

# Assembling and operating the Elecraft K3 transceiver

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The Elecraft company in California USA, relative newcomers to the ham radio market, provide a range of kit-built gear. Now they have added a world-class rig to their line-up – the K3 all-mode DSP no-solder kit transceiver, for HF and 6 metres.

When the Heathkit company made its last kit transceiver in the 1960s, it seemed like the curtain-call for ham kit-built rigs. With the introduction of integrated circuits and then surface mount components, one might have thought that any kit with up-to-date features and performance would be too complex and expensive to find a niche in the amateur market.

There were a number of successful designs and kits produced in the US for QRP and backpacker CW operators, like the OHR400 and Sierra transceivers; but an all-mode, all HF, full featured portable rig, kit-built - surely not? But it was to be surely yes, with the release of the Elecraft K2 transceiver at the 1998 Dayton Hamvention. Marketed with the slogan "I can't believe it's a kit", this compact transceiver offers modern circuitry and function in a small, rugged, no-nonsense package. Rated almost universally at 5/5 on e-Ham user reviews, it has established a reputation for outstanding receive performance, confirmed in tests by the well-regarded ARRL laboratory.

With sales of 6000+ kits by the end of 2007, the K2's success and standing at the top-end of portable HF QRP rigs was well-established, but it is a transceiver for a limited market. Involving around 40 hours or more of careful soldering, wire winding, assembly, alignment and testing, it is not a task for the beginner or faint-hearted ham. The few surface-mount components are already fitted and there is minimal internal wiring, but the construction demands high-reliability soldering skills and considerable attention to detail. You may also need trouble-shooting ability, as I did due to my poor soldering of a toroid lead in the power amplifier.

There was clearly a demand for a portable transceiver that would offer the features and performance of the top rigs by the big manufacturers, easy to

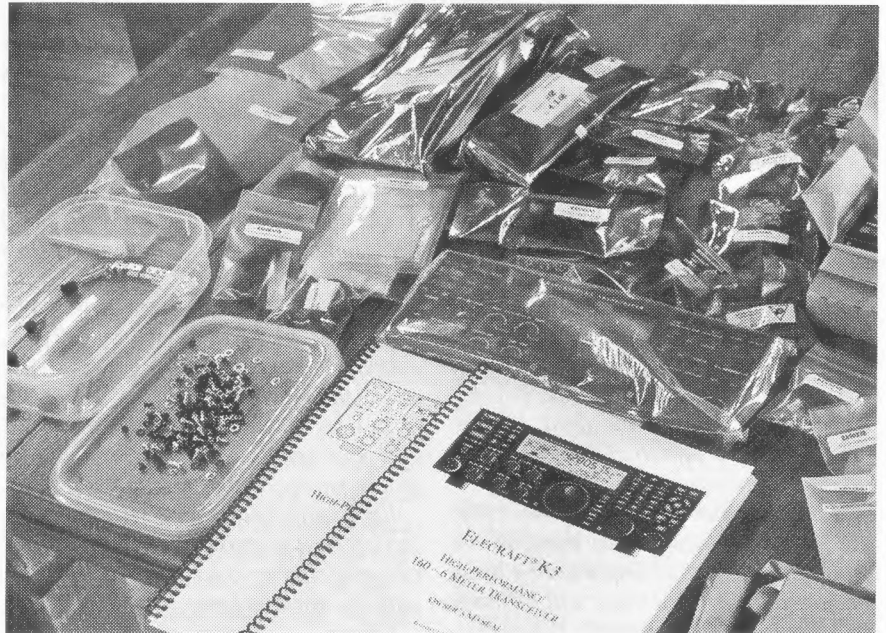


Photo 1: Just out of the box

assemble, but without the hefty price tag. Elecraft's answer was the K3, the development of which remained a well-kept secret until its release at the Visalia, California DX Convention in April 2007.

## What you get

Should you place an order, be prepared to wait for that white carton. This is definitely no instant-gratification purchase. The company partly funded the initial production run of 500 kits with a 50% deposit (which is now not needed). Demand has outstripped supply such that there is a current waiting period of over four months. As at July 2008, approximately 1160 have been shipped, the majority to the US, though quite a few are popping up in VK.

The rig can be ordered factory-assembled, or as a no-solder modular kit. The basic version gives you a 10W all-mode transceiver for HF plus 6 metres, with the stock 5-pole 2.7 kHz

filter. It will actually do 12 W on SSB. In addition, the K3 provides transmit coverage of the 60 metre (5 MHz) band. Options include an upgrade to 100 W, sub-receiver, a range of Inrad 8-pole roofing filters, general-coverage receive, on-board ATU, transverter outputs, and more. Note that you need to install a 13 kHz filter for use on 6 metres FM.

The basic version has full DSP, with configurable noise reduction, blanking and notch, plus TX and RX parametric equalization. IF width and shift adjustments are included. As with the K2, front panel space is saved by dual functioning of most button switches: tap for the main function and short hold for the secondary function. Some of the rotary controls also select their functions in this manner.

There are plenty of memories: 100 general-purpose and 80 per-band. Of the latter group, 44 are accessed quickly by the 4 fast-memory buttons on the right-hand side of the front panel. These

could prove quite useful where you want to quickly jump a large segment of a band, for example in contesting. The rig has the ability to scan, either with the receiver muted or open. You could, say, sit down and eat your lunch while the rig hunts through a selected portion of the 20 metre band, rather than be trapped at your desk. You can also scan through selected memories.

The LCD display is fairly basic, amber colour only. It shows VFO A and B frequencies, configurable dual-bar graph, pass-band filter graphics, and various annunciators and icons. There is no spectrum scope. Should you want this feature, there are third-party units available, and you will need to install the optional transverter module, which provides a buffered feed from the first IF.

The saving in weight due to the absence of a 240 V power supply, and the compact size, make for a very transportable rig. This is the one aspect that sets the K3 apart from other high-performance rigs. Elecraft wisely chose to stay with their core market rather than competing directly in the heavy desktop arena. The kit unit is quite compact at W x H x D of 272 x 254 x 102 mm. It weighs in at 3.85 kg with all the options installed. My rig weighs 2.9 kg with one option fitted.

Details of the circuitry are beyond the scope of this article, except to mention that it uses dual-conversion with IFs at 8.215 MHz and 15 kHz, after which signals go to the DSP.

Circuits are largely controlled by firmware, up-dateable free via the internet, as are complete schematics and manuals.

## Assembly

My K3 kit arrived very neatly packed and the first task was to inventory all the bits. Before unpacking it, you need to organise a well-lit uncluttered workspace, preferably where you can leave everything undisturbed ready for the next session. See Photo 1.

The kitchen table is not recommended, nor are areas accessible to inquisitive persons or animals. Most of the boards are sensitive to ESD (electrostatic discharge) and can be damaged in an instant by an ungrounded hand. My kit had all of one particular type of screw missing, so rather than wait for the US mail I got some from a local hobby shop

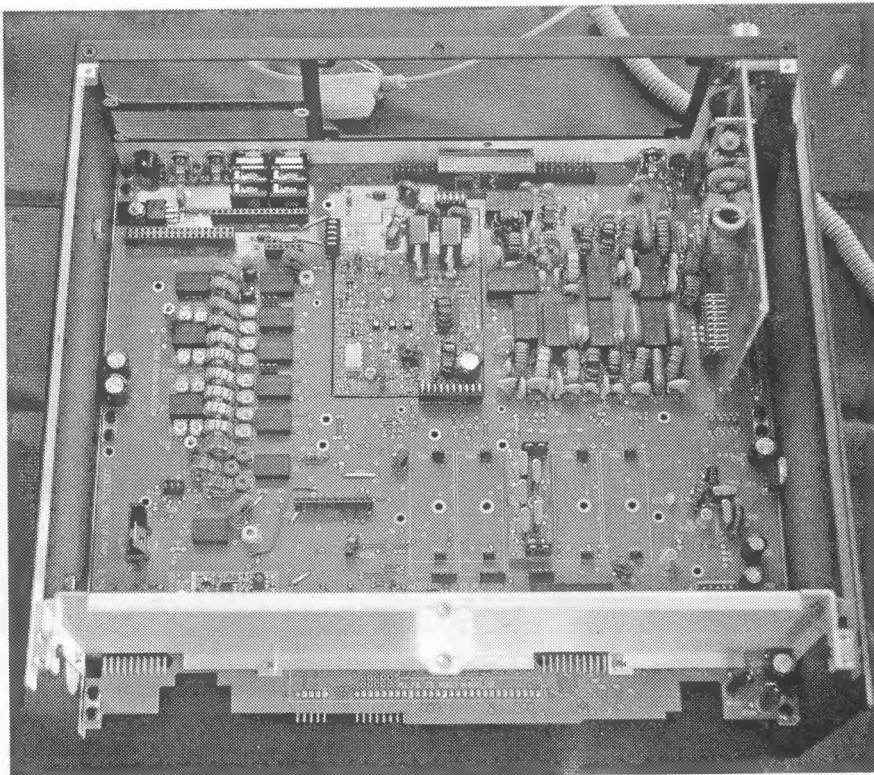


Photo 2: Assembly in progress

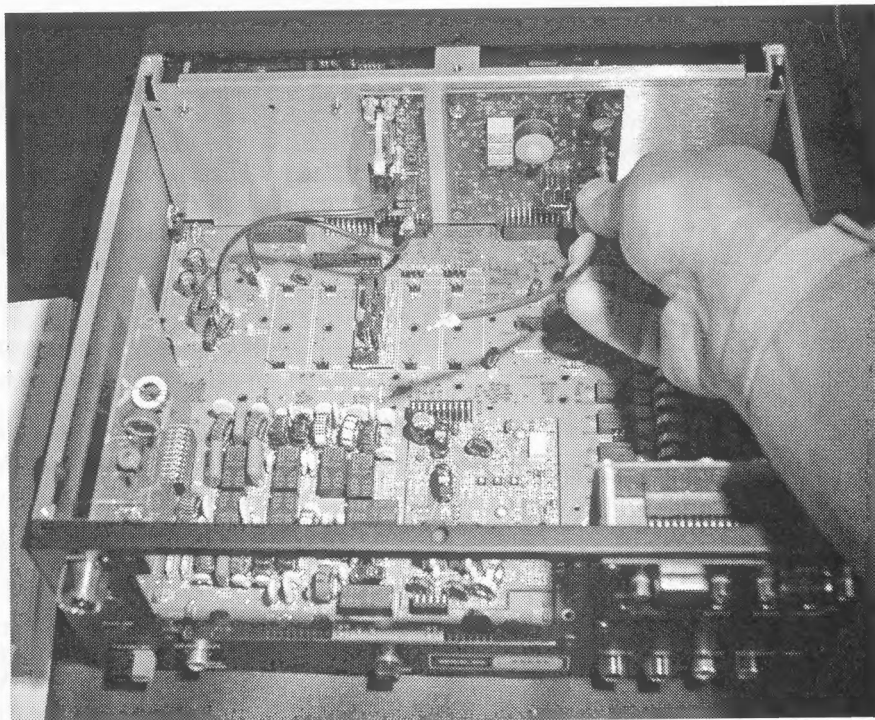


Photo 3: The transceiver nearing completion

for a few dollars. Most of the screws, nuts and washers are all mixed up into one bag and it is a good idea to sort them out into one of those plastic fishing tackle containers or similar.

Before starting the assembly, set out an anti-static mat with wrist strap and the few tools required. Most of it is done with a No. 1 Phillips head screwdriver and your (earthed) hands. A soldering iron is

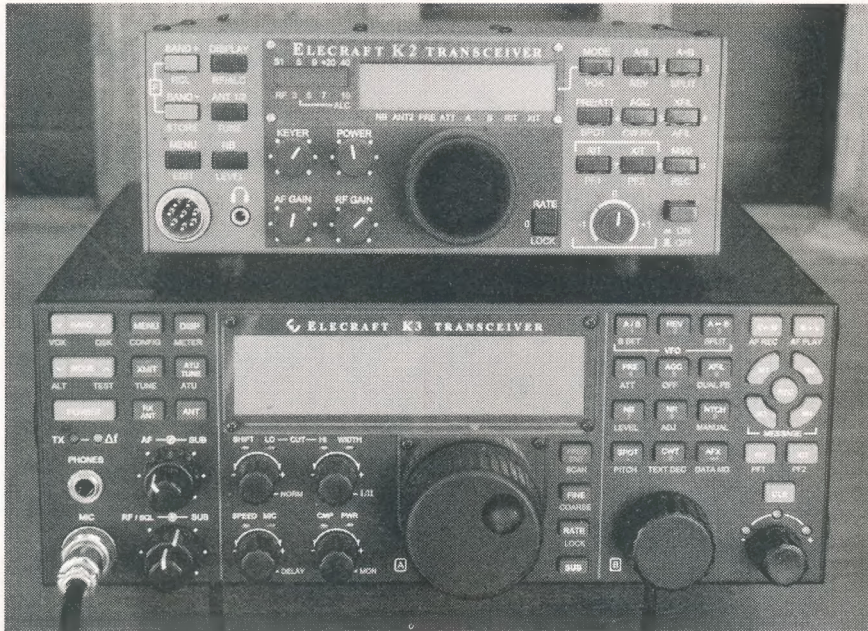


Photo 4: The completed K3 radio, with the earlier K2

website as there may be revisions, and paste or copy these into the manual before starting.

The K3 uses a lightweight design which relies on the rigidity and strength of the 7 panels, which join together using special screw connectors around the edges. There is no discrete chassis as such. Integral to the structure is the main board which carries most of the RF circuitry. Into this "motherboard" are plugged the front panel board and boards for audio and digital input/output, antenna, noise blanker, mixer and low-power amplifier. The DSP, TXCO and synthesizer are fitted to the front panel board. Additional boards can be plugged in for the various options.

In Photo 2, you can see at centre rear the low-power amplifier board, which plugs into an opening in the RF board. The output transistors are underneath and bolt to the rear bottom panel which acts as the heatsink. Fortunately, the tabs of the transistors are earthed and so no insulators are required. The 5 slots for crystal roofing filters are on the front right of the RF board. The basic 2.7 kHz

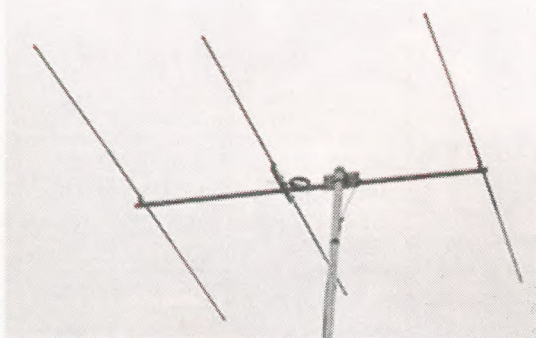
only required to make up the 12 V power lead. Take care to do everything exactly as described in the manual, ticking off each step on the way. Particular attention

is needed to the length of screws and the placement of stand-offs and lock-washers. The assembly manual is clear and well illustrated. Check first on the

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Photo 5: The K3 transceiver, rear view

5-pole filter has been installed in slot 3. Later on, the 13 kHz (FM) and 1.8 kHz 8-pole filters were added. The antenna input/output board is the one mounted vertically in the top right corner.

At the top of Photo 3 can be seen the front panel board installed in place. The two boards on the back of this are the reference oscillator (left) and the synthesizer (right). There are 3 internal plug-in coaxial cable connections. Note the anti-static wrist-strap which connects to the work mat. This is absolutely essential to prevent ESD damage.

Most of the assembly was quite plain sailing. There were a few fiddly bits where it would help to have very small and nimble fingers. A headset with a good lamp helped quite a bit, and the old 'blu-tac' on the end of the screwdriver trick came in handy. Connecting the front panel board was the trickiest part, requiring care and patience. I was not counting, but I think it took about 10 hours altogether, at a fairly leisurely pace.

Photo 4 shows the completed K3, with the K2 for comparison. The similarities of style and layout are obvious.

## Setup and controls

The K3 is quite straightforward to get on air, after first setting up the filters as detailed in the manual. There is a test and calibration procedure to be done, but the rig does most of the work and no test equipment or component adjustment is required.

Quite a bit of time was spent getting familiar with the basics, then attention turned to customizing the radio. There are two menus. The main menu has the

more frequently-used settings such as VOX sensitivity, repeater offset, display brightness/contrast, etc. and there is also an alarm you can set to wake it up.

The configuration menu is much more complex, with settings for all kinds of things to do with RX, TX and testing. This is also where you set up the filters. I found it to be quite logically structured and mostly straightforward to use. I did get confused at one point with setting up for 6 metres, but this was because there was a revision of the manual of which I was not aware. The lesson here was to check the website for current information before any new installation or if things don't seem to work as expected.

Having already used a K2, I found it easy to use the front panel on the K3 which is similarly set-out, albeit with more knobs (9) and buttons (35). I rather like the no-frills, somewhat military style of the panel, but it may not be attractive to all. The feel of the buttons is positive and the turning of knobs is smooth and precise. If you like, you can easily remove the VFO knobs with an Allen key wrench and adjust the spin resistance. As you assemble the kit you get to do this anyway.

The control labels and the LCD panel are all easy to read. I liked the uncluttered display and annunciator positioning; when operating under pressure it is easy to glance and see what is happening. Note that the controls are not backlit and you will need some light on the front when operating at night. The compact size means that some of the more expansive panel features seen on big rigs are absent from the K3. For example, band and mode are selected by

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up/down rockers rather than individual buttons.

Connections to the back panel are fairly standard. You can connect phones and mike to the back as well as the front and there is line-out audio in mono and stereo. Stereo is used for quasi-stereo and binaural effects which supposedly can help with weak-signal copy. It is claimed to be less fatiguing over long periods such as in contests but I am yet to try this feature. There is an RS232 port for computer connection and a 15 pin accessory port which can output band data, carry digital data, and control transverters. The 12 volt supply comes in via Anderson PowerPole connectors, pretty much the portable standard in the US. When power is switched on, a 12 V outlet provides up to 500 mA for any accessory device that needs to come on with the rig. There is only one antenna socket; two would be nice to have without having to fit an option module. Photo 5 shows the rear panel; the large blank space is where the fans go in the 100 watt version.

I recently fitted the optional KXV3 board which in addition to transverter lines, has in/outputs for a separate Rx antenna (such as a Beverage for the low bands) and a first IF tap for a panadapter. Regarding the latter, there are units on the market which suit the K3 such as the LP-PAN but you need a computer hooked-up. I have decided to wait in case Elecraft produce a stand-alone unit. When portable it would be good to have the option of taking a light-weight bandscope without having to carry a laptop. But it could be a long wait.

Overall, I am happy with the controls. A good feature is that you can set up a fast tuning step which is controlled by the RIT/XIT knob. This functions similarly to the "select" knob on my FT-817, and I find this excellent for contests. Unfortunately the selectable steps are only 2.5, 1.0 and 0.1 kHz, and for me it is annoying not to have 0.25 and 0.5 kHz steps. Also you have to go to the configuration menu to adjust this, though I plan to see if I can put it into a front panel button as a special function. Direct frequency entry is easy. The RIT/XIT is well set up, with LED indicators for +,0,- offset and also next to the transmit LED, there is a delta-f LED, which comes on if there is a TX/RX offset, due to RIT, XIT, or split operation.

## The operating experience

After reading various reviews praising the K3's receiver, expectations were high and the rig did not disappoint. The sensitivity, combined with the noise fighting capabilities of the DSP unit, made for good readability of some very weak SSB. Nevertheless, my home location is remote and solar-powered and therefore very QRM quiet.

On CW, some extremely weak signals could be plucked out. Unfortunately my Morse skills are almost non-existent due to lack of practice, but I imagine that the K3 might be a delight for a good operator. The auto spot tuning function is very helpful. I tried the Morse to text decode feature and at first this was disappointing, but a careful reading of the manual helped me to set it up to get better than 90% sensible copy of the WIA 80 metres automated Morse transmission. It seemed not to like the slow Morse, often breaking 4 and 5 dot/dash letters into smaller components, giving lots of Is, Ss and Ks. The rig is also RTTY and FSK decode capable, but this was not tested.

On transmit, everything functioned well, after a problem was sorted out. This took the form of a missing circuit board link which snuck through quality control on a run of units, and which prevented the front-panel mike from operating correctly. The result was dreadful distortion on my first serious transmission. Naturally I was appalled, having no idea what was wrong, let alone how to fix it. However the ever-helpful Elecraft forum and support people were there and it was business as usual after removing the offending board and soldering in the link with hook-up wire.

Audio reports have been good, though if you crank up the compression to the higher levels, it will not be hi-fi. I found moderate compression levels very helpful in getting through QRP on 80 metres to north-east NSW on a recent remote portable stop in East Gippsland. I was using the tiny 20 W Elecraft auto-tuner into a G5RV slung up about 7 metres into the mountain ash forest.

I gave the rig a workout on the NZART 80 metres Memorial Contest and was able to copy through static stations that others seemed unable to hear. When things got a bit cramped at one stage,

I selected the 1.8 kHz filter, which did an excellent job of cutting out strong close-in stations, while maintaining good readability.

It is expected that the voice recorder option will be available soon. I will probably get this, as being able to record and play voice would be very useful for long contest operation. It also allows voice announcement of controls.

Rather than reproduce the factory specs here, you can check them on the Elecraft website. While you are there, download the QST (ARRL magazine) review and the laboratory test comparisons, which are a real eye-opener when you see the receiver figures compared to some more expensive rigs.

## Summing up

The K3 is arguably at the very top when it comes to portable HF rigs. It is rugged, light weight, and easily customised. Everything is geared towards maximum performance on HF and 6 metre ham bands. If you want general coverage receive there is an optional module which adds 8 extra band pass filters. With noise reduction engaged on the static-free bands, signals seem to just pop out of silence. The standard of components, circuit boards and hardware is excellent. So is the cabinet finish and labelling.

It is unusual if not unique to see a transceiver designed entirely by active hams, with downloadable firmware revisions which take on board the comments of users. Some have complained about the slow delivery, suggesting that the release was premature. However, no one is twisting your arm to buy one and I suspect that without the process of accumulating forward orders to finance development and manufacture, this radio would never have been built.

The price of the basic kit is very reasonable for a high-performance transceiver. However, if you install all the options including 100 watt PA, full independent second receiver, and on-board antenna tuner, it will set you back a fair bit more. The good thing is that it is not just a one-size fits all. You can fit what suits your needs and budget. GST, currency conversion and customs clearance charges add quite a bit, but at least there is no middleman (or men). I should mention that the price does not include a mike. It is up to the buyer to

choose between hand mike, desk mike and headset, or adapt the pin-outs of an existing mike to suit. The Heil headset and a footswitch or VOX make a very good combination for contesting.

A very big plus for the K3, or any Elecraft product for that matter, is the outstanding customer service and support network. When stumped by a firmware change, I sent an email to the forum and got the information I needed from a US operator in twenty minutes. Likewise, the company support people will promptly and politely attend to your inquiries.

It is not real kit building like the K2, but the assembly experience I would say is definitely worthwhile. It engenders a deal of pride and you save quite a few dollars. I would recommend the kit version unless you are mechanically challenged. Compared to a K2 kit, it is a breeze. Also, you get a much better appreciation of what is inside the box; and yes, it is only available in black.

To operate, I find it to be a delight whether in the field or on the desk. It looks and behaves like a precision radio. My K2 is now reserved for extra-light operations, but that older, smaller brother (sister?) of the K3 is still the ultimate in kit challenge and satisfaction. Or if you like portable CW QRP, take a look at the K1, or even the tiny KX1 with mini-paddle. Judging by the forum postings,

there have been a few production glitches, but it seems everyone ends up satisfied. I can forgive the two problems I encountered, since they were easily fixed. The level of access to support, right up to the designers themselves, is outstanding in the world of ham transceiver manufacturing.

The K3 is a transceiver that would suit HF operators who want portability and high receiver performance at a moderate price, plus a dose of the owner-builder experience. Other considerations are the ability to customize the rig and to update firmware. With the Aussie dollar almost on parity with the US (at the time of writing), it represents great all-round value. (*Readers should consider the current exchange rates. Ed.*)

Please note that this is an unsolicited article and the author paid full price for the kit.

For further information see:

- [www.elecraft.com](http://www.elecraft.com)
- the K3 wiki at [www.zerobeat.net/mediawiki/index.php](http://www.zerobeat.net/mediawiki/index.php)
- [www.eham.net/reviews/](http://www.eham.net/reviews/)
- Heathkit history at [www.heathkit-museum.com](http://www.heathkit-museum.com)
- CW backpacking at the wilderness radio site: [www.fix.net/~jparker/wild.html](http://www.fix.net/~jparker/wild.html)
- the LP-PAN panadaptor at [www.telepostinc.com](http://www.telepostinc.com)

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## Editorial

*continued from page 5*

Even in the toughening economic climate, our countrymen are showing their generosity – several organisations are calling for donations, and funds are rushing in to those appeals. Such support is not surprising, given the devastation – Victoria Police are predicting that over 200 lives will have been lost, and the impacts of properties has been massive.

As further information comes to hand, I am sure that there will be some requirement for action from some or all of us in some form. Perhaps providing assistance: to individuals, through WICEN or other agencies, or even simply contributing to one of the relief appeals.

I am sure that we are all wishing the best to all who have been impacted by these events.

## Closing remarks

Enough reflection on the past few days.... This Editorial is already far too long!

Perhaps it was best that I decided against attending Wyong – it was much easier being at home and considering the actions that I might take if the wind direction had changed to bring the fire towards the town. From all accounts, the event went well. I look forward to some reports in due course.

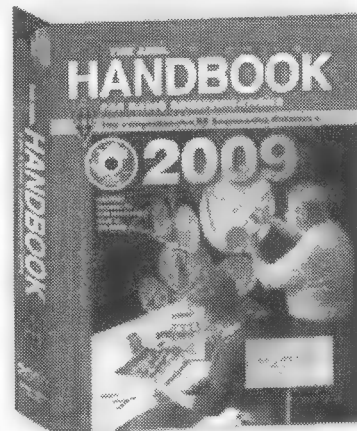
At the WIA Office, preparations are full steam ahead with all the paperwork for the AGM to be held in May.

Again, I ask that you write up that latest project as an article for AR. Our stock of articles is dwindling, so the turn around time between submission and publication should be shorter than average.

73

Peter VK3KAI

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