

Radio

# HOMEBREW and EXPERIMENTER'S Group

An official function of the  
Amateur Radio New South Wales  
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Newsletter Issue 02 (Net Version)

February 2005

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The Radio Homebrew and Experimenter's Group workshop meetings are free to Amateur Radio NSW (WIA NSW) members. A \$5 cover charge **may** apply to non-members. Meetings are currently held at Amateur Radio House in Parramatta on the first Tuesday night of each month around 6:30pm to 9pm (doors locked by 9:30pm) **and** on the last Sunday of each ODD numbered month around 12:30pm to 4:30pm ( that is after the Trash-n-Treasure). The Technical Book Shop and Technical Library are also usually open at these times for those who can't get in during the week. Cold drinks (leave your money in the fridge) and tea/coffee making facilities (FREE) are also available. Plenty of shops just up the road if you would like to grab something to eat in the hour or so break between the T&T and the Homebrew Meeting. Only a short walk from either Harris Park or Parramatta Stations and usually plenty of on-street parking for these meetings. The Sunday afternoon meeting is usually first a show-n-tell for any works-in-progress or completed projects members are working on and followed by a Technical discussion or demonstration. The Tuesday night are an informal Technical night where people bring in works-in-progress to get help or ideas from the rest of those attending. These workshop meetings are informal get-togethers of amateurs interested in building, or repairing their own radio equipment. Some people bring their latest piece of equipment along to work on or to receive advice, while others offer their experience and advice in helping others.

The group had some pieces of test equipment at Parramatta, while others are brought in for the occasion. If you think that you may need some equipment, then **please contact Peter O'Connell VK2EMU by email or leave a message for him at the Parramatta office** and he will endeavor to have the appropriate piece of equipment available.

## This Month

- **Radio Homebrew and Experimenter's Group News**
- **!! STOP PRESS – We are on the Amateur Radio NSW Web page**
- **News from other Clubs or Groups which may be of interest**
- **WIA (NSW) change of name information**
- **Completed 70cm Antenna Project with Photos**
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- **Need Circuits and ideas for “Project Circuit Folder”**

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## Radio Homebrew and Experimenter's Group News

**70CM Yagi Project** – As reported elsewhere in this issue, has been successfully completed. Mine works a treat, thanks to Peter, Gordon, Mark and all involved in this project.

### Sunday 30 January 31, 2005 ( Technical Meeting Report)

As usual after a Trash and Treasure event we had a busy meeting with about 40 members and visitors in attendance. We started off with a show-n-tell session on the following works-in-progress:

**Audio Filter and Amp Board** (Peter VK2EMU). He reported continued progress on the combined Audio Filter and Amplifier board he and Mark VK2XOF are working on. It is intended to be a building block for receiver projects providing a three pole active filter and a LM386 based headphone/speaker amplifier.

**PIC Programmer extension Board** (Peter VK2EMU) Peter and myself have built up the latest Silicon Chip PIC Serial programmer board with great success, once you figure out how to use the ICProg software. He needed to develop some programs on the newer 28 and 40 pin PIC chips, so developed an additional board with ZIF sockets on it for these chips, it basically hooks into the expansion port of the existing programmer board and extends the programming functions to the bigger chips. However he reports that you need at least Ver 1.05 of ICProg to access these newer chips.

**80M RX Board** (John VK2ASU). John reported on considerable success in design and construction of a direct conversion board for 80M using a 4093 as oscillator and buffer to feed a 4066 as the digital detector. He also played a tape of the resultant audio recovered off a live transmission and must admit it was quite acceptable. John has a passion for these QRP projects having also designed a Gilbert mixer using about eight discrete transistors.

**Conversion of PC SMPS to 13.8V @ 10A** (Keon VK2ZHA) he presented a completed and interesting approach to conversion of old but functional PC power supplies scavenged from an old PC or purchased at quite reasonable prices at markets etc. Instead of extensive modifications as per most articles he simply rewired the DC side of the original +12V supply to a set of terminals on the side of the case. Terminate and fit a small load resistor to the original +5V supply. Then minor modifications to the TL494 regulator chip so that it now monitored the +12 supply (instead of the +5V supply) with adjustment to provide 13.8V output. Also modifications to the LM339 comparator chip to now cycle the cooling fan on heat sink temperature. I will leave the rest of the details to him in a future article, but suffice to say a cool running PSU for shack use.

Then an excellent demonstration by Les VK2YJ of Grantronics:

**ATMEL AVR MicroController Introduction** (Les VK2YJ) a printed handout supported Les's introduction to the Atmel AVR family of Microcontrollers, their features and enhancements over the PIC family of components. Details of both Hardware and Software development tools along with demonstration of practical examples of AVR controlled projects which included moving LCD displays and data logging boards. I had always thought that entry level to AVR controllers very expensive but Les pointed us to some very reasonably priced (in some cases FREE) development tools.

### Next Meeting :

**Tuesday 1<sup>st</sup> Feb 2005**, 6:30pm at Amateur Radio House

**Tuesday 1<sup>st</sup> March 2005**, 6:30pm at Amateur Radio House

**Sunday 27<sup>th</sup> March 2005**, 12:30pm at Amateur Radio House ( after the Trash and Treasure meeting)

Peter is still organizing the agenda for this meeting, we will advise you a bit closer to the date, but do bring along your "works-in-progress" for the show and tell section of the meeting.

## **!! STOP PRESS – We are on the Amateur Radio NSW Web page**

The Radio Homebrew and Experimenters Group is on the net, just go to [www.wiansw.org.au](http://www.wiansw.org.au) and look for "Homebrew News" for latest news on the group and a "pdf" copy of this newsletter. Let your friends know too. We will shortly have our own email address, meantime just send any email to Parramatta office.

### **WIA (NSW) Division change of name information**

As per the recent EGM, The WIA (NSW Division) signed an Implementation Agreement with the "National" [Wireless Institute of Australia](http://www.wiansw.org.au) on December 10, 2004. As a result, the Division has agreed to generally identify itself as "Amateur Radio New South Wales" in the following form :

Name : **Wireless Institute of Australia (NSW Division)** ABN 66 000 012 082  
Trading as  
**Amateur Radio New South Wales** BN98112045

The Wireless Institute of Australia is one of the oldest radio societies in the world, being formed in 1910. The name "Wireless Institute of Australia (NSW Division)" was adopted in 1922.

As time and resources permit paperwork, Web pages etc are being changed to reflect this decision. The "new" Amateur Radio NSW retains the WIA (NSW) contact information as follows :

Office : 109 Wigram Street, Parramatta, NSW 2150 Australia  
Postal: PO Box 9432 Harris Park, NSW 2150 Australia  
Email: [vk2wi@ozemail.com.au](mailto:vk2wi@ozemail.com.au)  
Telephone: 02 9689 2417 Fax: 02 9633 1525  
Office Hours: Tuesday, Thursday and Friday 11am - 2pm  
Web Site: <http://www.wiansw.org.au/>

### **News from other Clubs or Groups which may be of interest**

Sorry not much news on this front as most clubs have shut down over Xmas and New Year period.

#### **Wyong Field Day ( February 2005)**

**Scoop !!** according to a msg received by Brian VK2GCE from the CCARC the projected date for the next annual Wyong Field Day is **Sunday Feb 20<sup>th</sup> 2005**, however this depends on the venues Racing Schedule. It may have to move if the Wyong Racing Club schedule a race for that day.

See you there !!.

### **Ham Homebrew Meeting – Completed 70cm Antenna project with photos**

(Your reporter Brian VK2TOX)



Sunday 28<sup>th</sup> November meeting at Parramatta saw most of us get our 70cm Yagi finished and tested. Some very careful work was required within the terminating box to complete the dipole-balun connections.

Here is Max VK2EQC and Max VK2AFE completing the rather fiddly interconnections within the terminating box of one of the Yagis. As you can see the kitchen at Wigram St was converted to a temporary workshop mainly because of the excellent natural light for "old eyes" to see the "little" bits and pieces.

Far right is completed dipole-balun terminating box. Balun is a  $\frac{1}{4}$  wavelength section of copper jacketed Teflon coax (self supporting) terminated within the box to the dipole elements. At a later stage the box will be filled with wax to weather seal it and its connections. As can be seen the "bend" in the folded dipole is formed by a short section of aluminum bar drilled and pop riveted to the upper and lower elements.

Mark VK2XOF (with his back to us) very kindly brought along some rather "beaut" test gear to check out the completed antennas.



The design concepts for this project were obviously very sound much to our relief. All antennas tested performed well with low SWR, good gain and within the specified bandwidth.



There were some small variations in centre frequency and bandwidth but on inspection these were easily attributed to minor variations in construction within the dipole-balun terminating box.

On one antenna the builder had used solder lugs to extend the dipole elements to the "N" connector and the balun. This unit showed a lower centre frequency as he had effectively lengthened the dipole elements with the solder lugs. We reasoned that this could be fixed by simply moving the little aluminum bar at the "bend" of the dipole in towards the centre and thus correcting the length of the elements.



Here we have an antenna being tested in "free space" ie sitting on a garbage bin. Mark's hand started shaking rather badly whilst attempting to hold the antenna up by it's end during testing. For some strange reason no one else was game to hold it up, considering most of us are old enough to have grand-kids, sterilization by RF is not really an issue. However even with only a couple of watts into the antenna it was obviously prudent not to stand in front of it. What you can't see from the picture is that the antenna is pointed down the lane beside Wigram St with possibly a hundred meters of free space so as not to de-tune it during the tests and best simulate it being up a mast.

Part of the kit of parts for the project was an antenna mounting bracket allowing the antenna to be mounted for vertical or horizontal polarization on a mast.

## Technical – Make your own Printed Circuit Boards (1) "How to get your circuits into the real world"

(This article compiled by your editor Brian VK2TOX from personal experience and items in various ARRL Handbooks and local journals)

There have been articles in both overseas and local electronics journals involving home fabrication of printed Circuit Boards (PCB's), including an excellent series in recent Silicon Chip magazines on the use of "Autotrax" and making PCB's. A company here in Australia called "Airborn" even has available libraries and drivers for "Autotrax".

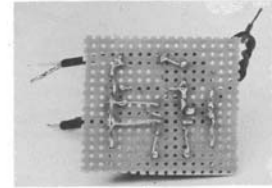
I was originally going to describe my efforts at producing (PCB's) by the iron-on laser toner method, but I realized that whilst writing this article I am actually building circuits using no less than seven



## Matrix Board

This again is very handy for constructing circuits, in general it is more suited to components with leads, although as you can see quite complex circuits can be built with a bit of planning.

The Matrix Board is a substrate with no copper attached, just a matrix of holes usually on a 1/4" or 1/10" grid. Basically you feed the components leads through the holes and use it's own leads to connect to the other components. There are various terminals and pins which can be used to connect larger components (or those without leads) to the outside world. A variation on this theme is to use adhesive copper strip, such as that used to do wiring in dolls houses to create earth or PSU busses. Long lasting and quite stable circuits can be constructed in this manner. Provided it is well laid out the circuit is also easily modified and serviced although it tends to take up more board space than a proper PCB.



ARRL Handbook 1999

## Wire Wrap

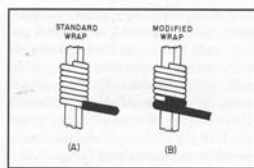


Fig 25.18 — Wire-wrap connections. Standard wrap is shown at A; modified wrap at B.  
ARRL Handbook 1999

This method of circuit construction enjoyed a brief popularity in the early days of logic IC's. DIL sockets with extended pins were inserted in a piece of matrix board then interconnection of circuit elements achieved by using a special insulated wire and a tool to "wrap" the wire around a pin. The end of a wire was first stripped of insulation then run and "wrapped" around another pin on an adjacent component. The pins had sharp edges so that when wire was "wrapped" around the pin tightly a good electrical contact would be assured. Using different colored wires, I have seen quite complex circuits constructed in this manner. This method is roughly analogous to the old "wiring looms" of valve days and required careful planning to avoid feedback. Although the components for this method are still available I think the operating speed of modern components requires a more reliable

approach to construction. I found that unless you used sockets with good quality/sharp pins and were careful to "wrap" the wire tightly you could be plagued with intermittent connections in a complex circuit.

## "Vero"™ Board

This is a variation on the above Matrix Board where along with the matrix of holes there is also copper strips attached to one side of the board. These strips follow parallel lines of holes.

To use this board firstly design your circuit layout on paper based around the grid of holes and copper strips. Decide where you need breaks in the copper and use a small drill on the copper side of the board and centered on one of the holes and gently ream away the copper strip to produce a break.

A fine point soldering iron, fine solder and not too much heat is needed, otherwise bridges across tracks will occur (sometimes by design) or with too much heat or re-work the tracks will lift off the board. If this occurs it can usually be repaired with short lengths of tinned wire.

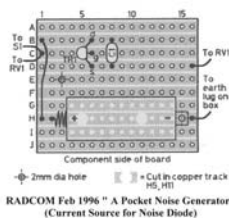
Much the same as the Matrix Board quite stable circuits can be constructed in this manner, with the added bonus in that they usually take up less board space as components can be "packed" tighter.

Ideal for analog or digital circuits using IC's because of the 0.1" matrix of holes and the copper strips. Care has to be taken with routing of signals and especially power supply rails. I usually double up on the strips for power supply rails and very generous with bypassing of pos and neg supplies especially close to IC chips to ensure low impedance supply lines.

Erratic operation of logic circuits using "Vero" board can usually be traced to insufficient bypassing or high impedance supply lines.

## Prototype Boards

These boards are available from different suppliers in various forms. They all consist of an insulated board with sets or a matrix of drilled holes and have pads or strips of copper attached to the



RADCOM Feb 1996 "A Pocket Noise Generator"  
(Current Source for Noise Diode)

underside. Often there is also a silk screened pattern on the top side of the board indicating the layout or pattern of the pads or strips.

Where the board has copper pads centered on the holes you use excess solder to bridge the adjacent pads together or use tinned wire or component leads to join sets of pads together to form busses. Sounds fiddly but quite easy as the pads are close enough to bridge (either accidentally or on purpose).

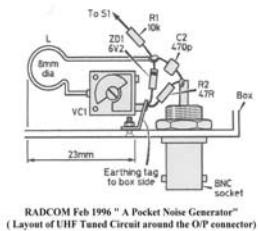
The other type (which I prefer) is based around various forms of DIL sockets with short bus strips from each pin along with dedicated power supply bus strips. These power supply busses often run up the centre of the DIL socket pins allowing you to tie-off various pins to either "high" or "low", greatly simplifying on board wiring and layout. Some of the boards are designed for three or four DIL IC's and others for dozens of chips.

### "Ugly" or "Blob" type construction

In this method components are soldered directly together as per the circuit and components with one lead to earth or a power supply rail are used to physically support the rest of the circuit. Often no board of any type is used only occasionally a tag strip to support or ground components. Components (using their own leads) are wired directly to major components such as tuning gangs, pots or terminals.

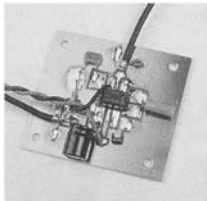
Quite amazing and reliable circuits can be constructed in this manner especially at VHF where short and direct connections lead to very stable circuits. I use this method for construction of VFO's etc where mechanical and temperature stability are paramount.

Often also called "dead bug" style of constructing a circuit where an IC or active component is laid on its back and other components soldered directly to its leads.



### Isolated Pads

This method can also be implemented in various forms. Basically it is usually a piece of single sided copper clad PDB board used "copper UP". You then cut up small strips and pads of single or double sided PCB and secure these to the copper side of the main PCB. These pads and or strips then form mounting pads or busses on the main board.



ARRL Handbook 1999

Making the pads or strips out of double sided PCB allows you to solder them to the main board or if they are made from single sided PCB then you simply "super glue" them to the main board.

Quite reasonable circuits can be constructed in a very short time by building the circuit as it appears in the schematic, soldering or gluing a pad anywhere components join. A little bit of planning is worthwhile to allow placement of power supply busses and placement of larger components.

This by far my favorite way of roughing up or constructing small modules of circuit. **See the excellent description of this method in the Drew VK3XU series of Circuit Books.**

If you have plenty of money these pads and strips can be purchased ready cut from sites in the US under various brand names.

(Continued next month)

## Parts for Homebrew Projects

Being a keen Homebrewer and running the Amateur Radio NSW Trash-n-Treasure, Seppo always has his eye out for parts for our projects.

Along with a growing collection of passive parts, xtal osc modules and other useful parts, he has currently an interesting quantity of various IC's. Most of these are older types but still quite useful to build projects around.

Please check out the following list and let us have any ideas or circuits you have that we might use these for.

TC5564PL-15	CMOS Static Ram 8K x 8
LM1408N-8	8 bit DAC (equiv to DAC0808)
AM7910DC	Multi-Modem Chip
4N35	Opto-Coupler
TL084N	Quad JFET OP-Amp
LM301AP	1MHz Op-Amp
LM318P	Fast General Purpose OP-Amp
TDA5660P	TV Sound Modulator Chip

Note: Since this list was made up we have received some more IC's and solid state devices, but these need sorting out so can add them to above listing.

## Need Circuits and ideas for "Project Circuit Folder"

Like most of you, I have been fairly busy over Xmas and New Year with family matters. So although involved in a number of projects I do not have anything finished at this time.

For the benefit of our members I would like to build up a file of "building-blocks", that is self contained circuits we can use to construct or modify a complete piece of equipment. It is usually easier to build up a piece of gear, be it a piece of test equipment or a RX/TX by breaking it up into a number of modules. It is also easier on the pocket book too. That way you can be assured of functionality before moving onto the next module and also get quite quick results, rather than quite a long time on a one piece of gear.

Also of interest are circuits of small pieces of test equipment that members could "knock-up" to assist them in testing or aligning the gear they have homebrewed.

Max VK2AFE brought in a selection of circuits from previous issues of AR which will be very useful, thanks.

So scribble a circuit down on a piece of toilet paper, photocopy an idea or email ideas/circuits to Brian VK2TOX (as per Call-Book or email address on front page). You can even hand it to him as he is there at most meetings.

This compendium of circuits will be available at meetings and eventually in booklet form to members. I am currently putting together some circuits to get it started, but I need your support too.

I am in the process of building a series of small/portable pieces of test equipment to take on field trips or to meetings, in general they will all run off 12Vdc Input, even if internal step-up PSU's are needed to run the circuits. Currently I have the following in various stages of construction or planning.

**HF Signal Generator (100KHz to 70MHz)** with about 1W output to feed antennae and filter analyzers

**VHF/UHF Signal Generator (50MHz to 500MHz)** as above but maybe 0.5W will do

**Audio Signal Generator (10Hz to 500KHz)** with buffered 10Vp/p O/P to test speakers and audio filters

**LF Function/Sweep Generator ( Sub Hertz to 1MHz)** with both logic and analog outputs

**LCD Frequency Counter (500MHz)**

would like to extend this up to 1GHz if I could find a suitable scaler device.

**HF/VHF MilliWatt Meter (analog)**

Does anyone have any circuits they have built up or ideas they have accumulated that I could incorporate into the above instruments. I particularly need ideas for the output stages of all the generators. For the audio/function generators I am currently looking at a wide band amplifier used as the output stage in an ETI Function Generator back in 1983 and perhaps "borrow" the output stage from Drew VK3XU Antennae Analyzer for the HF generator.

.END..