to whatever is necessary.

This is a useful trick to know. I used a variant of this to power a 'Classic 47' headphone amp, and the sound quality was excellent.

Op amp as an amplifier

Fig. 6 shows a circuit that will be familiar: the standard op amp configuration for an amplifier with an input on the inverting input.

V_{in} is not zero. It's a signal that needs amplifying. To keep this explanation easy, it's DC.

The non-inverting input connects directly to ground; V_{plus} is stuck firm at 0V.

Using its output, the op amp balances its inputs. V_{minus} becomes 0V. The non-inverting input is made a virtual ground.

V_{in} and R_{in} are real, not some mathematical flummery. There is a current passing through R_{in}, drawn from the input.

V_{out} and $R_{feedback}$ are also real; they result in a current.

But no current flows into the op amp where these currents meet. Applying Kirchoff's Law at the non-inverting input, $I_{in} + I_{out} = 0$.

Applying Ohm's Law, $(V_{in} / R_{in}) + (V_{out} / R_{feedback})$

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Fig. 5: **Op amp as a split rail PSU.**
Fig. 6: **Standard configuration when used as an amplifier.**
Fig. 7: **An alternative amplifier arrangement.**

= 0. This rearranges to $V_{out} / V_{in} = - R_{feedback} / R_{in}$. This is the formula everyone knows.

R_{in} does another job besides co-managing the gain. Because the op amp takes no current, R_{in} is the load the op amp presents to the signal source. This facilitates impedance matching, but, because $R_{feedback}$ has to be much higher than R_{in} to get good gain figures, there are limitations to what can be done in practice.

Fig. 7 shows the other amplifier possibility. The input is now connected to the non-inverting input but the two control resistors have not moved.

This has always seemed far less intuitive to me. By the same input balancing mechanism, a voltage equal to V_{in} appears on the inverting input. R_{in} (now not such a good name) and $R_{feedback}$ make a potential divider, with V_{out} the total voltage.

R_{in} / (R_{in} plus $R_{feedback}$) = V_{in}/ V_{out}

Rearranging that gives V_{out} / V_{in} = I + ($R_{feedback}$ / R_{in}).

These gain formulae are very similar, and depending on how much gain is employed, one more or less may seem academic, but the differences are intriguing. What if $R_{feedback}$ is less than R_{in}? In a non-inverting amplifier, this makes the gain less than one; the amplifier becomes an attenuator. Some op amps can operate like this without problems, but others become unstable.

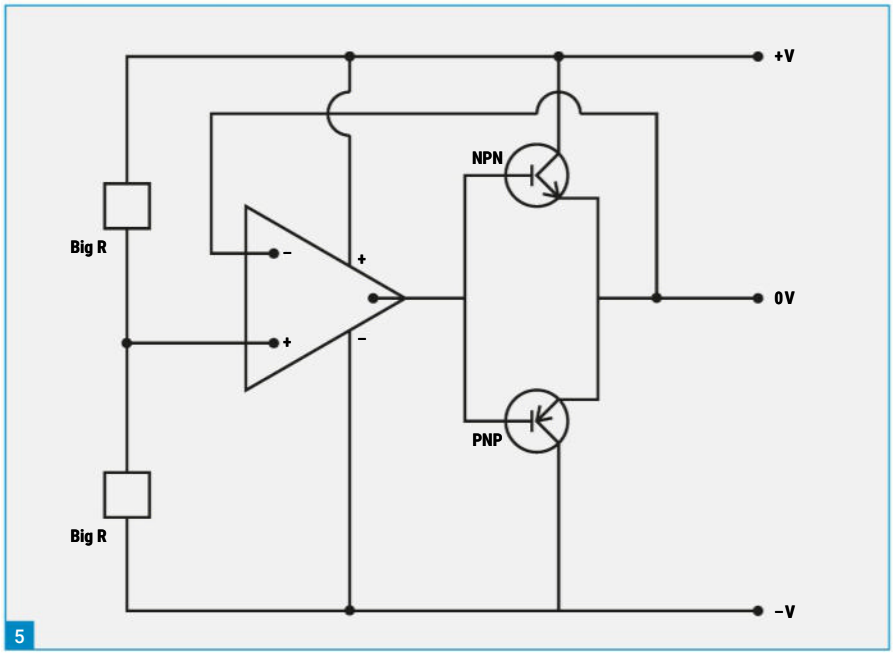
Unwanted attenuation can happen by accident. If $R_{feedback}$ is a potentiometer, to offer variable gain, it's a good idea to put another resistor equal to at least R_{in} in series. If the control is turned right down, the gain can't drop below unity.

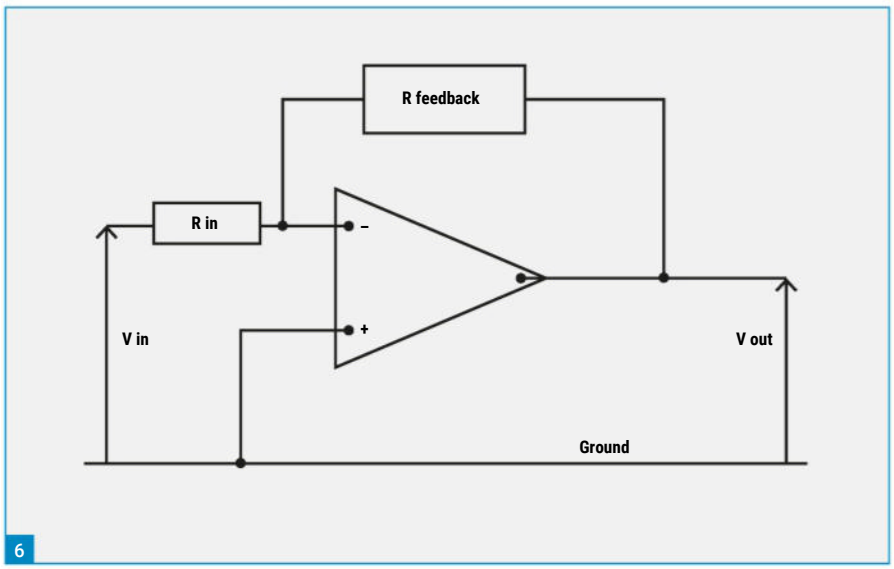
And what if $R_{feedback}$ is just not there, effectively zero Ohms? A non-inverting input amplifier would simply not function, but an inverting amplifier would still work, albeit with fixed unity gain.

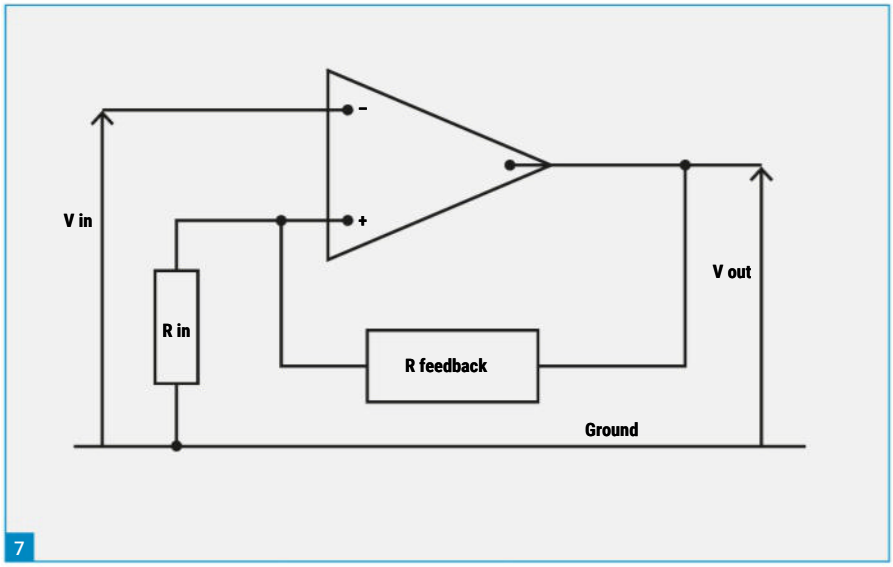
Conclusion

I think that's quite enough op amp theory for now. There is more to know, but from what's here, working op amp circuits can be built. If you've never played with op amps, get out the breadboard and have a go. There's nothing like practical experimentation to get a feel for how things work.

(Oh dear. I'm conscious, now I'm done, that a degree of anthropomorphism has crept into my explanations. Well, that's how I first thought about op amps, and it works for me. I hope it does not annoy the reader.) **PW**

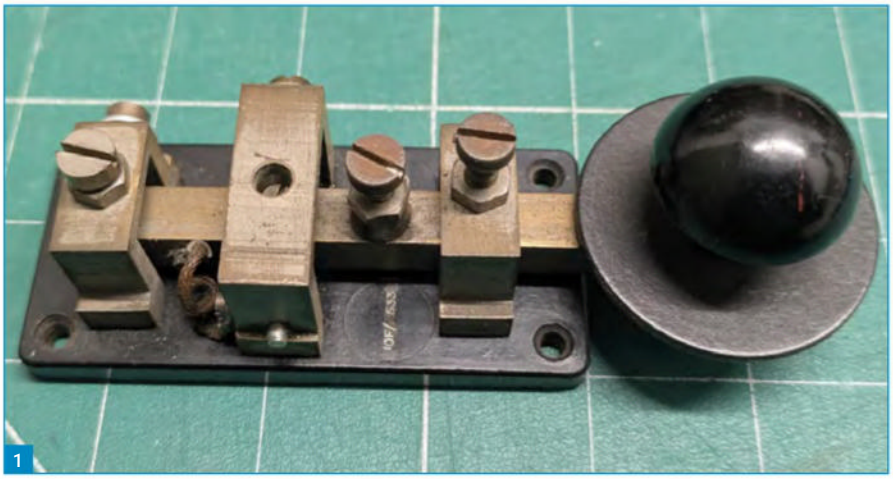






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1

A positive response

Roger G3LDI reports lots of feedback on recent columns.

My last article was very positive inasmuch that I received seven emails following publication, all telling me about their first QSO on CW. None have objected to me giving them some publicity and hopefully when they read this they will have been active more often and might indeed even look out for each other too.

This came from **Russell G0RBG**: *"Firstly may I thank you for the informative and encouraging CW article in* Practical Wireless.

"Like many, learning CW, I listen on 40m, trying to find the slower operators and decipher their QSOs. However, after reading your article earlier in the day, I decided to try my first CW QSO. I had an immediate response from DK4AC. I was a little surprised as I was able to read his callsign and RST. I started well but as we exchanged further details, my nerves kicked in and I made a few errors. But I had done it, and survived. I am sure you will understand how euphoric I felt.

"What happened next was definitely not expected. I had an email from DK4AC complementing me on my first CW QSO. Then I had an email from a G8 who had overheard the QSO and commented that he was able to read my code (probably as I tend to leave good character and word gaps) but has never attempted to go on the air himself. I am glad to say we now have a CW Sked arranged. So that will be two new CW operators that have taken the plunge due to your article."

This next one was particularly pleasing from **Mike G8GYW**: *"I am writing to congratulate you on your inspirational article in* PW. *I needed something like that to get me going and it may yet succeed, despite decades of procrastination.*

"I passed my RAE in 1968 but didn't take the Morse test. After several years operating on 2m I gave it up to focus on work and family, but got my licence back when COVID arrived and now I'm enjoying SSB on HF.

"As a teenager I had a few half-hearted attempts at learning the code but without success (too many distractions!). One motivating factor is that my mother was a radio operator with the SOE, and although she never spoke about her wartime activities she gave me her key, which I still have (**Fig. 1**).

"It would be great to get it back on the air but I think that at my age (nearly 74) I may have left it too late."

I did tell Mike he should be very proud of his mother's activities and that he should get that key cleaned up and on a proper base.

As a matter of interest, does anybody else own such a prestigious key? It certainly is one that deserves max respect and also maximum treatment and preservation. So, Mike, please send me another picture when you have it in pristine condition!

A couple more were just to confirm they were going to get back onto CW and even one from **Gerd DL7GA** who is a regular *PW* reader.

There was one telling me about his first QSO and first error which I thought funny! We have all been there however: *"Your column in Feb* PW *has pushed me over the edge to try CW again, and I think I have a new error to add to your catalogue!*

"I was first licensed in 1973, aged 16, including the 12wpm Morse test - but I don't think I have actually used CW since about 1975. I have been intending for ages to give it a go again, but never quite plucked up the courage - and your column left me without any further excuses.

"Last Sunday I was monitoring 30m, and I had been listening to DK4KK for a little while as he was calling CQ and working some 'rubber stamp' QSOs - so I already knew what to expect from him. So, I jumped in, and - hooray! - successfully completed a QSO.

"My mini-disaster? When working from a script (yes, I have a prompt sheet), and it says "GD name ES TNX FER RPRT", you don't send the word "NAME". Idiot!

"First of many, I hope."

Lastly, congratulations to all who took the plunge and my challenge and many thanks for the feedback. The next QSO and the next will be much easier and you will be more relaxed. I was disappointed not to hear from any youngsters who might have been tempted. It's not too late so do let me know if you are one of those people.

New CW Champion

I have been the RSGB Co-ordinator for the GB2CW scheme for the last 20 years or so and at 87 I thought it time to relinquish this position and pass it on to somebody new. Well, this problem of finding somebody was solved for me. The RSGB has just appointed a CW Champion and what better opportunity to also take on the GB2CW task.

This is the announcement made regarding Laura's new role: RSGB Board Director **Mark Jones G0MGX** is delighted to announce that **Laura Robertson MM7BFL** has agreed to take on the volunteer role of the RSGB CW Champion, **Fig. 2.**

Laura will head up the RSGB's Morse-related activities and become an advocate for the use of CW. In her role Laura will also help the Society to take CW to new audiences, with an emphasis on learning and development to further the skills of its members.

Laura is a member of CWops and volunteers in the CW Academy team as a co-advisor, primarily assisting EU-based amateurs who are enrolled on the courses. She is often active on the HF bands using CW in POTA and SOTA activities, as well as from her home station.

You can contact Laura via **cw.champion@rsgb.org.uk**

The RSGB has received a lot of interest in supporting this role, and in due course it will be in contact with those who have said they would like to join a Morse support team.

This is Laura's biography: Laura Robertson is a dedicated CW (Morse code) enthusiast, licensed as KO4DFJ (US Amateur Extra) and MM7BFL (UK Foundation) in 2020. She moved from Technician to Amateur Extra in just 30 days, which is quite an achievement. Laura is also an ARRL Volunteer Examiner (VE). Her Morse code journey started with the Long Island CW Club (LICW, member #665) while she was in the US Military. She practised sporadically, mostly on weekends. One personal learning tip that Laura often shares is the strategy of setting short, achievable goals, such as mastering a handful of new code words

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Fig. 1: G8GYW's SOE key.
Fig. 2: Laura Robertson MM7BFL.
Fig. 3: Victor Brand G3JNB.

each week. Early in her journey, she faced the challenge of maintaining consistency amidst her demanding military schedule, but she found success in dedicating at least 15 minutes daily to practice, regardless of the circumstances. Laura enjoys working from her home shack but especially likes QRP field operations. She takes part in POTA, SOTA and general QSOs.

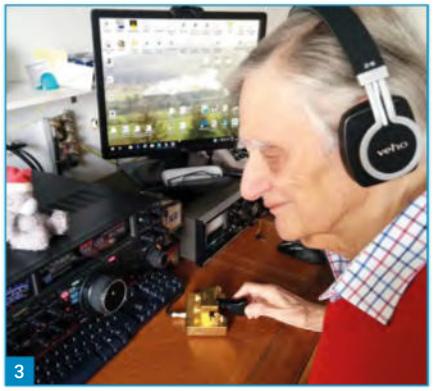
After retiring from the military in 2023, Laura committed to daily CW practice and regular on-air activity. She joined CWOps Academy for structured learning and completed their Morse training program in February 2025 (CWOps #3681). During the program, she facilitated a twice-weekly student-led Morse practice and homework sessions. She fostered camaraderie and supported fellow students. Now a co-advisor for AC6AC Master Advisor, she mentors new CW learners. She finds mentoring and seeing their growth deeply rewarding. After graduating, she continues to lead weekly 'No Op Left Behind' (NOLB) student-led Morse practice sessions. These sessions are for AC6AC graduates and current students, building a vibrant community of Morse code students. For those interested in joining a practice group, Laura suggests reaching out to local amateur radio clubs or online communities. Many clubs have regular practice sessions or can help interested learners find or form their own groups. Creating a practice group involves coordinating a few eager learners, setting regular meeting times, and establishing goals to achieve together, which makes learning enjoyable and effective.

Laura has tried many different Morse trainers, both online and offline, and strongly believes that daily practice is the key to mastering Morse code. Among her favourite resources are the Koch Trainer and Morse Code Ninja, both of which provide effective and engaging methods for learning. For Laura, learning in a group is especially valuable because it brings shared challenges, encouragement, and real-time feedback - something most people miss out on. In August 2025, Laura was named CW Champion for the Radio Society of Great Britain (RSGB). In this role, she promotes CW, supports new and returning operators, and shares information about learning, practice, and on-air opportunities. Laura is passionate about mentoring and hopes to inspire more people in the amateur radio community to enjoy Morse code.

The beat goes on

And the (zero) beat goes on dit dit. As you continue your Morse code journey, remember that persistence and practice are key. Keep your spirits high, connect with fellow learners, and enjoy





every 'dit' and 'dah' along the way. You're part of a vibrant community, and every step forward is a step in the right direction. Dit dit!

Volunteering for the RSGB is something volunteers do and the GB2CW scheme desperately needs volunteers to carry on the work of teaching CW. So, if you feel it is something you can do, please consider it. There are many good operators out there who aspire to a great standard of Morse operation but not that many who pass on their skill and talent to others.

I will carry on teaching locally together with four other volunteers and we have been quite successful within our club, Norfolk ARC, with new operators enjoying the Morse Mode. Unfortunately, it is only when becoming skilled and on the air that you realise what you have been missing. That is something that cannot be taught.

Morse and the disabled

Following my article on Morse and the Disabled, I had several emails, one being from **Victor Brand G3JNB**, **Fig. 3**. Victor is well known of course with his association with the RSGB but he also happens to be a past Chairman of the Norfolk ARC. This is what Victor said: *"Thank you for writing the excellent article on Morse and the Disabled.* ***Audrey*** *and I think it an important contribution to the* Practical Wireless *reader's appreciation of the importance of this subject. I have taken a copy for own my scrap book for future reference.*

"Personally, I have no doubt that the mental concentration required by my CW DXing over my own retirement years has proved beneficial and has certainly contributed to getting me to 92!

"Roger, it is unlikely that I shall be able to attend this year's DX Convention. I have greatly enjoyed them since the days of that pub in Twickenham and I was made so welcome by everyone at Kents Hill (RSGB Convention - **ed**) *last year, it seems to me that this is, indeed, an appropriate time for me to stop. I am really going to miss seeing you and my friends from 'NARC' and the lovely 'raffle ticket' lady!"*

I have suggested to Victor that he might consider a short visit on one of the days. At 92 he must be in the Honour Roll of DX-chasers if there is such a thing. He is wheelchair bound these days but I feel sure we could rustle up somebody who would be willing to help Victor around Kents Hill for the period he might attend. Victor's email address is:

victor.brand33@outlook.com

To finish with this month, a few notes to those venturing on the CW bands for the first time and indeed more appropriately those who are new to the DX bands in general:

Logging the contact

There are several ways to do this. Most people these days run something like Logger32 to log electronically. Other programs are available, of course, but I changed to Logger32 several years ago. I wish now in retrospect I had kept a real paper logbook going. I have 15 of these over the years and it is useful to be able to refer back easily with lots more details that can be recorded, weather, propagation, solar indices, and even personal information (son/daughter passed driving test today). You cannot do this easily electronically and paper logs are something you should not discard without some thought.

Equipment mention

Again, this is good to put in the log. You won't remember some years later what you were using. Comments are easier in a paper log.

Time of day guidance

Try to use some of the useful on-line prediction programs and solar information that is available. I use Propquest, written by G3YLA locally, and I also run Simon's Map. This is a gray-line clock with numerous add-ons and is a very nice display too.

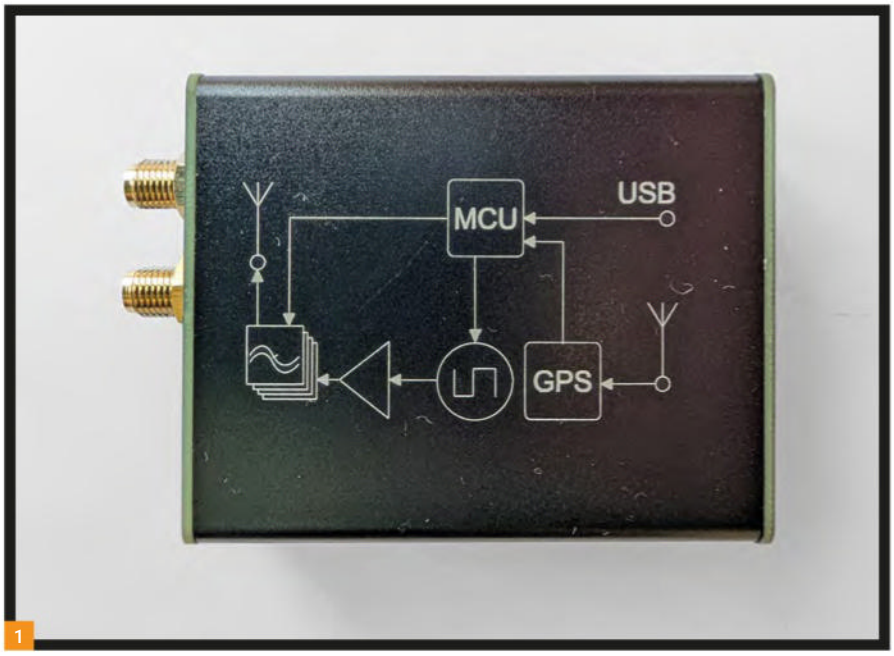
The CQ alternative

You don't have to call CQ. Look for other stations calling CQ. However, listen to their CW first before replying! If the CW is badly formed, badly spaced I would avoid them. Pick a very well-sent CQ, it will help you a lot.

73 and May the Morse be with you! **Roger G3LDI**. **PW**

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Daimon Tilley G4USI
practicalwireless@warnersgroup.co.uk



1

WSPR Beacon and the Xiegu CW Paddle

In this edition of On a Budget, **Daimon Tilley G4USI** gives us two reviews for the price of one!

Let's start with a cheap WSPR beacon from online store Banggood. I came across the beacon as a result of watching a 'Tech Minds' video on YouTube, and although I already have and use a better and more sophisticated version, for only $46 (£33) I thought I could put it to use. Now my youngest son is driving, my wife and I intend to travel abroad more often. In the past I have often taken an HF portable rig abroad, but our forthcoming plans include a number of city breaks. In my experience of trying to operate HF from cities on my travels, QRM is too high for comfortable use, so I thought that this little beacon would allow me to get my callsign on-air abroad from a hotel or apartment, while not having to actually operate or listen through QRM.

The YouTube video must have caused quite a demand, as when I ordered mine, a short time later I got a message saying it was out of stock and more were on the way. Even then, it arrived in about five weeks or so. Externally it looks almost identical to the $139 WSPR beacon that I purchased some years ago from Zachtek.com, but the Chinese unit is less capable than that, **Fig. 1**. I have not compared the internal components, though, as my Zachtek unit is permanently installed in an outside barn and is not very accessible.

The unit came well packaged with the main transmitter, a GPS antenna and a USB power / programming cable. The packaging indicates that the beacon is designed by BG6JJI, and a website link is provided to a set of instructions to configure the device. **Figs 2, 3** and **4** show other views of the unit.

In order to configure the unit, one must open a serial terminal and a link is provided in the instructions to an online terminal. The instructions describe what to do, but you basically type in your callsign (max. six characters) your locator square (max. four characters) your power ('23' for 23dbM or 200mW) and the frequency you want to transmit on, and then press enter.

I tried many times and it would not accept my configuration! Frustrated I turned to Google and discovered others had found this and that you need a GPS lock to programme the device. As I was trying this in my shack, I had no GPS signal so it would not work. Hanging the GPS antenna outside an upstairs bedroom window and using a laptop brought success, however.

A little tip here. The GPS antenna provides essential time data for WSPR transmissions, but of course it also provides location data. If you physically configure your four letter locator by typing it into the serial terminal, then that is what will be transmitted, but, if you configure the device with four blank spaces for your locator, then wherever you are, that will be accurate without needing you to manually amend it, but it also seems to send all six digits of your locator for improved location accuracy.

In use

First of all, please note that this device is capable of operation on just about any frequency in the HF spectrum. I suspect, but have not tried it, that it will also work at 50MHz and 144MHz, as the Si5351 chip is capable of those frequencies. It will, though, only work on a single band – if you want to change band, you must change the Config file in the serial terminal, so band-cycling, as in the more expensive Zachtek unit, is not possible. Additionally, there is no form of Low Pass Filtering for the device at all, which is not best practice. In permanent or frequent use I would recommend adding a suitable LPF for your band of choice at the antenna. However, the power output is small and I live on a reasonably remote smallholding with no near neighbours, so I did operate on 20m to test the device without one. If I were to use it frequently or in a built-up area, then I would recommend using one to prevent causing interference to others.

Indeed, in my use case, foreign city operation, then I intend to build a small filter inside the case for 20m and use it solely on that band.

On a positive note, though, the unit does use a Temperature Controlled Crystal Oscillator (TCXO), which maintains a high degree of frequency stability over time, and no drift was reported on any of the WSPR spots of my signal – a good sign.

As I know just how effective WSPR is, I decided that the first test would be with a heavily compromised antenna, namely a three foot telescopic whip of the type found on portable radios. I leant this in an East facing window of an upstairs bathroom, with the GPS antenna just outside the window on the external windowsill. I did receive some spots from a few European stations to the East over a few hours, **Fig. 5**, but results were not great. I then connected the device to a random length of wire I have permanently strung between my patio and a nearby stable. It is about 25m long and goes from 6ft high to about 15ft at the far end. I did not use any form of antenna matching and nor did I use a counterpoise, theorising that the outer coax braid of the GPS antenna could fulfil that role! The results were, of course, dramatically improved, **Fig. 6**. A resonant or properly matched antenna would work better still, of course.

So, can I recommend this? Well, yes, you cannot

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3

Fig. 1: The WSPR beacon. Fig. 2: Front view.
Fig. 3: Rear view. Fig. 4: internal view.
Fig. 5: Initial WSPR spots with 3ft whip.
Fig. 6: WSPR spots using random wire antenna.
Fig. 7: The Xiegu key. Fig. 8: Top view of key.
Fig. 9: Side view of key.

go wrong for the money. I could (and have in the past) build something like this from scratch myself, but it would be bigger and probably cost me just as much money and quite a bit of time. But remember to consider a Low Pass Filter for use in built up areas or for longer-term use.

Xiegu VK6 Iambic Morse key

I have reviewed most Xiegu products in these pages, so when I saw that they had released this Morse paddle, and being a keen CW operator, I contacted Sinotel and asked to borrow a unit for review, and they kindly obliged. Retailing currently at a reduced price of £59.95 from Sinotel (URL below), the key comes well packaged with a nice long lead to connect to your rig and two Allen keys for adjustment.

www.sinotel.co.uk

It looks to be very well made from a combination of materials and is heavy and solid. Materials used appear to be machined aluminium, some brass, steel and it has silver plated contacts (**Figs 7, 8** and **9.**) Given its heft, I suspect that the alloy base is filled with a much heavier material. There is a rubber mat on the base, designed to prevent slipping, but in practice this was insufficient to stop the key sliding on the desk. Placing it on a mouse mat helped considerably, but if I were to keep the key, then I would add a better non-slip material underneath, such as router matting, but this is a minor issue at this price.

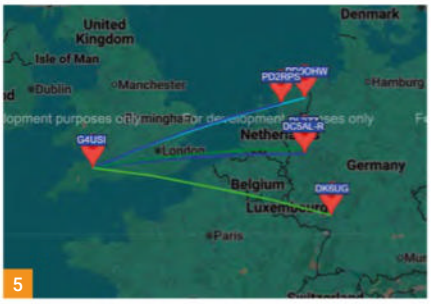
Adjustment is simple and robust. Once you have it set, then the key seems to hold its settings well and mine has not needed any further adjustment since I received it. The return mechanism is magnetic and works very well, and the finger pieces are made of a carbon-fibre type composite.

I like my paddle adjustments to have a very small gap to operate and the Xiegu allows for these tiny adjustments. Over the course of the last two months or so of fairly extensive use, I have really enjoyed using it and it has performed every bit as well as my more expensive paddles. I highly recommend it for the money.

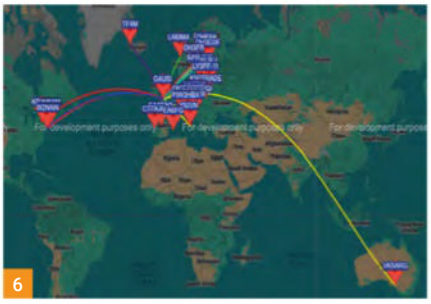
Until next time, when I have a homebrew project in mind for you. **PW**



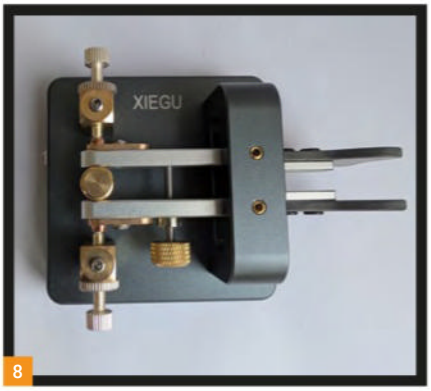
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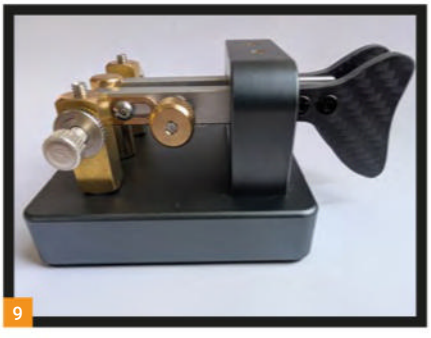
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7

Marconi's Short Wave Beam System (Pt II)

Michael Jones GW7BBY concludes his look at the classic Marconi beam system.

By 1923, armed with a vast amount of empirical data resulting from his trials with Short Waves and beam antennas, **Marconi** was convinced that a Short Wave system using beam antennas would provide direct links without relay stations between Great Britain and her dominions with lower power, smaller installations and greater security owing to the narrow bandwidth. He now found himself in the awkward position of having entered into a contract to supply a Long Wave system to connect the British Empire. He now had to go back to the government and virtually say, *"Hey, I was wrong about Long Wave, we need to scrap all that, I've got a better idea -Short Wave!"* This was a real dilemma, but the strength of his convictions backed up with his scientifically proven test results won the day.

After lengthy deliberations the British government announced on 2 July 1924 that Marconi's Short Wave Beam System would be adopted for communications with the Empire. However, there were conditions: Strategically important communications to Empire countries would be operated by the state, that is to say the Post Office. This service became known as the 'Empiradio Beam System'. However, Marconi and other companies would be permitted to operate wireless services to countries outside the Empire such as America, known as the 'Via Marconi' service.

Before signing the contract, the Post Office required an onerous demonstration of the proposed system. Stations were to be constructed for communications between UK (Bodmin/Bridgwater) and Canada (Drummondville/Yamachiche). If the trial was concluded satisfactorily, further stations would be constructed for communication with Australia, South Africa and India. The transmitters were to have an input power of at least 20kW, both transmitting and receiving antennas should have a beamwidth less than 30°. The system should be capable of passing traffic at an average speed of 100wpm simultaneously in both directions for 18 hours per day.

Over the next two years the stations for the UK/Canada circuit were constructed. This was a considerable undertaking both financially and logistically as there would be no payment from the UK government until the system was proven.

Empiradio was not Marconi's only preoccupation at this time: the Marconi Company was still operating a Long Wave service to America via its Waunfaur/Towyn installation. To improve this service a new Beam Station was being built at Dorchester/Somerton. Marconi had also received contracts for Beam stations between Portugal and Cape Verde, Portuguese East Africa and Portuguese West Africa. Beam stations were also to be built in Brazil and Argentina.

The demonstration of the Empiradio Canada UK Beam System was conducted between 7 and 14 October 1926, maximum speeds of 250wpm were achieved in both directions, the average over the test period was 120wpm. The Post Office issued a certificate on 20 October signed by Engineer in Chief **Mr T. F. Purves** stating that the Post Office was completely satisfied with the performance of the system.

The Canada/UK circuit was subsequently opened for public use on 25 October 1926 on a frequency of 18.1MHz (16.5metres). Once in service, traffic speeds in excess of 300wpm were easily achieved, 200wpm being commonplace. Speeds could drop below 100wpm under poor propagation conditions to improve accuracy. But it can be seen that there was no difficulty achieving the average of 100wpm stipulated by the Post Office. This was 5 – 15 times faster than could be achieved on the LW systems. Work then continued apace on the Australian, Indian and South African stations.

The Short Wave Beam stations were cheaper to build and maintain and were more efficient. The service operated directly to the service destination with no need for relay stations. Output power was in the order of 10 – 20kW against hundreds of kilowatts for Long Wave stations. RF efficiency was improved as the antennas were not compromised, furthermore their energy was radiated in a narrow beam. Bandwidth was greater, enabling greater traffic speeds and later on telephone traffic and multiplexed operations. Finally, less real estate was needed for the antennas.

The short wave beam system

The beam service was to provide communications over a number of 'circuits' or 'routes' such as UK to Canada, UK to Australia etc. Transmitting stations and separate receiving stations were constructed in the UK and reciprocal stations in the distant country. It was still necessary to have the transmitting

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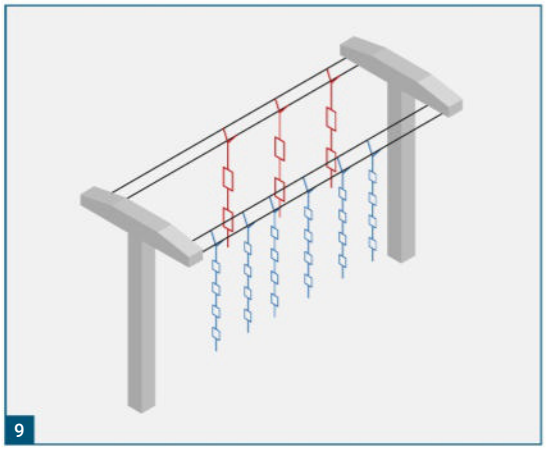


Fig. 7: Tetney Machine Room. Fig. 8: Dorchester Beam Antenna. Fig. 9: Simplified diagram of SWB antenna showing driven element (red) and reflectors (blue). Fig. 10: Example of Franklin's coaxial feeder.

and receiving stations separated by some tens of miles to avoid overloading the receivers and allow full duplex operation. The Canadian circuit opened on 25 October 1926 and was quickly followed by the Australian circuit from Tetney near Grimsby transmitting to Rockbank (Melbourne) on 8 April 1927 on 11.6MHz (25.9 metres). Some beam stations operated on more than one circuit, the Bodmin station commenced operations to South Africa on 5 July 1927 (18.1MHz/16.6 metres) and the Grimsby Beam Station to India on 6 September 1927 (18.5MHz/16.2 metres) and shortly afterwards circuits to Argentina, Brazil and the United States. The frequencies quoted are for daytime services; at night they would shift to a lower frequency in the order of 8 – 9MHz. (**Paul Hawkin's** book *Point to Point* gives more details [**12**]).

Most of the infrastructure for sending and receiving telegrams was already in place for domestic and international telegrams via cable and the existing Long Wave system, also for handling 'Marconigrams': telegrams for the mercantile marine service. Requests for a telegraph service came in via Post Offices, telegraph offices, businesses, government or the public to the Central Telegraph Office at St Martins Le Grand in London. The message would be converted to Morse code and reproduced on a paper tape or 'slip' as a series of perforations. The slip was then run through a high-speed Morse machine that directly keyed the appropriate transmitter by landline from the Central Telegraph Office.

Traffic for the Marconi controlled stations was sent and received via Marconi's Telegraph Office at Radio House, Wilson Street, London. Of course, similar telegraph offices were in place at the distant country.

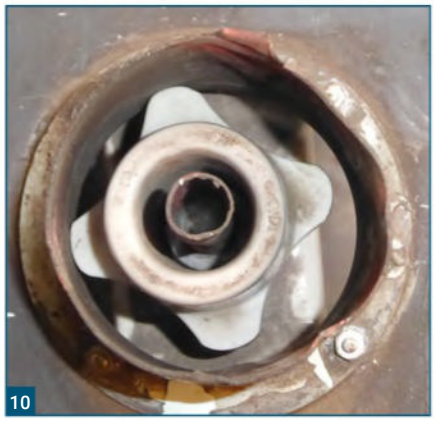
In the two years from 1926 to 1928 the Short Wave Beam System encircled the globe and the Marconi company was earning revenues from sales of equipment, building stations and telegraphic fees. We might also remember that at this time Marconi dominated maritime radio systems and was a major contributor to the success of public broadcasting in the UK and overseas.

The 1930s and the two decades after the Second World War saw an exponential growth of international radio telephone services, facsimile, teleprinter and data services all built on the back of Marconi's short wave vision and experiments of 1922/23.

Power

The power required even by the relatively low powered, transmitting stations was considerable. The SWB1 transmitters required a power of 20kW input for 11kW output. Remember that most stations had more than one transmitter. Dorchester started with four SWB1 transmitters, a further eight were added soon after as further circuits came online. 25kW SWB10s were introduced in 1938. Sufficient power was generally not reliably available to stations located in country areas where the landscape and geology was more advantageous for transmitting purposes. Dorchester, for instance, had three Ruston and Hornsby 150HP three cylinder and two 200HP four cylinder generating sets in primary service until 1938 when 3.3kV grid supply became available. These generators produced 440V DC, which was used in turn to drive motor generator sets to produce the necessary voltages for HT, LT and other intermediate needs including lighting, heating and pumps for coolant circulation. To minimise noise and vibration affecting the transmitters the generating sets were in separate buildings, **Fig. 7**, and mounted on substantial cork mats.

Each transmitter had its own two-stage rectifier bank containing 16 Marconi MR7 high vacuum half-wave rectifiers in the first stage and two in the second stage to provide HT DC supplies for the valves.



Beam antennas

The beam antennas used for the Short Wave Beam System were curtain arrays invented by Marconi's assistant, **C. S. Franklin**, in 1924 as part of a large scale study into the characteristics of short wave transmissions, **Fig. 8**.

Five 287ft high masts were erected 640ft apart in a straight line very precisely oriented so that the direction of the beam was on a Great Circle route perpendicular to the plane of the antenna. Each mast was topped with a 90ft cross beam with triatics (supports like a catenary running from mast to mast). Between the five masts there were two pairs of two 'panels' or 'bays'. As each transmitter required a daytime and a night-time frequency, one pair of panels would be for daytime and the other pair for night time. One panel, simplified for clarity, is shown in **Fig. 9**. Each panel consisted of a front curtain of vertical co-phased dipoles (red in the drawing). These were the driven elements comprising three vertical wires of unequal length separated by inductors, 19ft apart and suspended from the triatics (green). The unequal length of the dipole elements was presumably to control the elevation of the beam to about 10°. Another curtain forming a reflector (blue) was supported approximately one-quarter wavelength to the rear. Each reflector had five vertical wires separated by insulators. There were two reflectors to each driven element. There

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Fig. 11: Franklin's feeder system for SWB antennas junction boxes are blue, coupling boxes are red. Fig. 12: One of the coupling boxes at Tetney. Fig. 13: An SWB1 transmitter showing the four 'panels'. Fig. 14: Dorchester transmitter hall.

would be as many driven element/reflector sets as necessary for the frequency and service required. In the case of the Bodmin to Canada circuit there were 32 driven elements, and 64 reflectors over two panels [**11**]. The beamwidth achieved by these antennas was <30° with an elevation of 10° - 15°. The receive antennas were duplicates of the transmitting antennas.

This formed the basis of the beam antennas, but there were variations to accommodate different circuits and frequencies. Later developments allowed the beam direction to be altered by phasing parts of the curtain. Also, the beam could be reversed to communicate with countries 180° apart from the main lobe. As at Dorchester where the Cairo beam was situated on the opposite side to the New York Beam, the same reflector being used for both services. This was a considerable saving on masts.

Feeder system: Coax

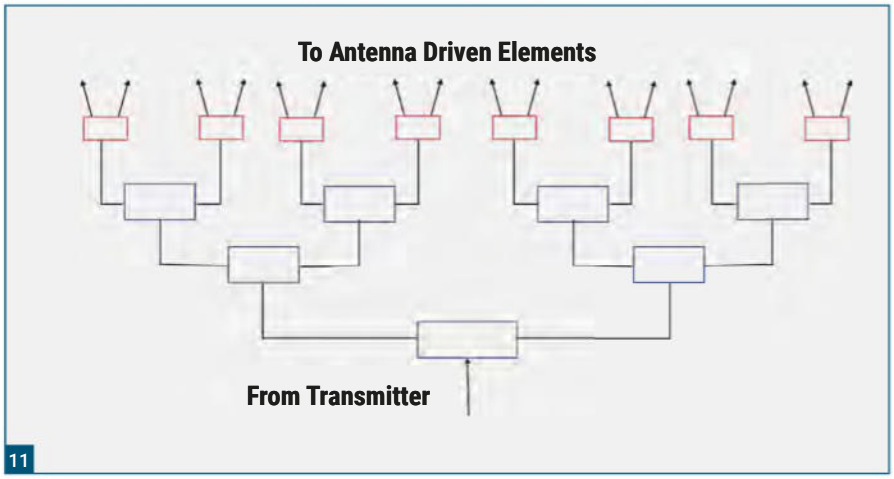
Coaxial feeders comprised of concentric copper pipes were devised by Franklin. The outer pipe was 3 or 3.5in diameter and the inner pipe 1in diameter. The conductors were separated by a number of porcelain insulators, **Fig. 10**. Junction boxes were positioned along the feed path to distribute the power from the transmitter to a number of antenna coupling units to ensure all vertical elements were fed in phase, **Figs 11** & **12**. The nominal impedance was 75Ω. It is C. S. Franklin that we have to thank for inventing the coaxial feeder that many of us rely on to this day.

Transmitters

The SWB1 Transmitter, **Fig. 13**, designed by C S Franklin in 1924 was the mainstay of the Short Wave Beam System from 1926 until 1939. Although some did remain in service until the late 1960s.

The SWB1 transmitter provided an RF output of 11kW for an input of about 20kW utilising either CAT2 or CAT3 (Cooled Anode Transmitting) valves in the finals with 8,000 – 10,000V on the anodes. These were the first valves to successfully employ copper glass seals to the anodes to enable direct attachment of liquid coolant jackets for cooling. Pumps were also required for the coolant, paraffin at first, then changed to water at the beginning of the second world war to minimise fire risk during bombing.

As can be seen from the picture these transmitters were constructed as four open frames of heavy brass construction referred to as panels 1, 2, 3, and 4 sometimes called A, B, C and D. Note that the terminology of the



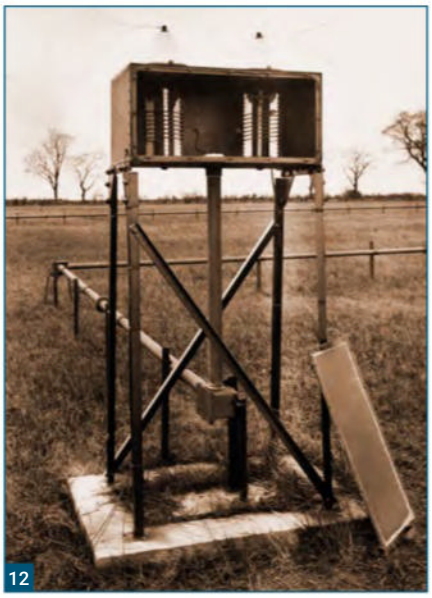
time referred to amplifiers as 'magnifiers'. Panel 1 was the final magnifier. Panel 2 was the master oscillator (Franklin) and magnifier or driver. Panel 3 was a duplicate of panel 2 to enable rapid switching to a second frequency as required for daytime/nightime changeover. Panel 4 was the keying and absorber unit, directly keyed from the Central Telegraph Office. The absorber was intended to keep the loading on the motor-generator power supplies constant, by diverting power during the spaces (key off) to a small hut containing resistances able to absorb an equivalent amount of power to that drawn by the transmitter when keyed.

A transmitting station may have more than one transmitter either for multiple circuits or to cover a number of frequencies. Each transmitter usually operated on two frequencies for daytime and night time operations. Dorchester, **Fig. 14**, started with 4 x SWB1s and 8 more were soon added to enhance coverage and provide new services to Bangkok, Nairobi and Tehran. In 1938 an SWB10 25kW transmitter was introduced, this was augmented in 1953 by a further 5 x SWB10s.

The SWB transmitters continued in service after WWII, but were augmented by 30kW Marconi DS13Ds. In the early 1960s the Beam antennas were replaced by Rhombics. It was the advent of Satellite communications in the 1970s that brought about the end of the Short Wave Beam System. The SWB1s were scrapped and the SWB10s transferred to other duties.

Receivers

One of Marconi's assistants, a brilliant Belgian electrical engineer **Gaston Matheiu**, designed the Beam Receivers. They were in two principal parts: the 'A' set was located at the beam station where it received the raw signals from the antennas and produced an output at 30kHz. This was impressed on a landlline, above the normal audible traffic at nominally 3kHz, and sent to the Central Telegraph Office. Here the 30kHz signal from the beam station was filtered off and sent to the 'B' set where it was filtered, amplified and



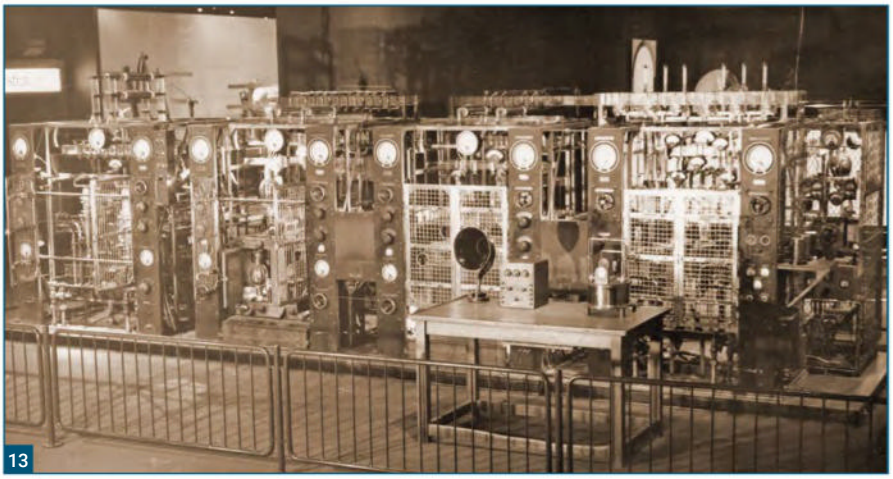
fed to a high speed undulator that recorded the Morse signals on a strip of paper about 1/2in wide called 'slip'.

The 'A' sets were dual-conversion superhets consisting of a preselector, RF Amplifier and Local oscillator to produce the first Intermediate Frequency (IF) at 187kHz; then three stages of IF amplification, filtered to a bandwidth of 5kHz. Second conversion was to 30kHz followed by two IF stages and filtered to a bandwidth of 3kHz suitable for sending down landlines.

Success of Marconi's system

By the end of the 1920s we have a scenario in the United Kingdom where we have two distinct Short Wave Beam Schemes: the Empiradio operating short wave services to the UK dominions using equipment supplied and erected by the Marconi company but operated by the GPO and Short Wave Beam Services built and operated by the Marconi Wireless Telegraph Company between the UK and countries outside the Empire called 'Via Marconi'.

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Such was the success of Marconi's system that other countries were rushing to acquire their own short wave systems, with or without beam antennas, and significantly without dependence on foreign owned cables. By 1928 the Portuguese Empire, which wanted complete freedom from UK operations, entered into a contract for beam stations, one of the terms being that a Portuguese Marconi Company would be established. Spanish Short Wave Beam stations to Equatorial Africa and South America followed soon after.

Cable and Wireless

In the years preceding the First World War the UK government had been concerned about the lack of security and susceptibility of its cable systems to enemy disruption. Now, in 1928 governments recognised that the Short Wave systems could be susceptible to jamming and saw the strategic importance of the cable systems.

Furthermore, UK and dominion governments had subsidised the cable companies who were now losing money to the wireless companies promoted by the same governments. While the losses were so severe that the only option seemed to be to liquidate the cable companies, the strategic importance of maintaining cable operations dominated political thinking. The mind of government also considered that all means of communication within the UK and with its dominions should be under the control of the GPO.

With these factors in mind it was decided in July 1928 to merge the cable companies and wireless companies to form the Imperial and International Communications Ltd. This was completed on 8 April 1929, the holding company being Cables & Wireless Ltd. The merged companies included Eastern Telegraph Co, Western Telegraph Co, Eastern Extension Co, the Pacific and European Co, and Marconi's Wireless Telegraph Co (MWTC), and eight others, as well as interests in 18 other companies in various parts of the world. The amalgamated company ultimately became Cable and Wireless Ltd in 1934.

Gugliemo Marconi

The above outlines the facts of the merger, but some of the backstory follows. Marconi returned to London from America at the beginning of November 1927. He had apparently suffered a heart attack on the voyage over from America and was bed-ridden until the new year. Meanwhile the government was in discreet negotiations with the more conservative MWTC board members whose minds were focussed more on political and financial gain than pushing the frontiers of radio technology.

MWTC was never in a completely secure financial position and the proposed merger provided a solution. The merger changed the character of the Marconi company from one of manufacturer and operator of international wireless systems to one of manufacturer and supplier of communications systems.

Marconi had every right to feel betrayed by the British Government and his own board of directors, as he at the head of Marconi Wireless Telegraphy Company had proposed and built one of the first and most powerful worldwide communications networks only to have it taken away from him in a forced merger with the cable companies.

On the other hand, he undoubtedly profited considerably, there was a share in the proceeds from the merger, he was also retained as technical advisor at an enhanced salary. It is debatable if this was a mere figurehead position as little seems to have been expected of him.

Following the merger he spent more time in Italy, where he worked on the UHF radio link between the Vatican and the Papal summer residence at Castel Gandolfo. He was drawn into Italian politics and returned permanently to Italy in 1934.

Satellites

The advent of satellite systems brought about the end of the Short Wave Beam stations, the last to close being Bodmin on 31 March 2002. The following year, after 77 years the 16kHz Longwave transmitter at Rugby closed on 1 April 2003. **PW**

Notes & Bibliography

[11] *Wireless World*: 3 November 1926; The Wireless Beam; p43.
[12] Paul Hawkins: *Point to Point*; 2017.

Recommended reading

Marc Raboy: *Marconi, The Man Who Networked the World*; 2016. Oxford University Press.
Larry Bennett G4HLN: *The Marconi Beam Stations of Somerset*; 2023.
Paul Hawkins and Paul Reyland: Marconi's *Wireless Telegraph Stations in Essex*; 2022.
Marconi Review: Oct/Nov 1928 and Oct/Nov

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1

The Man Who Learnt to Talk Through the Trees

Ray Howes G4OWY/G6AUW introduces readers to a little-known but very influential figure from the past.

No, not an April Fool's joke as the title might suggest. This tale relates the extraordinary exploits of tech visionary and polymath, **Major General George Owen Squier** (1865-1934). A leading advocate for military aviation and radio technology - and the first US Army Officer to gain a Doctorate in physics and engineering. Squier had established Langley Field in 1916, in what was then, desolate Virginian farmland - named after aviation buff **Samuel Pierpont Langley** (1834/1906). To date, it continues as a military US Air Force Base and a principal NASA research facility for space exploration.

With more honours than you could shake a stick at, Squier's visionary streak enabled a template for a new upcoming Technocratic military officer class. A decade earlier, promoted to the rank of US Signal Corps Chief of Aviation in 1916/17, he'd written the memorandum that formed the US Army Signal Corps Aeronautical Division (a 'Heavier than Air Service unit'), the progenitor of the modern day USAF (US Air Force). During 1903, at Fort Leavenworth, Kansas, as Commander-in-Chief of flight training, he'd drafted (with a little help) a design for what was to become the first US military aircraft, manufactured by the Wright Brothers in 1908. On 6 September 1908, seated next to **Orville Wright** on an acceptance test flight at Fort Myer, Squier became the world's first military passenger to ride aboard a heavier-than-air vehicle (an endurance record). Come 1909, Squier, on behalf of the US Army, purchased a Flyer - the world's first military aircraft (at a cost of $30,000). For the next couple of years, a primary pilot trainer in the then new art of flying. A Wright Brothers Military Flyer is displayed at the National Air & Space Museum in Washington DC (having seen it and pondered over its arcane construction, the pilots who flew these aircraft were either very brave or slightly mad).

World War 1

A prominent figure in the build up of the Air Force prior to WWI and the architect of the US Aviation Act, this act instigated the financing of thousands of aircraft at a cost of $640 million dollars - allegedly, the largest sum of money ever expended on a military contract at that time. Named the 'Air Service', its personnel had expanded greatly in a short space of time - to 150,000, by the end of WWI.

Squier's orders during WWI were specific. To oversee all communications and aviation operations - and the production and training thereof. One of the most famous men in America (given the title 'father' of American air power), he'd been a vocal petitioner to have his military superiors and the US Congress adopt aviation as an obvious operational military advantage. His pleas would later kick-start the US aircraft industry (and the future military industrial complex). Perhaps what he may not have foreseen would be the emergence of communication satellite deployment (the 'eye in the sky') - and its use for global aviation surveillance. His 'military technocrat' idea, later evolved into the modern day concept of 'engagement militarism'.

Visiting the Columbian Exposition & World's Fair in Chicago in 1894, along with official chaperone **Thomas Meddenhall**, they were on a quest to appraise the leading-edge heavy artillery and the future applications of electricity for military purposes, and the then emerging electrification technology on display (electrification would enhance the workings and remote control of coastal artillery). A huge pavilion built by **Mr Edison** and **Mr Westinghouse** was generously filled to the rafters with a vast cornucopia of electrical equipment. This visit gave Squier the idea to promote 'electro-technical' as an educational subject - given its connection with 'electro-mechanical use and the new artillery technology'. At Langley Field, an Army Electrical Engineering and Aviation Laboratory was later set up on his recommendation. A year earlier, at Fort Monroe, Squier and **Albert C Crehore** (physics professor and friend) were engaged in an attempt to solve the perplexing problem of measuring artillery muzzle

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1. George Owen Squier (March 21, 1865 – March 24, 1934), the American general, scientist, and inventor. 2. Squier's obituary, published in all of the leading American newspapers, a few days after his death

velocity. And conducting experiments with radio and submarine cable comms utilising alternating current.

Radio connection

Squier's multifaceted expertise fully embraced radio. His idea to use radio communications for military use, and its weaponisation to control artillery systems at a distance, added a crucial strategic link at the outbreak of the Spanish and American war in 1898. And his unique technical ability to engage radio technology for military objectives at the time, upended battlefield logistical perspectives.

Recalled in 1900 (a year earlier, sent to London to study radio with Marconi), he'd previously commanded a relief operation to solve the ongoing disruption to radio communications in the Philippines. Squire, then a First Lieutenant, was in charge of cable laying operations in the area. His orders were to evaluate the viability of counter measure underwater communication cables. Communications with the Philippines archipelago having been cut due to the ongoing civilian rebellion with an American occupation - a consequence of a war with Spain (the US Navy Battleship *Maine*, had exploded in Havana harbour, a Spanish controlled territory). The indigenous guerrilla actions had prevented the use of a reliable messaging pathway. So, the need to lay underwater comms cables became a necessity. Squier's cable laying operation succeeded. A thousand miles of vital cables being laid in just one year.

Government short-sightedness

Knowing the potential of military aeronautics (a discipline that revolutionised warfare), Squire had been keenly aware of the Wright Brothers aerial escapades with their successful 'heavier than air' flights (twice, in 1905, the Wright Brothers offered their aircraft to the American Government, but the government demurred). However, Squier's subsequent (prescient) decision to petition the US government, would result in things aeronautical being eagerly embraced. In 1908/9, with the acceptance testing process now finalised (and a couple of not unexpected flight mishaps), the Wright brothers' *Flyer* entered service. A decade on, with WWI now ablaze and what should have been a head start, American aviation was caught napping (the US declared war with Germany 6 April 1917). The feasibility of aviation finally focused minds, causing an abrupt U-turn. Unlike the French government that had splashed out millions of francs on its military aviation industry, the US government had invested very little money on its aviation programme.

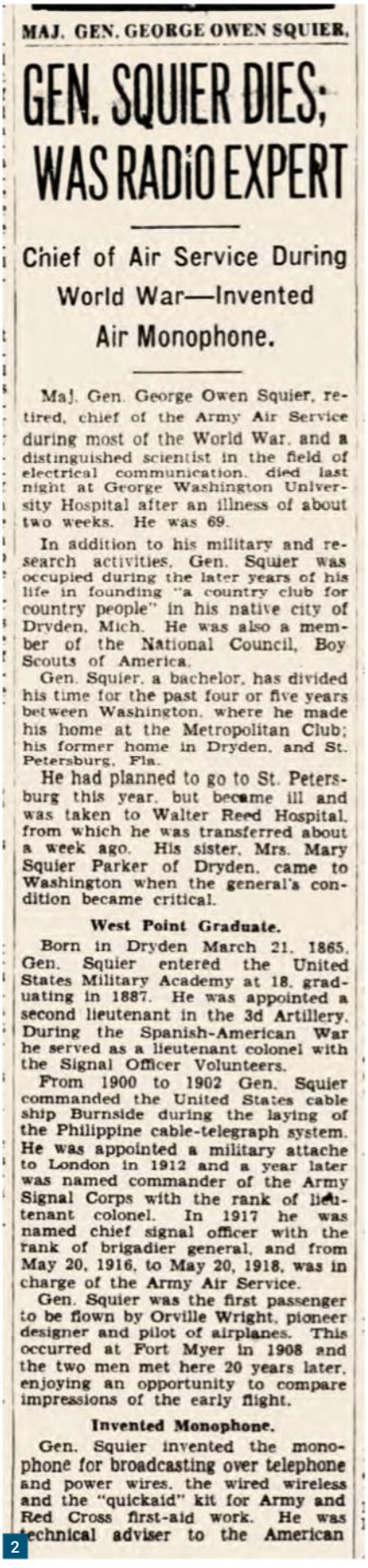
As a consequence of America's short-sightedness, combat aircraft wise, now an indispensable tool of war, the US military were forced to buy the French SPAD XIII ready built. Squier, then began the huge task of building a US Air Force at breakneck speed, initiating a plan to buy the Curtiss JN-4-H and the De Havilland D4.

Having been given US Congress and the Army's blessing, but wanting to further embed the practicalities of new technologies and their applications into the realm of education, Squier was forced to put his idea on the back burner, as come 1917 he's promoted to Brigadier General and Chief Signal Officer of the Army, and thrust into WWI. The advent of radio communications now burning brightly (a Signals School was set up in Fort Leavenworth to teach the relevant radio comms skills - and of course, the aerodynamic aspects of those flying machines), was now on a mission to finalise his concepts of radio and an airforce, both of which, would fulfil vital roles in warfare. As **Wilbur Wright** once said: *"there is no sport in the world quite equal to that which aviators enjoy while being carried through the air on great white wings. Compared with the motion of a jolting automobile, is not flying real poetry?"* Squier would have agreed with that sentiment.

A renaissance man, Squier brought about a tectonic shift in the development of aviation, the most revolutionary technology of his day. Science and engineering had begun to enter a new radicalised era of achievement. During WWI, Squier had attempted to convince the British government to adopt submarine cable communications - without much success. And his idea of using radio to remotely detonate mines and cannons at a distance, a capability not used by any other country's military operations at that time, gave America a global monopoly in its use. As a result of Squier's dogged perseverance, America's armed forces and its Air Service were the first military personnel to be fully equipped with radio communications (during WWI, radio had come of age). The period between 1917/18, the US Navy operated the world's largest radio network. No expense was spared to equip its military forces with the most modern communications technology. Unsurprisingly, given access to WWI Western Front operations, Squier, wrote a report for his superiors at the War Department in Washington detailing British Radio Service's intercepts methodology. Acquainted with the movers and shakers of his day, Squier's insights into the field of communication technology and multiplexing techniques underpin today's vast mobile-phone industry. Many data modes used by ham radio operators employ the benefits of multiplexing in some shape or form.

Multiplexing

Awarded patents (between 1909/11) relating to multiplex telephony, Squier's invention enabled



MAJ. GEN. GEORGE OWEN SQUIER.

GEN. SQUIER DIES; WAS RADIO EXPERT

Chief of Air Service During World War—Invented Air Monophone.

Maj. Gen. George Owen Squier, retired, chief of the Army Air Service during most of the World War, and a distinguished scientist in the field of electrical communication, died last night at George Washington University Hospital after an illness of about two weeks. He was 69.

In addition to his military and research activities, Gen. Squier was occupied during the later years of his life in founding "a country club for country people" in his native city of Dryden, Mich. He was also a member of the National Council, Boy Scouts of America.

Gen. Squier, a bachelor, has divided his time for the past four or five years between Washington, where he made his home at the Metropolitan Club; his former home in Dryden, and St. Petersburg, Fla.

He had planned to go to St. Petersburg this year, but became ill and was taken to Walter Reed Hospital, from which he was transferred about a week ago. His sister, Mrs. Mary Squier Parker of Dryden, came to Washington when the general's condition became critical.

West Point Graduate.

Born in Dryden March 21, 1865, Gen. Squier entered the United States Military Academy at 18, graduating in 1887. He was appointed a second lieutenant in the 3d Artillery. During the Spanish-American War he served as a lieutenant colonel with the Signal Officer Volunteers.

From 1900 to 1902 Gen. Squier commanded the United States cable ship Burnside during the laying of the Philippine cable-telegraph system. He was appointed a military attache to London in 1912 and a year later was named commander of the Army Signal Corps with the rank of lieutenant colonel. In 1917 he was named chief signal officer with the rank of brigadier general, and from May 20, 1916, to May 20, 1918, was in charge of the Army Air Service.

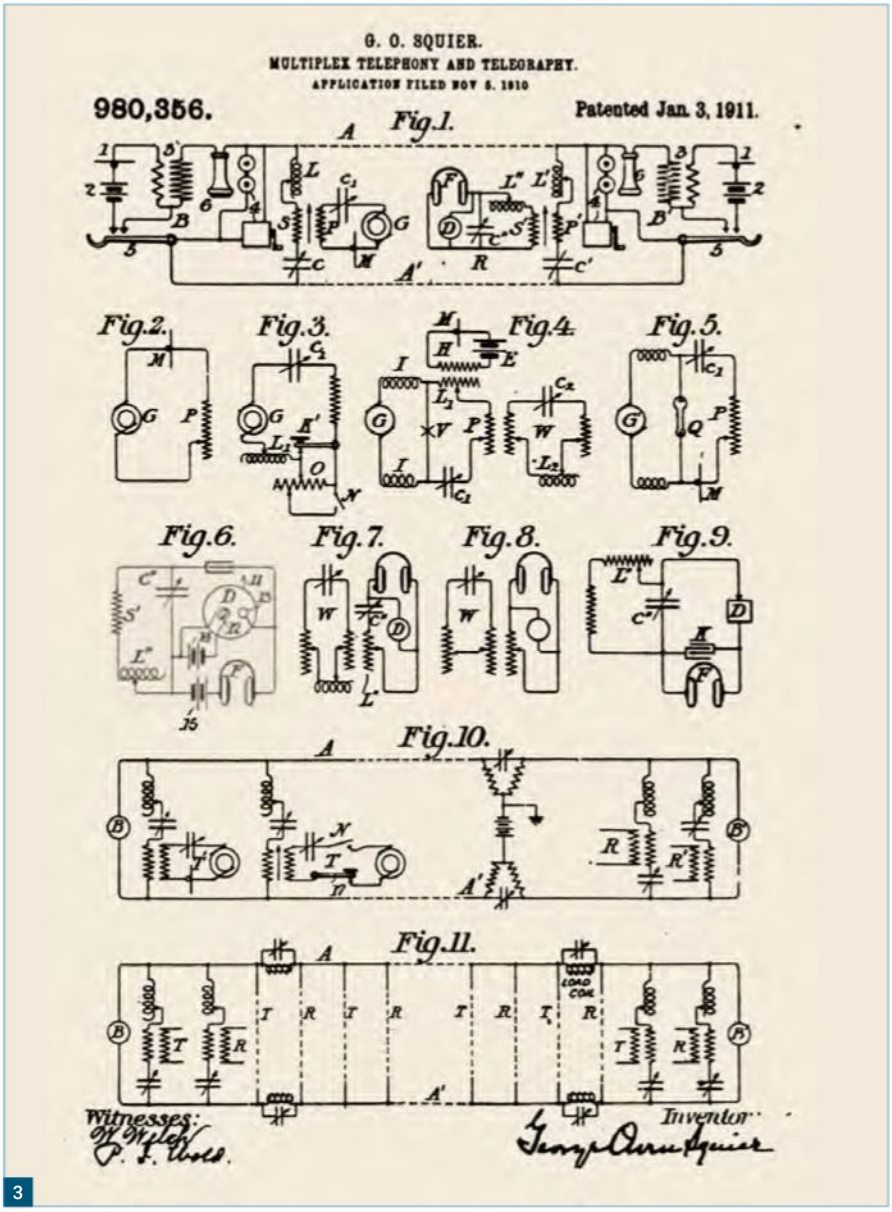
Gen. Squier was the first passenger to be flown by Orville Wright, pioneer designer and pilot of airplanes. This occurred at Fort Myer in 1908 and the two men met here 20 years later, enjoying an opportunity to compare impressions of the early flight.

Invented Monophone.

Gen. Squier invented the monophone for broadcasting over telephone and power wires, the wired wireless and the "quickaid" kit for Army and Red Cross first-aid work. He was technical adviser to the American

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3

3. Squier's patent application for multiplex telegraphy and telephony.

multiple signals to be 'squeezed' into one wire transforming transmission signalling rates. Up until his data-shifting signalling technology concept, transmission rates were painfully slow - only one signal could be transmitted at a time via one wire (the original idea had adapted the principles of radio comms to a single wired circuit). The one wire concept had limited the number of messages that could be sent and received at any one time (multiplexing consolidates multiple signals or data streams into one simultaneous signal, then demodulated/'demuxed'). The efficiency and scalability of bandwidth greatly increased the information rates passing between a transmitter and a receiver. Multiple messages sent through one wire quickly became the new normal. A Eureka moment for telecommunications. Squier's ingenuity had built the foundations for future modern-day telecoms shenanigans. But for some inexplicable reason, given Squier's one-time worldwide celebrity, his name has slipped off the proverbial radar. Considering his profound contributions to science, communications and aviation, it is perplexing as it is bizarre.

Muzak

At his retirement in 1922/23, Squier, honed in on his 'Wired Wireless' endeavours, discovering a novel approach to distribute music and news broadcasts via the existing telephone and power lines - as did telegraph and telephone signals. In those days, domestic radio was an expensive luxury and not quite yet the mass sensation it would soon become. So, the distribution music and news broadcasts via the existing telephone and power lines infrastructure became a game changer. Squier founded Wired Radio Inc in 1934. Later renaming it Muzak, the 'ak' bit, borrowed from Kodak. 'Piped' (via subscriptions) into shops, hotels ('elevator music') and so on, it was loved and hated in equal measure. Like social-media, Muzak was endemic. Both a music delivery tool and covert subliminal psychological device, used to modify shopping behaviour via the moderator of music ('piped' into factories to increase productivity). Squier's invention of 'piped' music still lives on, its legacy still heard. Muzak was sold in 2011, for $300 million dollars. The acquisition by Mood Media saved it from assured oblivion.

Talking through the trees

Published in a 1919 issue of the *Electrical Experimenter*, Squier, had penned an article called *Talking Through the Trees* (*Scientific American* published a similar article in the same year entitled *With Trees for Ears*, describing the exciting possibility of using trees as a communications resource). What appeared to be an outlandish proposition, apparently wasn't. The gist of Squier's quirky idea to substitute a tree for an antenna - to be a replacement for *"any man-made aerial"* and reduce *"static interference"*, that a tree can act in much the same way as *"any other aerial"*, had been revelatory. In passing, a patent was awarded to **Gordon Wadle** and **Kris Lagadinos** (2010), which exploited the potentials of ph difference between soil and the roots of trees. This unit (Voltree) amplified tiny electrical bioenergy currents (via some clever circuitry) to recharge or replace batteries. Squier's flora solution originally blossomed in 1904 or thereabouts, a consequence of an exceptionally dry summer season that had affected soil conductivity. The Army telephone buzzer and telegraph equipment became inoperable at Camp Atascadero, CA. But when the radio apparatus was connected via a metal nail put into the trunk of a living tree, as if by magic, it became operational again. Squier recommended that whenever possible, *"trees in full foliage"* be used.

After much trial and error with his flora type antenna alternative, Squier, happened upon an optimum height *"that a nail be driven into a tree"* (remarking that although a tree is at ground potential, it paradoxically acted as an *"insulated aerial")* - *"two thirds from the bottom is ideal, copper nails being preferred"*. That *"several nails driven"* into a tree and connected in tandem, produced *"clearer signals"*. Apparently, QRP worked surprisingly well too. The establishment of two-way telegraphy communications being surprisingly viable, even over a longer distance.

Naming his inventions the 'Floraphone' and the 'Floragraph', after a decade or more of extensive experiments, at the outbreak of WWI, Squier's novel tree radio concepts were used as an emergency communications mode - and eavesdropping on clandestine German radio telegraph signals.

Squier's tree-antenna biotechnology enabled radio reception on multiple frequencies - but an

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improvement in signal strength wouldn't go amiss. Hence the decision to connect several trees in series. It proved to be an astute move. The tree antenna solution never really caught on though, but his other brainstorms cleverly did. Moving onto 1917, Squier, now the US Army's Chief Signal Officer, established a Radio Research Laboratory at Fort Monmouth New Jersey. This laboratory was named in Squier's honour. Earlier named Camp Little River, it became known as Camp Alfred Vail, as **Vail** then was Chief Signal Officer (**Samuel Morse's** one time collaborator). The development of advanced RF technologies at this facility contributed to many aspects of the radio art. Onto 1929, the first radio equipped meteorological ballon was sent aloft from Fort Monmouth. And most, if not all of the communications equipment used by the US military during WWII was designed at Fort Monmouth. Once the headquarters of the US Army Communications Electronics Command (CECOM), Fort Monmouth closed its doors on 15 September 2011.

To London and back

As related, Squire was packed off to London in 1912 as US military attache - given unrestricted permission by **Lord Kitchener** to visit the Western Front. Communications and aviation being the prime focus. Recalled by **President Woodrow Wilson** in 1916 (recognising Squier's unique talents) to sort out ongoing problems with the Army's Aviation Section of the Signal Corps troubled aviation program - then, spiralling out of control. A successful assignment, he was promoted to Brigadier General, then appointed the US Army's Chief Signal officer in 1917/18. The Japanese Government had also benefited from Squier's scientific knowhow, helping them to defeat Russia during a protracted war in 1904/5. The Japanese government were so impressed that they'd named George O. Squier the *"greatest man in the world"*.

Rising from his humble beginnings in the wilds of Michigan, Squier bridged the gaps between scientist, soldier and inventor. Many of his contemporaries often wondered how such an *"unassuming man could be regarded as a genius"*.

Largely forgotten

His originality just kept on coming. Sadly nowadays, forgotten (a decade or two ago, US military historians downplayed Squier's enormous contribution to the development of aviation). Contrarian always, and a loose cannon at times, his extraordinary military career was indicative of a man who thought 'outside the box'. Like Edison, an inveterate tinkerer, whose imagination brought forth wonders from a *"pile of junk"*. The importance of Squier's pioneering streak shouldn't be forgotten, as we are all beneficiaries of it today. Back in the day when radio had just sprung into the arena of war, who, other than Squier, aside from his brilliant idea to squeeze multiple signals through one wire, would have entertained the thought that trees are alternative antennas - that banging a metal spike into a tree and connecting it up to a radio apparatus, could transform battlefield communications. Squier, thought it and did it. Again, given his considerable cable expertise, he'd tried unsuccessfully to persuade the British government to adopt the viability of cable communications. His expert testimony before Parliament during 1912 was used in its ongoing investigation of the Marconi scandal. That Liberal ministers had abused insider information for monetary gain - via share purchases of the American Marconi Company (prior knowledge of a lucrative Marconi contract to provide radio station equipment across the British Empire).

Moving on, Squier's research into the magnetisation of steel casings for armour piercing projectiles had partly come about as a result of magnetising the edge of a razor blade to preserve its cutting edge ability. Razor manufacturers later co-opted this idea.

Given an Honorary Knighthood by the British government in 1920, a bronze statue of General George Owen Squier stands in his hometown of Dryden, Michigan, located at the General Squire Memorial Park. Squier had stipulated, in his multiplexing US patent (granted in 1910), that it was for free use in the public domain. Of course, companies like AT&T were not slow to capitalise on Squier's philanthropy and invention. In 1924, he had initiated a lawsuit to restrain AT&T from using his multiplexing technology. An attempt to rescind his prior patent instruction. The outcome didn't go well.

The complaint was subsequently dismissed. Squier's patent bore the inscription, *"Dedicated to the Public - free to any person or corporation who wishes to use them"*. Hence the retort by AT&T that Squier's multiplexing invention was therefore free to use without royalty payments. Summing up, the presiding **Judge Knox** ruled that there was no need to pay financial tribute to him (Squier). To add yet more salt to his wounds, AT&T had erroneously claimed that multiplexing was *"based on inventions of its own engineers"*. AT&T's protracted tactic to besmirch Squier, that his claim to be the sole inventor of multiplexing was *"not valid"*, took its toll. But this setback did not dim his unwavering resilience nor his interest in technology and invention. Saying that the practical application of science, the 'tinkering' of, is preferable to the theory of it. **Nikola Tesla** had something to say about that (especially relevant today): *"Today's Scientists have substituted mathematics for experiments, and they wander off through equation after equation and eventually build a structure which has no relation to reality"*.

Squier, was an avid fan of mathematics and used its methods often, but it will be his consummate skill as an engineer and experimenter that will be a lasting reminder of his hands-on approach to the practical aspects of radio, science and technology. Unconventional, and never a conformist, he'd often skirted the boundaries of insubordination. He made the system, which then was riven with the hierarchy of nepotism, work for him, rather than work against it. Squier witnessed the rapid expansion of electricity in 1889 and, likewise, as the Great War began, would usher in a similar expansion of radio broadcasting (the US finally entering the war), his foresight for the future of radio was realised. The end was in sight for immense radio waves and immense antennas (courtesy of spark transmitters, only Morse code could span the oceans with a prayer and ginormous brute RF force).

At the outbreak of WWI, the UK had only two high-power radio stations, but no links with its colonies. The whopping US New Brunswick Radio Station (NFF) acted as a prime radio link between the US and Europe during hostilities at this time.

Although the US New Brunswick station, New Jersey, had been a back-up solution, it was becoming imperative that the British government be able to keep in touch with its ships at sea via two-way radio links. A series of radio stations was hurriedly constructed by the Marconi Wireless Telegraph Company, providing a solution for a worldwide communications network for the British Admiralty.

Squire predicted that with the onset of a war, radio communications would be both vital and transformational. Proven right, as WWI progressed. And much like the British military comms dilemma, the US had suffered a similar problem with an inadequate communications network, causing its military machine much angst and logistical problems. This gaping inadequacy would be solved with the eventual deployment of the new age of radio applications being imbedded into the US Army and Airforce.

Aside from Squier's other ground-breaking accolades (he had graduated from West Point in 1887), his co-development of the synchronograph (the use of AC in telegraphy) and the Polarising Photo-Chronograph, an instrument that determined the velocity of artillery shells in collaboration with his fellow tinkerer, **Professor Albert C. Crehore**, much of it still remains an historical footnote. A one-time Chief Instructor in the Department of Electricity and Mines, he'd noted that *"electricity threatened to revolutionise"* the use of *"heavy artillery"*. It did that in spades. In 1943, a US Navy Troopship was posthumously given his name, the *USS General G.O. Squier*. Soldier, engineer and scientist, amateur radio owes a nod to the man whose work with radio technology had significant synergies with the continuance of our hobby. Squier's diverse technological innovations and his unique approach to science and technology to solve real life problems, is a lasting testament to his unconventional methods of getting the job done. His impact on radio communications, aviation and multiplexing, three of the world's most important technologies, still resonates today. Slowly, slowly, the spirit of time changes everything. **PW**

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The Nissei DG503MAX Digital Readout Power/ SWR Meter

Vince Lear G3TKN checks out a new digital power / SWR meter from Nissei.

Most Power/SWR meters use analogue meters in a number of ways.

1) Single Meter – This uses just one meter which has to be set to full scale deflection in the 'forward' position before it is switched to 'reflect' to read SWR. When used solely as a power meter, the sensitivity control may need to be set to a certain level such that it matches the calibrated power scale.

2) Twin Meter – This uses two meters, one reads 'forward' power while the other reads 'reflected' power. This is certainly an improvement over the single meter device as one does not need to switch back between forward and reflect. However, some models may still require one to set the sensitivity control for maximum 'forward' reading before reading SWR off the 'reflected' meter.

3) Cross Meter – In more recent times, cross needle Power/SWR meters have come on to the market. They have two moving pointers that cross; one reads 'forward' power while the other reads 'reflected' power. The position at which they cross reads SWR.

They do present a lot of information on just one meter, but the disadvantage is that one has to look carefully at where the two meters cross and read the calibrated lines on the scale to note the SWR.

With all of the above types of Power/SWR meters it is necessary to look at them at (as near as possible) right angles to avoid 'Error of Parallax'.

Why a digital readout meter?

The Digital readout meter offers the advantage that it gives a NUMERICAL readout of both 'FORWARD' and 'REFLECTED' powers as well as SWR (Standing Wave Ratio).

Another advantage is that there is no 'error of parallax' and one can look at it from almost any angle to take the readings.

However, if one is using the DG503MAX to tune an antenna using an ATU, it is important to switch off the 'MAX' (PEP) feature so that the SWR readings will quickly rise and fall as the ATU is tuned. The switch to do this (on the MAX model) is located at the rear of the DG503.

What does the DG503 offer?

Initially I wanted a power / SWR meter which I could use on both 2m and 70cm. When I came across the DG503, I found that not only did it offer coverage from 125MHz to 525MHz but also from 1.6MHz to 60MHz at a maximum power rating of 200W.

It also has the advantage of two pairs of SO239 sockets at the back; one pair for a VHF/UHF transceiver and the other pair for an HF transceiver. Selection is made from a switch on the front panel so that both transceivers can be left permanently connected to the meter.

As the unit covers the 70cm band, I felt that it might have been a good idea to include 'N' type sockets for the VHF/UHF inputs rather than SO239's.

The 'MAX' model reads peak envelope power (PEP) on SSB, which is useful.

The specification of the Nissei DG503 is shown in **Table 1**.

The DG503 would be a very useful power/SWR meter for use with a fixed station 2m/70cm setup whether on SSB, FM, AM or Digital Modes. The 200W maximum power capability is likely to be adequate for most people on VHF/UHF unless of course they were running a linear amplifier

I use the DG503 connected between my HF transceiver and solid-state linear amplifier so I can keep a check of the drive power to the amplifier. At the same time I also have it connected to a 2m/70cm FM/C4FM transceiver.

The linear amplifier can easily be switched to 'bypass' mode so that the DG503 is then 'looking' directly into the antenna (or via ATU if required via switching on the ATU) and the SWR easily read off the antenna.

How accurate is the DG503?

I do not have access to expensive test equipment, but in the past the Bird Thruline power meter has generally been regarded as a reasonable standard and that is what I made use of, to check out the Nissei DG503MAX on HF [**Table 2**].

I was able to do checks on 2m (up to 25W) using a VHF slug for the Bird Thruline. However, I was not able to check out 70cm as I had no UHF slugs available for the Bird [**Table 3**].

The SWR readings (HF and VHF/UHF) with a 50Ω dummy load connected to the DG503MAX, were again all in line with expected values (1:1 SWR) and I was also able to take a series of SWR readings on my Windom antenna, which I compared with values of SWR shown on my RigExpert AA55zoom antenna analyser. The results can be seen in Table 2.

Photo 1: Front view. Photo 2: Rear view.

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- **Frequency Range:** 1.6 - 60MHz (HF) / 125 - 525MHz (VHF/UHF)
- **Power Measurement Range:** 0 - 200W (±5% accuracy)
- **Supported Modes (MAX mode):** DMR (TDMA), AM, SSB (PEP), and Analogue (CW, FM, FDMA)
- **Minimum Power for SWR:** 1W
- **Insertion Loss:** Less than 0.1dB
- **Impedance:** 50Ω
- **Connectors:** SO-239 (UHF-female)
- **Display:** 3.5in backlit LCD
- **Power Source:** 12-13.8V DC (12V wire included)
- **Calibration Points:** 28 / 145 / 435MHz
- **Dimensions:** 140 x 84 x 122mm
- **Weight:** 750g
- **Features:**
- **Direct Readout:** Digital display shows forward, reflected, and SWR ratio via a 3.5in LCD screen.
- **MAX Mode:** The 'MAX' button enables measurement of peak power for SSB and AM, as well as digital modes like DMR (TDMA).
- **Dual Frequency:** Covers both HF and VHF/UHF bands in one unit.
- *Note: The DG-503MAX is a distinct, enhanced version of the standard Nissei DG-503, specifically designed to handle digital peak power.*

Table 1: Key Specifications.

Value for money?

In my opinion the DG503 offers very good value for money as it not only gives coverage from 1.6MHz to 60MHz but also 125MHz to 525MHz without the need to plug and unplug coax leads, selection being via a simple front panel switch.

Nissei also do a 1200W PEP model; DG103MAX, that just covers 1.6MHz to 60MHz.

The price (January 2026) for the DG503MAX from Martin Lynch is £139.00, with the standard DG503 (non-MAX version) at £99. The 1200W DG103MAX is listed at £129. **PW**

Frequency kHz	DG503 SWR	RigExpert AA55 Ant. Analyser
3650	1.28:1	1.41:1
7100	1.58:1	1.65:1
14150	1.80:1	1.78:1
18100	1.33:1	1.41:1
21150	3.09:1	2.95:1
24900	1.38:1	1.53:1
28500	1.06:1	1.25:1
50100	1.64:1	1.42:1

Table 2: DG503 SWR readings of 132ft Windom antenna SWR. DG503 power readings with 10W, 50W & 100W into 50Ω dummy load reference to a Bird Thruline power meter.

I was not able to measure up to 50W on the slug I had for the Bird Thruline, so I have included just the measurement taken on the DG503, which shows the output power in line with the expected output from the FT7250 dual-band mobile transceiver at the HIGH level. The High, Low and Medium settings and powers listed are taken from the specification of the Yaesu FTM7250.

Frequency kHz	10W	50W	100W
3650	10.02W	51.22W	100.33W
7100	10.40W	50.16W	98.9W
14150	9.66W	49.77W	98.16W
28500	9.14W	48.22W	99.41W

Table 3: DG503MAX power readings on 2m taken with a Yaesu FTM7250 feeding into a 50Ω DUMMY load on Low (5W); Mid (25W); High 50W.

BAND	LOW (5W)	MID (25W)	HIGH (50W)	
2m	5.77W	25.66W	50.2W	DG503MAX
- -	5.55W	23W	X X	BIRD THRULINE
70cm	4.42W	21.15W	44.83W	DG503MAX

Unfortunately, I had no 'slug' for the Bird Thruline for the 70cm band so I have just recorded the readings as given by the DG503MAX. Without a way of accurately measuring the three output power levels from the FTM7250 on the 70cm band it is impossible to say how accurate it actually is on that band. However, I do feel the readings shown by the DG503MAX are 'realistic' in terms of what I would expect from the FTM7250 on the 70cm band.

NEWS EXTRA

JOHN AMBROSE FLEMING MEMORIAL EVENT - GB2JAF: Peter Rosen G3YFW is organising a Special Event station GB2JAF with the Southgate Amateur Radio Club on International Marconi Day which this year falls on Saturday 25 April.

This event is to celebrate the life and work of Professor **Sir John Ambrose Fleming FRS**, the great British physicist, the inventor of the Thermionic Valve and the man who designed the spark transmitter that **Guglielmo Marconi** used on 12 December 1901 to send the first wireless spark transmission across the Atlantic from Poldhu in Cornwall to Signal Hill, St. John's in Newfoundland. At the same time, they will also be celebrating the birth of radio inventor Marconi himself on 25 April 1874. Peter has been deeply involved recently in supporting research for Fleming's biography by **Dr. James Lewis**, and UCL where Fleming set up the Department of Electrical Technology in 1885.

This event will be the first of several special events this year and beyond to recognise the remarkable work of the relatively unknown British physicist who became known as The Father of Electronics and whose work contributed to major developments in Wireless, Computing, Radar, Telephony and more. Fleming invented the Thermionic Valve when working as a consultant to the Edison and Swan United Electric Light Company in Ponders End in the Lea Valley where these valves were produced for many years. Peter can be contacted on e-mail: **peterrosen80@gmail.com** for further information.

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Dashboards for the shack

Tim Kirby GW4VXE
gw4vxe@icloud.com

Tim GW4VXE starts with a review of alternatives to the HamClock software.

With large computer monitors being comparatively cheap, it's become common in many shacks to run some 'dashboard' software, often showing a map of the world with various layers of information, usually amateur radio related, to be overlaid on it.

One very popular piece of software to do this is HamClock, created by **Elwood Downey WB0OEW**. Many people have installed this onto a Raspberry Pi to display the information on a big screen on the shack wall. Commercial units to run and display HamClock have also been available from at least one of the major amateur radio retailers.

Sadly, Elwood WB0OEW recently passed away and initially it was reported that support for HamClock would cease during 2026. This caused a flurry of activity, spawning new dashboard software, but also effort going towards supporting the HamClock software moving forward. At the moment, it looks as if the efforts to replicate the servers which run HamClock will be successful and that support will not end in 2026.

Here, I've never used HamClock. With all due deference to its creator and those that love using it, I find its design rather cluttered with information I've little use for and apparently little opportunity to display the information I am interested in! No criticism implied – we're all different!

Last year, I started using DXChrono created by **Peter MM9SQL**:

www.dxchrono.com

This is a nice, uncluttered map which can show a variety of information, such as the solar indices, auroral information, EME and meteor shower information and current DXpeditions. It can show time zones around the world as well as NCDXF beacon information. It also interfaces directly to Peter's 'Cloudlog' logging software (URL below) displaying the contacts that you have made today on the map.

www.magicbug.co.uk/cloudlog

One of the projects coming out of the reimagining of HamClock has been OpenHamClock (**Fig. 1**):

https://openhamclock.com

This open source project has absolutely stormed out of the blocks and within a few days of its inception was doing all sorts of interesting things. In addition to the 'usual' solar and propagation information, it will interface with WSJT-X and show what your station is hearing and where you are being heard. It will interface with the Reverse Beacon Network for CW operators and show on the map where you are being heard. It has a DX Cluster built in, with filtering so you can restrict display of spots to stations that you are particularly interested in – or display everything! You can display satellite passes. There's lots more, including SOTA and POTA. It's well worth opening up a browser and having a play. Because development has been very rapid, there are some bugs, but the developers have been very responsive so far.

Although not browser-based, I want to mention a PC-based piece of software called 'Simon's World Map' developed by **Simon Brown G4ELI**. This does lots of good things too, based around a nice map of the world. You can read more at:

www.sdr-radio.com/simon-s-world-map-1-5

Plenty of options then, to have a nice display in your shack which can be quite a talking point for visitors. If you're running a special event station for visitors, I'd suggest something like this is very important to provide some instant visual impact to lead into more detailed discussions about what's going on.

Portable Planner—browser based software for satellite operators

While we're on the subject of software, Peter MM9SQL has recently enhanced his web-based Portable Planner software designed for satellite operators. This runs entirely in a browser, so can be used when you are at home or are out portable.

https://portableplanner.com

It will calculate satellite passes for you as well as calculating a mutual footprint if two of

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you are trying to work on a particular satellite – when can you both see the satellite? As a 'casual' user of the linear transponders, one of the most useful features that attracted me was the ability to calculate what frequency your signals will come out, on the downlink, for any particular uplink frequency. Or, for a particular downlink frequency, it will calculate what your uplink frequency should be. This being the case, using a half-duplex radio such as an FT-817 or FT-818 and running Portable Planner on your mobile phone, it ought to be possible to make some interesting satellite QSOs.

A junk box based approach to getting on 2m CW!

I was very pleased to hear from **Paul Roberts G0OER** who wrote to tell about how he'd built a 2m CW station recently out of bits and pieces he had lying around. I want to reproduce his email in full as it is, in my opinion, in the very finest tradition of *PW*!

*"Many people will know that **Steve G4ALG** and others have been running VHF CW nets on Tuesday nights (2m) and Friday nights (70cm) for a couple of years now. I started my licensing life as GW8KNZ, but it's a long time now since I was regularly on VHF and then only the odd appearance on FM. I'm also a very keen home brewer, so my first outings with homebrew were on 2m in the 1970s. These days I'm mostly on CW but until recently this has been restricted to HF. Having borrowed a VHF commercial rig back in September, I was astonished to discover that I could work Steve and others on CW, despite there being a huge ridge between me and the north. I was hooked. The commercial rig duly returned, I did a quick inventory of my ever-expanding junk box and realised that I had all the gear in it to build myself a 2m transceiver. The core of it is one of those Ukrainian transverters which sadly disappeared from the market with the start of the war. I had bought one on a whim, but never used it. I also possessed a venerable Microwave Modules 100W linear amplifier which I'd purchased on another whim some years ago. With the VHF side taken care of, I decided to build a 10m transceiver for the purpose of using it exclusively as an IF for this (and possibly other) transverters. More rummaging in the junk box yielded a very old 'MLX Board' - which essentially is a transceiving IF board, using a 9MHz filter.* PW *carried an article on this board back in August 1986, and mine had been kindly donated to me for a project by the author, **George Dobbs** himself. I also had a rare and precious Plessey SL6440 mixer chip in my stores, and that, plus a home brewed BPF, was pressed into service to give me a receiver on 10m. As the MLX only has an SSB filter, I dug out another board from my junk box: an old Howes ASL5 audio filter/amplifier board which has a nice 500Hz filter.*

"The 'glue' for all these separate modules is an ESP32 board, which talks to an SI5351 clock generator board. The SI5351 provides an adjustable BFO for the MLX board, a local oscillator for the SL6440 mixer, and a keyed 28MHz oscillator for the CW generator. I also had a rather nice 3.2in touch sensitive TFT display. I was able to program the display so that most buttons and controls operate from it. The only manual controls I need are the tuning and volume knobs. The ESP32 also gives me an S-meter and a CW keyer built in. The whole project has taken several weeks, but I had the joy of having a QSO with Steve and other stations just after Christmas. I realise that a few extra components could bring this onto SSB, but I'm seldom on phone, so that's a project for another day.

"With a few CW fanatics in our local club (Shirehampton Amateur Radio Club) 144.048 now serves as a local chat/ragchew frequency for those who have 2m CW facility here in Bristol. We are mostly vertically polarised. If you hear us, please call in!

"In the meantime, I'm loving my new rig - I have the transverter idling away at 1.5W (it's capable of 10W) driving the 2m linear at a similarly relaxed level of 45W. My junk box is a little less full than it was, but that's no bad thing!"

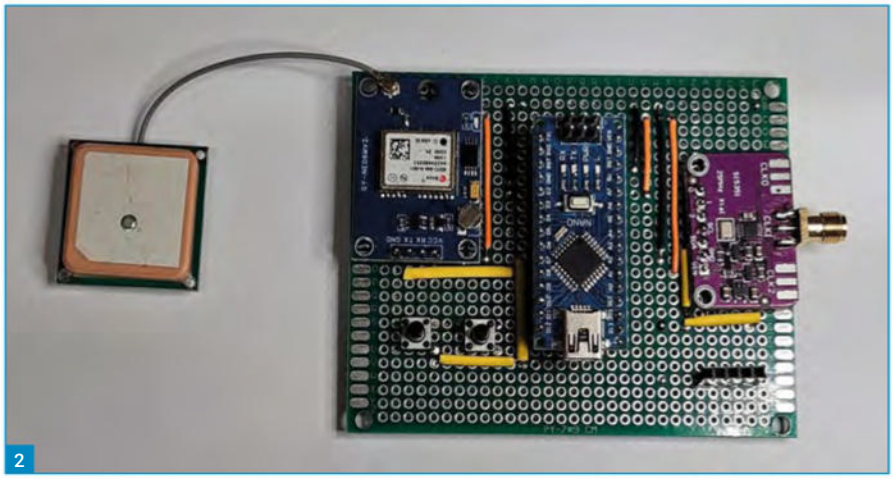

2

Fig. 1: Fig. 1: OpenHamClock – a new arrival on the Ham dashboard scene. Fig. 2: Steve G4AQB has built this Arduino based 6m beacon.

More on FreeDV

Jef VanRaepenbusch ON8NT kindly mentions a few more resources for people who are interested in exploring FreeDV and RADE in particular:

https://tinyurl.com/s3pyp3jy
https://evoham.com/freedv-for-beginners/
https://tinyurl.com/46793mdm

Jef says that 144.280 seems to be in use as a RADE frequency in Germany and in the UK, 144.625MHz with some activity on 50.380MHz, also in the UK. Jef advises keeping an eye on the FreeDV reporter for activity:

https://qso.freedv.org

SOTA

Simon G7WKX says that on Saturday 11 April a number of SOTA activators will be visiting Upper Park (GW/MW-032) which is on private land - a visit arranged by **Ben GW4BML**. Simon expects that there will be a fair amount of 2m/70cm activity, especially given the current SOTA VHF Challenge. Simon continues that in mid-May, he and **Nic M5NIC** will be activating a number of SOTA summits in Eire, to the south of Dublin.

The 8m band

Roger Lapthorn G3XBM (Cambridge) monitors FT8 on 40.680MHz but feels activity is down a little.

The 6m band

Roger G3XBM continues his FT8 tests at 5W and is often spotted across Europe.

Steve Macdonald G4AQB (Bolton) writes, *"Recently, I have been experimenting with an Arduino Nano FT8 / WSPR Beacon for 50MHz locked to GPS satellites* [**Fig. 2**]. *The circuit runs only 10mW and can send either FT8, WSPR or both modes programmed and timed with the firmware. Tests have shown that the circuit is very stable on both modes from stations received locally and I am looking forward to trying further tests when the Sporadic E season begins in May".*

Dave Edwards G7RAU (Lizard, Cornwall) suffered considerable storm damage recently in hurricane force winds, losing his 2m, HF, 6/4m and 70cm systems. To add insult to injury there were some close by lightning strikes which took out the station UPS, a rotator controller and some other devices. Dave's replaced the broken elements on the 6/4m beam and the Yagi is back up. He reports hearing TZ1CE for most of the afternoon on 13 February.

Here at **GW4VXE** (Goodwick) I found a decent Es opening on 13 January, working DL, SP, UR, OK, OE, LZ, HA and 9A. On the evening of the 19 January aurora, I caught some Auroral E to the north east, working LA6NNA (JP65) and OG8A (KP22). On 21 January there was some Es to the south, with a good opening to Spain, with an interesting outlier

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contact of ON1JP (JO21). The photo, **Fig. 3**, shows my 6m antenna.

The 4m band

Steve Rawlings G4ALG (Chepstow) says that further development of his QRP 4m VXO transmitter has stalled owing to lack of time. However, when **Steve G3ILO** recently suggested a test on 4m, Steve was pleased to find that his prototype transmitter continued to work well and they had a good chat on CW.

The 2m band

Robert West GM4GUF (Biggar) really enjoyed the aurora on 20 January. He doesn't have a take-off to the south, there are too many hills, so Auroras give Robert the best chance to work some DX. Robert says that this was a good aurora so he kept going. The opening lasted from around 1200 to 1800 UTC and instead of the usual North Easterly beam heading, Robert was beaming East South East to East. On CW, Robert's best contacts were OM4CW (JN88), SP2CNW and OE5XBL. In total, Robert worked 20 G, 11 F, 9 DL, 6 GM, 4 GW, 3 LA, 3 ON, 3 PA, 2 SP, 1 SM, 1 OE, 1 OM and 1 EI, 65 contacts in all.

John Ashmore G8GXF (Wolverhampton) reports that the GB3SEV/B beacon has been renamed GB3SSB and is now active from Clee Hill in Shropshire (IO82QI) on 144.462MHz. John can hear this easily using an indoor aerial.

During the recent 145 Alive session on 7 February, **Phil Oakley G0BVD** (Great Torrington, Devon) worked three stations from Wales and one in Cornwall. Phil was hoping to have heard more from 'up country'.

Although no correspondents have reported it, the 7 February 145 Alive event included some 144MHz SSB activity for the first time and it's understood that this was very successful with a lot of contacts being made in some areas. The majority of this activity was using vertically polarised aerials, whereas 'regular' SSB activity on 2m is normally horizontally polarised. But as ever, use whatever aerial you have!

Ian Bontoft G4ELW (Bridgwater) was active for the aurora on the evening of 19 January and says that two or three Scottish stations were just audible but towards the end of the opening, Ian worked PA2M (JO21). Ian says that he has just started using the ON4KST VHF chat (URL below) and is enjoying seeing what other people are working and whether he can hear them.

https://on4kst.info

Steve G4ALG writes, *"I do try to be active on 2m CW as often as possible, running 5 to 40 watts from an IC-7000 to a home-made 6-element Yagi, and a home-made J Pole vertical. Having a vertically polarised antenna for 2m remains an important part of my station equipment because a lot of local operators keep in touch via 2m FM using verticals. For many stations, putting up a rotatable horizontal beam isn't something that they can or want to do. The result is that several stations are trying 2m CW using a simple vertical or collinear antenna, with many of these stations participating in the Two Metre Tuesday 2m CW activities. These CW activities start at 1800UTC every Tuesday, with most activity taking place between 7pm and 8pm.*

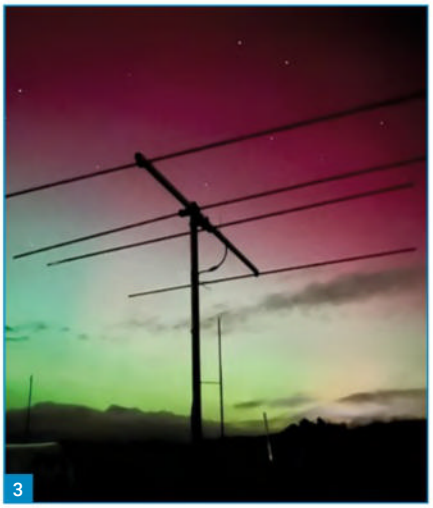


Fig. 3: **The 6m beam at GW4VXE during the aurora on 19 January.**

"Ever since you wrote about your successes with the Quansheng UV-K5 handheld transceiver in PW*, I have been curious to try the rig. When the topic was raised again in* PW *and on the FISTSCW email reflector, I recently bought one of these little rigs for only £20. Using the instructions kindly prepared by* ***Matthew M0MZB*** *within his post on FISTSCW, I loaded the KD8CEC v0.3QC software and, with an external in-line adaptor, I was soon sending and receiving CW on the UV-K5, using either a straight key or a paddle. I have found receive sensitivity to be very good on both 2m and 70cm. The internal battery pack provides a power output of about 4 watts on 2m and 3 watts on 70cm. I'm delighted with the performance of this little rig, using both the supplied dual-band antenna, and external antennas.*

"Other telegraphists having only an FM rig for 2m, but with an effective vertical antenna, might be interested to know that this rig has spawned local 'cells' of 2m CW activity here in the Forest of Dean and in Bristol. Paul G0OER reports that five members of the Shirehampton club in Bristol are now QRV on 2m CW with modified Quansheng handhelds".

The 70cm band

Steve G4ALG writes, "The continuing poor propagation on 70cm means that it's been difficult to find CW QSOs on 70cm. But I do try to take part in the weekly 70cm CW activity every Friday, starting at 1800UTC, where I usually manage to have one or two chats with other regulars, including ***Chris G0SDD, Allan G4NNJ, Mike G8EJN*** *and* ***Chris GU3TUX****. More support of this weekly activity throughout the UK would be very welcome, especially during the period 7pm to 8pm".*

The 23cm band

Steve G4AQB writes, *"We are now entering the seventh year of our 23cm FM Net here in the Manchester area and still going strong. The 23cm FM Net is every Wednesday evening at about 8.30pm - 10.00pm on 1297.500MHz and most stations use horizontal polarisation. Everyone is welcome to call in and join the Net".*

Satellites

Patrick Stoddard WD9EWK (Phoenix, AZ) reports *"Early February saw the loss of SO-124 (HADES-R), when it re-entered the atmosphere. SO-124 had been doing a great job as an FM satellite, which also relayed D-STAR transmissions. With its re-entry, its 'twin' SO-125(HADES-ICM) continues to orbit the Earth relaying both FM and D-STAR transmissions for radio amateurs around the world.*

"As SO-124 went silent, another satellite has seen its FM transponder activated. The QMR-KWT 2 (RS95S) satellite from Kuwait has an FM transponder with a 145.920MHz uplink (plus 67.0Hz tone) and a 436.950MHz downlink. Don't know if this one will be turned on full-time, but we can hope...

"Maybe not so helpful for UK or European hams, but ZF1DM has been a regular on satellites from the Cayman Islands lately. Working FM, SSB, and FT4, lots of stations around North America have added that callsign to their logs. It's really nice to have regular satellite activity from the Caribbean.

"In recent weeks, ***Andy DL6AP*** *was on a cruise from Europe across the Atlantic to the Caribbean, and then back across the Atlantic to Europe. Andy activated lots of grids from the cruise ship, and operated from some Caribbean islands - Guadeloupe (FG/DL6AP), Martinique (FM/DL6AP) and French St. Martin (FS/DL6AP). As Andy returned to Europe, he also made terrestrial contacts with European stations".*

FM and DAB DX

Simon Evans (Twyning, Gloucestershire) says that both FM and DAB DX has been conspicuous by its absence this month. He passes on the news that the Irish authorities have extended the DAB+ experiment for another year – currently they can be found on 5B, 7C and 10D. You can read more at:

https://failtedab.ie

Simon also reports that the French PTT have given permission for more local DAB services and that the Cherbourg area has been allocated 7C and 8D.

And finally

That's it for this month – quite a full postbag! Thanks to everyone who has been in touch. Please keep your news coming. **PW**

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Your Letters

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E-mail: practicalwireless@warnersgroup.co.uk



Useful info

Dear Don,
I think that you may be interested in a device that can be used with the new Icom IC-7300 Mk2. If you've seen one, you may have noticed that there is now provision for an external module, such as a pre-amplifier, as well as allowing the addition of a receive antenna. There is no provision for something like an SDR though. I'm using a Mini circuits ZSC-2-2+ and this way I have a tap-off connection for my SDR, see photo.
Dave Warner G4OER
Lincolnshire

Various

Dear Don,
Although I fully understand the popularity of VNA's, and no doubt why, given their seeming versatility, they continue to sell like hot cakes, the temptation to utter a comment on **Keith Rawlings G4MIU** VNA article was almost overwhelming.

I should mention that before I put my oar in the water, I do not own a VNA. However, courtesy of *PW* and *RadCom*, I've lost count of the number of articles that I have read explaining the benefits, the technicalities and the actual hands-on operation of these seemingly must-have devices. So, I know more about using VNA's than I do about navigating the complexities of the entertainment and telephone technology in my car - and that, I can assure you, is a gross understatement.

To get back to VNA's, I once thought (way back when someone called **Liz Truss** was Prime Minister for five minutes, I think?) that it might be a good idea to utilise a VNA to evaluate the attenuation and so on, of those clip-on common mode chokes. It may also improve the efficiency of these devices in some other circumstances too. So, lo and behold, Keith had obviously come to the same conclusion. And I guess, like many of my fellow ham's, I have these things liberally sprinkled all over the show in my shack. Perhaps far too many.

"Let's make 270 CW great again", yeah, let's do exactly that. A great idea. But as **Ian EI3LH** implies, it will be a big hill to climb. But of course, once upon a time, CW was popular on VHF and UHF - especially during contests/radio-sport. There again, Packet Radio was once popular too. Anyhow, I wish Ian well. It could happen, given a groundswell of committed interest.

And another loop antenna - this time, **Billy GM6DX**. I'm gonna be busy come springtime.
Ray Howes G4OWY/ G6AUW
Weymouth

*(**Editor's comment**: Thanks as always Ray, I do enjoy your monthly feedback on the magazine – even if I can't always agree, hi. Indeed, and a plea here, I welcome feedback from all our readers otherwise I am working in the dark and guessing what sort of articles are wanted. Hopefully this month's selection will strike a chord with at least a majority of readers but feedback is always appreciated!)*

The Morse Mode

Dear Don,
It's not often that I'm tempted to wax lyrical about an article in any magazine, even *PW*, but I just had to say thank you to **Roger G3LDI** for his 'Four P's' submission.

I thought it was the most inspirational and encouraging piece I'd read for a long time. If I wasn't so busy, being retired, I'm sure I would have dug out the key and started practising again.

Being a G8, I always felt that I scraped into getting an amateur licence, back in 1967. I was learning Morse and was getting pretty close to the magic 12 WPM when suddenly I didn't need to. VHF and UHF were quite good enough for me and they were much more busy in those days with all us newly licensed G8's.

But I always felt that maybe I wasn't a 'proper' radio amateur without CW. So, some ten years ago I found a nice lady who patiently taught me the ins and outs of CW QSO's and one day I took the plunge and called a nice Frenchman on 40m and stumbled, is that the right word, maybe bumbled through a QSO.

I was in such a mess afterwards. I was terrified of not being able to understand him, but I scraped through. The kind man even sent me a QSL card. But I never tried again. I kept practising. Sending is no problem but receiving was, I just couldn't get beyond 12 WPM. In the end I used to give myself a headache trying so hard and CW got left by the wayside.

I wish I had seen Roger's article then. I'm sure it would have inspired me to keep going and bumble through a few more raggy QSO's. Who knows where that would have led?
Dave Ingledew G8AXZ
Belper, Derbys

Morse for the Disabled

Dear Don,
I am writing my Morse book for publication on Amazon this time as the RSGB is no longer interested. One chapter, which is quite long already, is devoted to Morse for the Disabled. Would it be possible to put a request in *PW* for anybody operating WITH disabilities already to contact me with comments, details, problems etc., with possible permission to quote them personally, although that is not as important, might be some reticence there. So far, I have blind ops, those with physical injuries and problems, dementia and Alzheimers, deafness, all of whom seem to manage pretty well. This might help others in a similar situation. *PW* has a good circulation and I might get more input than just a general email to groups etc.
Roger G3LDI
Swardeston, Norfolk

(Editor's comment: If you can help Roger, do drop him a line at his usual email address: roger@g3ldi.co.uk)

Vintage Radios

Dear Don,
Over the past year I have found myself fixated with vintage radios; I just love the look and feel of them. I was lucky to pick up at low cost an old FT101E and no sooner had it arrived switched in on, to see the lights flicker, a loud hiss and crackle from all the knobs. Not bad I

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Rallies & Events

All information published here reflects the situation up to and including **16th February 2026**. Readers are advised to always check with the organisers of any rally or event before setting out for a visit. To get your event on this list, email the full details, as early as possible, to: **practicalwireless@warnersgroup.co.uk**

22 March 2026
2026 DOVER AMATEUR RADIO CLUB RALLY: 10:00 – 14:00. Our spring Rally All the normal facilities, Eastry Village Hall, High Street, Eastry, Kent CT13 0QB. Entrance fee as £3. Tea, coffee and bacon rolls available onsite. Tables are £15 each, maximum 2 tables per vendor. What 3 words locator ///townhouse.supper.struggle Google maps. More information see our website:
https://darc.online/rally

22 March 2026
CALLINGTON RADIO AND ELECTRONICS RALLY: Town Hall, New Road, Callington, Cornwall, PL17 7BD. The venue is booked from 08.00am until 1.30pm with public access from 10.00am until 1.00 pm. Entry is £2 each with no charge for those under the age of 16. A comprehensive selection of traders, clubs and societies from the Southwest will be present along with a 'Bring and Buy' stall and our usual excellent catering service.
The Bring and Buy stall accepts payment by all major debit and credit cards using contactless, chip and pin or by phone. The café area and serving hatch will be in an adjacent room seating about 18 people. The venue has disabled access, toilet facilities, and ample parking in a nearby car park with up to one hour's parking free.
Although all tables in the main hall have now got confirmed bookings or are reserved, there is a waiting list should there be any cancellations. Charges for tables are 6ftx2ft (£5), 5ftx2ft (£4) and 4ftx2ft (£3). There is an adjacent room available (~50sq.m) with no tables at a cost of £45 for a single occupant. Pre-booking is essential, so please contact Alastair M0KRR at **alastair.kerr1@btinternet.com** or by phone on 01503 262755 with your requirements as soon as possible. Also check our website for further information.
www.callingtonradiosociety.org.uk

11 April 2026
2026 QRP CONVENTION: Yeovil Amateur Radio Club are delighted to announce that the 2026 QRP Convention will be held at Digby Hall, Sherborne on the 11th April 2025, doors open 09.30. Talks are: Lecture on Drake Receivers by Adrian Dening, and a talk by Steve Hartley.

12 April 2026
NORTHERN AMATEUR RADIO SOCIETIES (NARSA) EXHIBITION (BLACKPOOL RALLY): Norbreck Castle Exhibition Centre, Blackpoool FY2 9AA. Details from
Dave M0OBW, 01270 761608, 07720 656542
dwilson@btinternet.com
narsa.org.uk

19 April 2026
LIMERICK CLARE AMATEUR RADIO CLUB RALLY AND IRTS AGM: Treacy's Oakwood Hotel, Shannon, Co. Clare V14NH97. Doors open 10.30AM. Traders 8.30AM. Entry €5 as in previous years. Free parking. Refreshments. Trader stands and bring and buy sales. Monster Raffle. Pre-booking of tables via email to dermotgleeson1@gmail.com by 15 March is essential. IRTS AGM to follow at 2.00PM.
limerickclareamateurradio@gmail.com

4 May 2026
DARTMOOR SPRING RADIO RALLY : The Yelverton War Memorial Hall, Meavy Lane, Yelverton. Devon, PL20 6AL. Free Parking. There will be the usual Bring and Buy, Trader Stands and Refreshments available. From 10am – 1pm. Admission £3.00. Please check the website (below) before setting out. Contact Roger:
Tel: 07854 088882
2e0rph@gmail.com
www.dartmoorradioclub.uk

15-17 May 2026
HAMVENTION 2026: Greene County Fair & Expo Center, 210 Fairground Rd, Xenia 45385, USA
https://hamvention.org

14 June 2026
JUNCTION 28 RADIO RALLY: New venue for 2026. The Post Mill Centre, South Normanton, Derbyshire DE55 2EJ. Doors open 1015. Admission £4. Large and small suppliers and individuals providing new and used equipment, components, accessories and test gear. Free onsite parking, toilets and fully accessible venue. Licensed bar and café serving refreshments. Indoor and outdoor tables available. For more information and to book tables contact
j28rally@snadarc.com
or visit snadarc.com

21 June 2026
EAST SUFFOLK WIRELESS REVIVAL (IPSWICH RADIO RALLY): Kirton Recreation Ground, Back Road, Kirton IP10 0PW (just off the A14). Doors open at 9.30am and the entry fee for visitors is £3. The venue has free car parking. Trade tables are from £10. There will be trade stands, a car boot sale, a Bring & Buy, special interest groups, GB4SWR HF station and an RSGB bookstall. Catering is available on site. Contact
Kevin G8MXV, 07710 046 846.
www.eswr.org.uk

26-28 June 2026
HAM RADIO 2026: Messe, Friedrichshafen.
www.hamradio-friedrichshafen.com

5 July 2026
NEWBURY RADIO RALLY: Newbury Showground, next to junction 13 of M4 motorway in Berkshire, RG18 9QZ. This is the 38th year of The Newbury Radio Rally and is the ideal event for anyone interested in radio communications, computing and electronics. There will be a display area with an amateur radio station, exhibits, special interest groups, clubs and societies. Open to sellers at 08.00hr and visitors at 09.00hr. Massive Free parking. Entry is £4 visitor, £15 seller's pitch. ADVANCE BOOKINGS (with discount) can be made via the website (below). On-site catering. Disabled facilities. Contact:
NewburyRally@nadars.org.uk
or web: www.nadars.org.uk

9 August 2026
FLIGHT REFUELLING ARS HAMFEST: Cobham Sports and Social Club Ground, Merley, near Wimborne, Dorset BH21 3DA. 9am to 3pm. Admission £5 (includes parking). Talk-in on 145.550MHz. Onsite catering and bar.
No dogs except assistance dogs. Indoor and field pitches. Car boot sellers and field traders welcome from 7am. Booking forms available via:
frars.co.uk

14 August 2026
31ST ANNUAL MINI_RALLY NIGHT: Cockenzie & Port Seton Amateur Radio Club. Community Hall, Main Hall, Port Seton. Bring along your own "junk" and sell it yourself. Tables on First Come First Served basis. Entrance fee £4 for everyone. Rise in entrance fee is due to rising costs. 1800 to 2100.

13 September 2026
CAISTER LIFEBOAT RADIO RALLY: Caister Lifeboat station, Caister on Sea, NR30 5DJ. Entrance via carpark on Beach Rd. Raffle, onsite cafe, gift shop, museum. Free entry, open 10am-3pm (9am for sellers). Inside and outside spaces available. Contact:
Zane M1BFI, m1bfi@outlook.com
Tel 07711 214790

25 October 2026
GALASHIELS RADIO RALLY: The Volunteer Hall, St Johns Street, Galashiels, TD1 3JX. Doors open 1115 ,disabled access 1100 ,admission £3. There will be traders ,bring and buy and refreshments. Further details at:
www.galaradioclub.co.uk

6 December 2026
MID DEVON AMATEUR RADIO & ELECTRONICS FAIR 2026: Winkleigh Sports & Recreation Centre, Mid-Devon EX19 8HZ. 09:00 – 13:00. Entry £3 per person, no charge for partners & under 16s. Easy access from the A3124, free parking, free WiFi, hot food and refreshments available. A chance to track down those hard-to-find electronic components, two-way radio and computer hardware.
Traders please book ASAP, NOTE - as per last a maximum 4 tables per booking, we may remove the 4 table pre trader restriction after October 1st if the rally is not fully booked. Tables are 6 foot frontage (tables supplied), Mains electricity available on request at no extra charge. Please pre-book ASAP with:
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thought. I set to, carefully opened up the case and with a bright torch visually inspected all I could see. Looked not too bad, I can fix this! So, after watching several YouTube videos started to dismantle the radio taking lots of pictures as I went. Then cleaned all, inspecting each component as I went and reassembled. To my joy I had receive on all bands although transmit was a bit iffy, down to what I found out was a duff mic and a sticking relay. This was soon solved also. All that was left was to try to calibrate all I could. Again with the help of some very good YouTube sessions I managed to figure this out too. I now have a fully working radio. However, one relay does still stick now and then but this is solved by a gentle tap on the case in the right spot!

I've now moved on and also acquired a KW2000A! I'm a glutton for punishment. This again I gave a good clean and managed to get to receive but no transmit, putting it manly down to a mic problem. I was partly right. However, this time I needed some help. I live in Kent not far from Dartford where these radios were made about 50 years ago and managed to twist the help of a friend who worked in the factory in the 1970s to take a look. Two days ago, I picked the radio up but not before being given an instruction on how to tune the transceiver up correctly. It's not straightforward, we take so much for granted now with the modern radios. The KW now takes pride of place in my radio room and I have already made several contacts throughout Europe confirmed on QRZ with good reports. My eternal thanks to my good friend for his help.

Alistair Burgess 2E1AJB
Birchington, Margate

*(**Editor's comment**: Well done, Alistair. Some of us well remember how to tune up valve radios although I also remember loaning my TL-922 linear amplifier for a club special event station and it being 'blown up' by a club member who was unfamiliar with the process! An expensive mistake. I owned many valve sets in the early days from a Codar AT5 through a Heathkit DX-100U, and various marks of the FT-101. I should probably have hung on to them!)*

Interception and Code Breaking

Dear Don,

George Wiessela observes that far more material exists concerning British radio interception and code breaking than the Third Reich's. He's quite right; as **Churchill** said, *"History is written by the victors"*.

I too have that book *The Third Reich is Listening*, and I can heartily recommend it. What struck me was while German SIGINT was expertly done, there was a different attitude to the product obtained. Within the British armed services, different radio-intelligence organisations existed, working on separate things, but there was a war-wide scope to the processing of intelligence gained.

Germany's radio-intelligence facilities were more fragmented, and the intelligence gathered was more service-proprietorial. With hindsight, knowing as we now do, that approval in Hitler's eyes could be a matter of life and death for military high-ups, perhaps this is not surprising.

Thanks Georg for an excellent article.

Tony Jones G7ETW
Southampton

Bottles to Software… and Back Again

Dear Don,

Amateur radio has a habit of looping back on itself. Technologies evolve, fashions change, and yet the core fascination — making signals travel further than they have any right to — remains the same. My own journey began in the late 1960s with milk bottles, and today it finds me restoring ex-Navy RA17 receivers while helping my club build a Raspberry Pi Pico–based SDR. In between lies half a century of valves, transistors, software, satellites, and a great many Elmers.

Early Days: Milk Bottles, Morse Keys, and Interference Complaints: My introduction to radio came courtesy of the Milk Marketing Board's Project Club. By persuading my parents to order extra pints, I earned activity books such as Building Crystal Sets and Building Transistor Radios. A Merit electrical kit soon followed, complete with lamps, switches, and an induction coil.

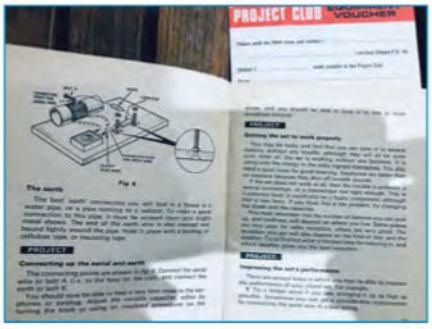
That coil became my first 'transmitter'. Once vibrating, it radiated a buzz that could be heard on the family radio. With a homemade Morse key from my grandad, I began sending clandestine messages — until local shopkeepers complained of rhythmic interference across the broadcast band. A maternal QRT was swiftly issued.

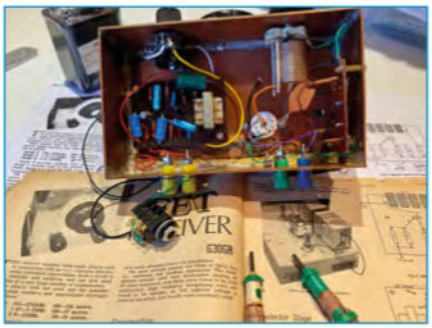
Elmers and the First Real Receiver: Kind neighbours donated old wooden radios and radiograms, their shortwave dials hinting at a wider world. A small Sony portable with SW coverage, a treasured Christmas present, opened that world further.

The real breakthrough came when I knocked on the door of G3HDO, who explained SSB and the need for a BFO. Through school I met **Fred G3TBU** and **Fred G3WFZ**, both of whom gave generously of their time.

In 1971, *PW* (20p per month!) published G3OGR's FET super-regenerative receiver.







My father and I built it on a Perspex chassis. It worked — hand-capacity quirks and all — and soon I was receiving amateurs, number stations, and LW broadcasts. But receiving wasn't enough. I wanted to transmit.

G8KVU and the First Transmissions: I passed the RAE in 1975 and received the callsign G8KVU. My father acquired a PYE boot-mount Ranger, complete with valves, a vibrator PSU, and a severed control cable. With patience and determination, he reverse-engineered the wiring and we got it working on 2m AM.

A better solution came from *PW*: G3XGP's 1W FM transmitter. A local photographer etched the PCB, and the rig worked beautifully. Under lift conditions, I worked Brighton from Coventry on a single watt into an 8-element Yagi.

The Navy, Morse, and G4NMD: In 1979 I joined the Royal Navy. While serving in Plymouth, I took the 12 wpm Morse test at Falmouth Radio Station and earned the callsign G4NMD.

My father, having caught the bug himself, became G6APJ and later took over G8KVU. When he became SK in 2020, modern rules

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prevented reassignment — but the callsign lives on today as the club call of a builders' group I co-founded.

From Valves to Software: My HF station began with a KW2000A and stayed valve-based until 1993, when I bought an Icom IC-725 as a self-gift upon being ordained as a Church Minister. Over the years I've kept my station up to date, and today my main HF operating is via an SDR transceiver.

Yet the maker spirit never left. I still have the 1971 G3OGR receiver, now being restored thanks to germanium whiskers. I still have the 1W FM transmitter and am designing a digital VFO for it.

Surrey, Satellites, and a New Chapter: We moved to Surrey in 2017, and for the first time I had a dedicated shack. When COVID-19 arrived, amateur radio became both a refuge and a lifeline. Lockdown introduced me to contesting, the WAB Cabin Fever Awards, and digital modes such as FT8.

My first local club was the Guildford & District Radio Society (GDRS), whose contesting heritage sharpened my operating skills.

A turning point came on the local repeater GB3GF, where I met **Eric M0REQ**. Satellites were his main passion, and he kindly helped me get started on the LEO birds. What began as technical mentoring quickly revealed a shared enthusiasm for building, experimenting, and helping others grow in the hobby.

From that shared vision, SEMARC was born — a club built on curiosity, inclusivity, and hands-on radio.

A Beautiful Symmetry: RA17s and Pico-SDRs: SEMARC is currently embarking on a club project to build a simple SDR shortwave receiver using the Raspberry Pi Pico. At the same time, I am restoring several Racal RA17 receivers — ex-Royal Navy, beautifully engineered, and state-of-the-art in their day.

It's a satisfying symmetry: the club building a modern, minimalist SDR, while I restore precision valve engineering from the era when frequency synthesis meant mechanical ingenuity, not firmware. Two technologies separated by 70 years, yet both teaching the same lessons about curiosity, craftsmanship, and the joy of making things work.

CW, QO-100, and Looking Forward: After many years away from regular CW, I returned to Morse through the CWOps CW Academy. In 2025 I was honoured to be elected as a member of CWOps, and I now occasionally serve as a co-advisor.

My operating has also expanded upwards. I'm active on LEO satellites and have built a narrowband QO-100 station. I'm now developing a wideband ATV system for QO-100 and terrestrial paths — a blend of RF engineering, digital video, and practical construction.

Conclusion: From milk bottles to SDRs, from spark-like buzzers to QO-100, and from solitary listening to club leadership and satellite experimentation, the journey has never really stopped. Amateur radio remains what it has always been: a maker's playground, a technical challenge, a community, and a source of lifelong curiosity.

Graham Smith G4NMD
Guildford

*(**Editor's comment**: Thanks for this Graham and maybe it will inspire others to share their stories through the magazine. It's great that you have followed many facets of the hobby over the years – I was sorry to read recently of an amateur who has left the hobby because it had nothing that interested him!)*

Amateur Radio is not Dead

Dear Don,

Ever since the tentacles of the World Wide Web have spread to every corner of the globe, roughly two decades ago, predictions of the death of ham radio have been in circulation, mainly in countries with a high density of radio enthusiasts. These rumours of its demise, to quote a classic, are greatly exaggerated, which I am going to give a proof of. The last Sunday of the summer of 2025, I visited a gathering of radio aficionados in a nature reserve some 20 miles south of Warsaw, the capital city of Poland. Such events are not unique, on the contrary, the numbers are globally on the rise. Amateur Radio is not dying - it is evolving, just like almost everything in the human domain. This pastime has evolved during the century long timespan - from very few pioneers, experimenting with basic inventions, through applications of commercial products, broadening the spectrum of radio frequencies, the sudden increase in the wake of the surplus WWII equipment and technology spur, into the digital and microwave era.

The internet did not kill the radio hobby, on the contrary, it has become a useful tool. Many old school radio amateurs are partly right - the interest for shortwave aural modes is fading. Nevertheless, the number of new Amateur Radio fans is growing rapidly, in particular in such countries as China, Indonesia, Malaysia or India, but even in Europe or the USA. Traditional DXing on the HF bands is ebbing due to several factors. HF antennas are large, expensive, prone to damage and, in many places, forbidden. Electromagnetic pollution is ubiquitous and increasing, which impairs reception of weak signals. Travels are affordable and exotic spots can be seen in person, so radio long-distance contacts are not so exciting. The VHF and UHF bands are more practical to play with. This gathering in Poland, named The Mazovian Amateur Radio Picnic was the eighth in a row, and has the potential to become a permanent annual meet for the radio populace of the capital and its growing suburbs. The idea is to cross the age, gender, background, mode and RF-spectrum borders.

Large cities have the human potential, educational institutions and curious young people, relatively good economy. The density of issued licences is also high, yet the on-the-air activity is low. The aim of this Radio Picnic is to demonstrate practical wireless to youngsters, explain the state-of-the-art techniques to the mature radio amateurs and provide a village pump for anyone who is, or has been, interested in Amateur Radio. This annual outdoor event is sponsored by a branch of the national organization PZK, a local fire brigade and the EmComm group, and a few of the suburban school clubs. It is free to attend, and attracts some 250 visitors - the better the weather, the more people show up. Some of them bring along their offspring. The highlight of these picnics is demonstration of practical wireless - those magic invisible rays - for the newbies. Radio clubs used to be the backbone of Amateur Radio in Eastern Europe behind the Iron Curtain. A few reasons lay behind such format: training of potential radiomen for military service and civil defence, shortage of suitable equipment, and the need of supervision of contacts with foreign stations.

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Today, there are thousands of skilled contest operators, with roots in the Soviet Block, who are very active and successful all over the world. Youngsters are curious and often nosey, they learn fast and quickly get bored. Presenting Amateur Radio as a gateway to learning stuff that can be useful in real life is fruitful and long running. On the contrary, showing million-dollar contest stations as typical amateur installations will deter both kids and their parents from this hobby.

May this report serve as an inspiration for your local radio group or club. Meeting in person, from time to time, is healthy, stimulating and bring in new members. The emphasis is on teenagers, as they are eager to explore and learn, when given an opportunity.

Henryk Kotowski SM0JHF
Stockholm

*(**Editor's comment**: Thanks for this Henryk. It's great to hear of such events and, yes, there is so much that the hobby has to give and not, as you rightly say, just in terms of DX and contesting. It just takes the right encouragement. I recall attending a mobile rally in the UK at which the local Air Cadets were helping with car parking. All had Foundation licences, gained in parallel with their Air Cadets comms badge, but none had aspirations to take it further, which I found disappointing. I'm sure, with the right encouragement, many youngsters would benefit from digging deeper into amateur radio.)*


In the years when
Civilisation was menaced with destruction
T. Purves
who served 1939 - 1942
gave generously of his time, powers and
technical skill in essential service to his
Country.

VIRecognition

Dear Don,

In my old age and dotage, I teamed up with **John GM8CVN** to do a project: find out more about the local radio amateurs we listened to, and heard about, when we were short wave listeners some 60 years ago. 'Local' to us was the Scottish Borders, Northumberland and Cumbria. I had fond memories of hearing GM8RV, G6UC, G8SG, G4LV and others on 80m.

Our research started during the Covid lockdown. Along the way, we 'unearthed' two local 'Y' station operators and three Voluntary Interceptors. But it is the story of the discovery of one VI which may be of interest and perhaps relevance to your readers.

In our research, the Artificial Aerial callsign, 2CGY, had cropped up from time to time; later **GM2CGY**, **Tom Purves**, was noted living in Ayton but now was a Silent Key. After some research, I was put in touch with his octogenarian son, **John**, living in Selkirk. I visited John who had kindly sorted out some memorabilia of his late father. Among the items were a certificate that John knew nothing about and a photo of a group at Barnet. The certificate (attached) was the one given to Voluntary Interceptors by **Herbert Creedy**. John had no idea what VIs were or indeed what his father had done during WW2; his father had gone to the grave without revealing his secret listening from home!

Which brings me to the point of this letter. I wonder if there are further 'Herbert Creedy' certificates in family papers that remain a mystery; perhaps there are VIs still to be discovered!

Bruce McCartney GM4BDJ
Langholm

*(**Editor's comment**: Thanks Bruce. If anyone can help, drop me a line or direct to Bruce – his email address is on qrz.com. Many radio amateurs were called into VI service during the war but, as with GM2CGY, said little afterwards. I recall one friend, whose father was a VI, telling me his parents got bricks through the window, thinking the father was a conscientious objector but, in fact, when volunteering to serve was taken on one side and asked to perform the VI role (along with several of his amateur radio acquaintances). One give away, perhaps, was the motorcycle courier who turned up every morning to collect his interceptions from the night before and take them to Bletchley Park!)*

Next Month

in the UK's best & only independent amateur radio magazine...



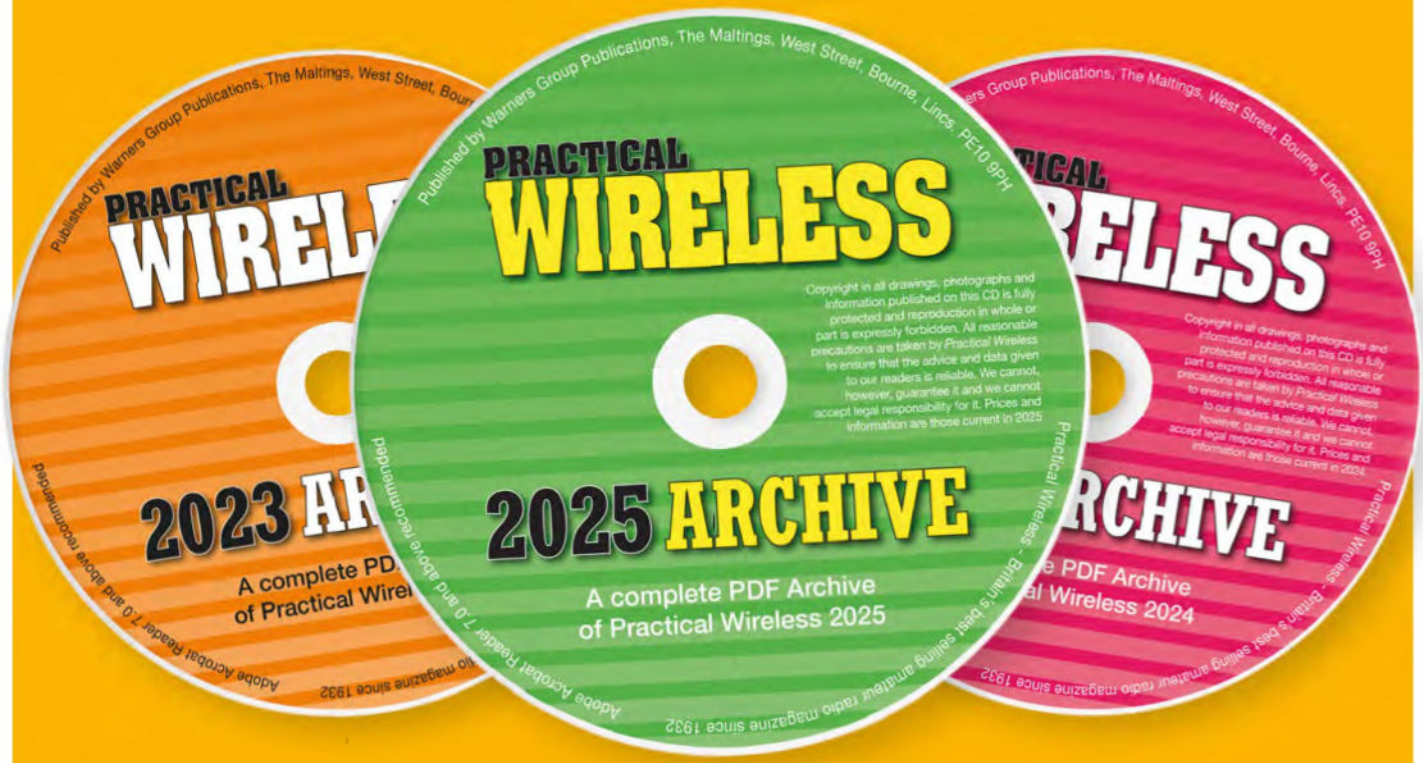


SERVICING AND RESTORING BAYGEN/FREEPLAY SPRING-DRIVEN RADIOS (Part 1): Phil Harris G4SPZ starts a two-part feature on how to service the once-popular Freeplay wind-up radios.
THE EDDYSTONE 910: Bernard Nock G4BXD waxes lyrical about an Eddystone treasure.
TUNING WITH FEELING: Samuel EI9FZB tackles the challenge of decent tuning knobs with a smooth feel.
SUE'S SLIM JIM: Tom G0CAJ returns to the classic Slim Jim, with some advice on building one for other bands.
TATONKA LASTENKRAXE CARRIER USED AS A BACKPACK SHACK: Jonathan Hare G1EXG describes how to use a back pack to go portable.
WILLIAM SHOCKLEY & THE TRANSISTOR: Tony Jones G7ETW looks at the early history of the transistor.

There are all your other regular columns too, including HF Highlights, World of VHF, Antennas, Vintage TV& Radio and Data Modes as well as your Letters, Rallies, the latest News and more.



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