

# ANODE

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## Editor's Comments

### Volume 7 Issue 5 December 2006

I had intended having a 'last' Ham-Comp before the holidays. But if you guys are all going away...

I won't be going away like many previous years. Some years the run-up to Christmas has been very busy for me. And several years the period between Christmas and New Year the client would phone and request emergency service on something. Maybe he [usually] didn't have a good Christmas and didn't see why anyone else should either.

[So the Greeks have banned cell phones in schools.]

73  
JB



Of course I wish you all a happy and blessed Christmas. Or a happy holiday season.

## Projects for the Holidays

1. Do a backup. Whether you are going away or not. Before you install new software and wreck the settings on your pc.
2. Try new software - such as Open Office, the morse decoding program or any other 'low-cost' related software.
3. Hone your fox-hunting skills and update/modify the hardware. There is a new year ahead with some "Jackal hunting" sessions.
4. Make a lightning detector. As I write this, there is a rumbling to the south. Don't stand on the roof with a metal pole! But build a simple lightning detector using a loop antenna. Measure the peak voltage and set a

limit to indicate the "closeness" of the strikes. You can then use it to trigger an alarm, that wakes you up. You can then unplug antennas etc...

5. Make a mains monitor device. With all these mains borne glitches and brown-outs, its becoming very difficult to operate a computer on the West Rand. With a recorded list of mains borne events, you could give the municipality a hard time. They always come back with the fact that the power is up 99.99% of the time. Its just that the .01% happens to contain high voltage pulses or no mains power. Maybe their measurement of

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**Special points of interest:**

- Contact details on back page (updated)
- New email address for Anode and ZS6WR. See back page

## Projects for the Holidays

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- time differs from ours.
- 6. Make a PC interface circuit. Couple up your pc to a radio, tnc, packet modem. Read the articles on PSK31 and maybe start constructing an interface to the sound card.
- 7. Catalogue your crystals. You can check them with the circuit given in last months issue. At the same time enter the fundamental frequency into a spreadsheet. Bring it to the club in the new year, so we can put it into a club database.
- 8. Build a burglar alarm. Before you go away or so you can go away. But don't let it go off and annoy the neighbours!
- 9. Read the Anode Compendium for inspiration.
- 10. Try out Linux and Packet Radio.
- 11. Build an experimental antenna for small spaces like a "Cluster House" complex.

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### On the subject of Fox-hunting

[You don't want much do you?]

From: "Mike Andrews"  
 <mikea@mikea.ath.cx>  
 Subject: Foxhunting controller/transmitter  
 Date: 06 October 2006 15:13

Anyone got pointers to a good \*and\* inexpensive 2m FM foxhunting xmtr with integrated controller? Ramsey used to make just exactly what I want, and so (of course) they've discontinued it.

I'd like it to do a (programmable) CW ID, with a programmable delay from a minute or so up to 30 minutes, in roughly 1-minute steps. Xtal control is OK, but a good, stable VFO (DDS or DDS + PLL, rather than PLL alone) would be better. Settable power level

would be good, too, and I can do with max power about 1 W.

Thanks and 73, de  
Do a web search for the "Montreal Fox". I've built one that works OK. The circuit board that's available is quite rough, but the thing is buildable.

Tim Wescott  
Wescott Design Services  
<http://www.wescottdesign.com>

Posting from Google?  
See <http://cfaj.freeshell.org/google/>

"Applied Control Theory for Embedded Systems" came out in April. See details at <http://www.wescottdesign.com/actfes/actfes.html> Mike Andrews wrote:

I'm looking for something that doesn't involve using an HT. I'd lots rather use the HT on the fox hunt, and not risk having it stolen.

Losing a transmitter/controller would chap me considerably, but losing my HT would be bad.

I would think you could get \*used\* HTs pretty cheap.

For that service, you don't need fancy scanning features etc. -- something like an old IC-2AT would do fine - and since you're going to need to power the keyer anyway you don't really need a workable battery with the HT.

I would think you could find something useful for less than the cost of a new transmitter kit or the parts to build one.

--  
 Doug Smith W9WI  
 Pleasant View (Nashville), TN EM66  
<http://www.w9wi.com>  
 On Fri, 6 Oct 2006 09:35:30 -0400, Yuri Blanarovich <K3BU@optonline.net> wrote in <PYsVg.73 \$Jl6.13@newsfe08.lga>:

In absence of dedicated controller, you could use  
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# Projects for the Holidays

(Continued from page 2)

one of the memory keyers, AEA comes to mind. They have beacon mode, where you can program message and set the repetition time.

73

Thanks, Yuri. If nothing else comes up, I may go to that, or roll my own.

If I wind up doing the full-tilt-boogie 5-transmitter foxhunt, I'd really prefer not to buy 4 more HTs, for that matter. 5 ammo cans, each with a transmitter/controller and a battery inside and a BNC or SMA jack through the lid, would be a lot more affordable.

73, de

{—}

## CMOS twin oscillator forms micropower metal detector

by Mark E. Anglin

Novar Electronics, Barberton, Ohio

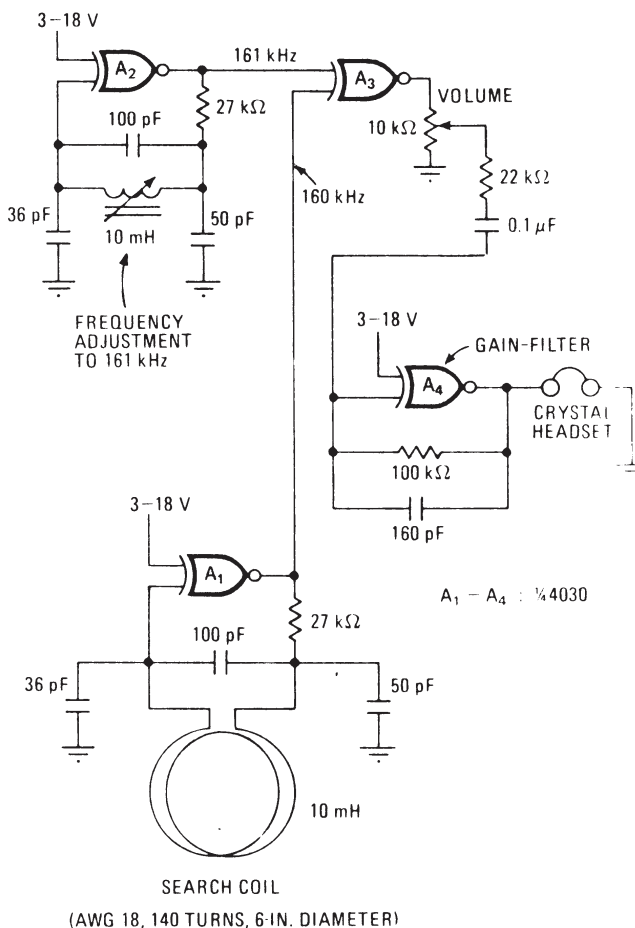
A battery-powered metal detector can be built with the four exclusive-OR gates contained in the 4030 complementary-metal-oxide-semiconductor integrated circuit. The gates are wired as a twin-oscillator circuit, and a search coil serves as the inductance element in one of the oscillators. When the coil is brought near metal, the resultant change in its effective inductance changes the oscillator's frequency.

Gates A<sub>1</sub> and A<sub>2</sub> in the figure are the active elements in the two simple oscillators, which, are tuned to the fundamental frequencies of 160 and 161 kilohertz, respectively. A<sub>1</sub> serves as a variable oscillator containing the search coil, and A<sub>2</sub> oscillates at a constant frequency.

The pulses produced by each oscillator are mixed in A<sub>3</sub>, and its output contains sum and difference frequencies at 1 and 321 kHz. The 321-kHz signal is filtered out easily by the 1 MHz low pass filter at A<sub>4</sub>, leaving the 1-kHz signal to be amplified for the crystal headset connected at the output. The headset has a high impedance (2,000 ohms) and therefore will not impose a big load on A<sub>4</sub>.

A change in the output frequency indicates a frequency change in the variable oscillator due to the mutual-coupling effect between a metal and the search coil. The device's sensitivity,

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**Metal detector.** Two oscillators and a search coil form a simple metal detector. Objects near search coil change A<sub>1</sub>'s frequency oscillation and the 1-kHz output note produced by the mixing oscillators A<sub>1</sub> and A<sub>2</sub>. A<sub>4</sub> amplifies and filters audio signal.

## CMOS twin oscillator forms micropower metal detector

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determined largely by the dimensions of the search coil, is sufficient to detect coin sized objects a foot away.

This device's effectiveness derives from the twin oscillator approach, because it is not feasible to directly vary a single oscillator

operating at 1kHz. An oscillator operating in this range requires high values of L and C, and these elements would load down the gate and consequently reduce circuit sensitivity. In addition, the cost of high-value inductors and capacitors is great.

## Packet Radio Under Linux

By Jeff Tranter on Mon, 1997-09-01 01:00.

Linux and ham radio share a common spirit of cooperation, experimentation and do-it-yourself attitude. These two interests come together in packet radio.

In my teens I spent many enjoyable hours tinkering with radio equipment and communicating with other "hams" around the world through the medium of amateur radio. Moving away to attend a university and start a career and family meant that my hobby had to go on temporary hiatus for a number of years. Recently, I came back to the hobby and decided to explore an area of amateur radio that didn't exist in my teen years--digital packet radio. As an avid Linuxer, I was intrigued to see how I could use my Linux system for packet radio. I was on a limited budget, and wanted to get started without investing in a lot of hardware and software.

### What Is Ham Radio?

Amateur radio is a pursuit enjoyed by millions of "hams" around the world. By international agreement, most countries have allocated a portion of the radio spectrum for amateurs to experiment with radio technology. The hobby goes back to the early days of radio and is popular with people of all ages. Operating an amateur radio station requires an operator's license, which can be obtained by passing an examination that covers radio theory, regulations, operating practices and basic electron-

ics. Full privileges also require a knowledge of the International Morse Code (yes, it is still used) although some countries now offer no-code licenses that typically include restrictions in operating modes and frequencies.

Hams are known for building their own equipment and accessories, experimenting with new technologies and helping each other and the public. This is close to the spirit of Linux, so it is not surprising that many hams are also Linux users.

### What is Packet Radio?

As personal computers became increasingly powerful and affordable, amateurs looked at using radio for digital communications. Packet radio is one such method in which text is encoded as binary data and transmitted via radio in groups of data, called packets. One popular protocol developed for this purpose is AX.25. Based on the X.25 protocol but adapted for the special needs of amateur radio, it offers error-free, packet-based communication between stations. Other protocols, such as TCP/IP, can run on top of AX.25. A few of the applications of packet radio include chatting by keyboard with other hams in real-time, using packet bulletin board systems, sending electronic mail, and connecting (via gateways or worm holes) to other packet networks or to the Internet. Data rates range from 300 bits per second on HF (High Frequency) bands to 1200 bps on VHF (Very High Frequency) and 9600 to 56Kbps and beyond on UHF

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## Packet Radio Under Linux

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(Ultra High) frequencies.

### What Kind of Packet Radio Hardware Do You Need?

A typical packet radio station consists of a computer or terminal connected to a Terminal Node controller (TNC), and radio transceiver (transmitter/receiver). A TNC is a device containing a small microprocessor, dedicated firmware in ROM, and a modem to convert signals back and forth between audio and serial bit formats, and also encodes and decodes data with the AX.25 protocol. A typical TNC connects the radio to the computer via its serial port.

Another popular option is the "poor man's modem-only" Terminal Unit (TU). It essentially has a modem chip sandwiched between its audio and serial port connectors. Software drivers on the computer must therefore handle all of the AX.25 protocol. It's popular because of the price--typically one third the cost of a TNC.

The typical DOS-based packet setup has a number of limitations. Since the system is single user, the computer must be dedicated to packet and cannot easily be used for other purposes. Generally, the computer is used as a dumb terminal or dedicated software is used that takes over the whole computer. Although some software packages such as JNOS run on XT or AT class machines, Linux typically runs better on a 386 machine having limited memory than a commercial operating system alternative such as Windows 95.

Packet software is either free or distributed as shareware in binary form. Some packages, notably JNOS, are also available as source code.

### What Does Linux Offer?

As of release 2.0, Linux has native support for

the AX.25 protocol built into the kernel (a unique feature among operating systems). For earlier releases, Alan Cox's AX25 package is easily patched in. Furthermore, AX25 is integrated with the rest of the Linux networking code and utilities. To Linux, a packet radio interface appears as just another network interface, much like an Ethernet card or serial PPP link.

The kernel contains device drivers for serial port TNCs as well as several popular packet modem cards. It even offers a driver that uses a sound card as a packet modem (more on that later).

Once up and running, you can let users telnet into your Linux system via packet radio, offer them a Unix shell or one of several BBS programs, or even let them surf your system with a web browser. Thanks to Linux's multiuser and multitasking capability, this occurs without affecting the normal use of the system.

A Linux machine can act as a router to connect packet network traffic to a LAN or Internet connection and can route e-mail via packet. You can have multiple packet interfaces with many simultaneous connections over each interface.

### Back to My Story

My first introduction to packet was using the sound card modem driver with a hand-held 2-meter band transceiver for 1200bps packet. The audio connects from the PC sound card to the radio's microphone and speaker jacks. A signal from a serial or parallel port in conjunction with a simple (one transistor) circuit is used to control the radio's PTT (Press To Talk) circuit. This approach requires no TNC and no packet modem--if you already have a computer and sound card this costs almost nothing. Figure 1 shows a block diagram of my setup.

Configuring the system was straightforward--I just followed the detailed instructions in the AX25 HOWTO. Utility programs included with

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## Packet Radio Under Linux

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the AX25 package allow me to monitor the packets being broadcast and received, and to call and answer other packet stations.

I obtained an IP address from the local IP coordinator (the 44.x.x.x ampr.org Internet domain is assigned for packet radio) and configured my system for TCP/IP over packet. All the standard network tools then operated over packet. Assuming they are configured for TCP/IP, I can ping or finger other stations and connect to them using telnet. Similarly, I can log on to my home Linux machine over the Internet.

Next I plan to set up a simple BBS system users can log on to via packet radio. I'd also like to look at more sophisticated packet networking tools supported under Linux, such as NetRom, NOS and Rose. In the future I may even explore options for higher-speed packet such as the 56 Kbps Ottawa PI2 card.

### Conclusions

As well as being fun, packet radio under Linux taught me a lot about networking, much of which is also applicable to Ethernet, X.25 and other network protocols.

Linux is a great platform for packet, particularly since it is fully integrated with the rest of the networking subsystem. Its reliability lets you leave a Linux system up for long periods of time without crashing (ideal for a BBS environment). As an example, one local Linux system has been on the air continuously for over 310 days without interruption. Some of the software I used was still in alpha release yet was stable enough to use. Finally, packet radio has opened up a whole new area of Linux for me to explore, ensuring that I won't run out of things to do in the foreseeable future.

### Acknowledgments

Thanks go to Gord Dey, VE3PPE, for reviewing this article and adding many valuable suggestions. I also wish to thank Terry Dawson for writing the AX25 HOWTO and utilities, Alan Cox, Jonathan Naylor and others for writing the Linux packet code and Thomas Sailer for writing the sound card packet modem driver.

Jeff Tranter is the author of the Linux Sound and CD-ROM HOWTOs and the book Linux Multimedia Guide, published by O'Reilly and Associates. His hobbies beyond Linux and ham radio include playing guitar, cross-country skiing and lava lamps. His ham radio call sign is VE3ICH and you can reach him via e-mail at [jeff-tranter@pobox.com](mailto:jeff-tranter@pobox.com).

## The Half Sloper Antenna

Here is an inexpensive, compact, and easy to build antenna that's great for DX

Here is an antenna that will cover 160, 80, and 40 meters. It's inexpensive, easy to construct, and will fit on a small city lot. It's also great for DX. It's called a Half-Sloper.

The Half-Sloper (or quarter-wave sloper) has a low angle of radiation and exhibits some directivity in the direction of the slope. The antenna's polarization is vertical. By using the loaded coils described below, a 3-band sloper can be constructed to fit into less than fee of yard space.

### Materials

The antenna is constructed of # 14 stranded, insulated wire. The loading coils are made with # 16 enamelled magnet wire on 1 1/2-inch I.D. diameter, schedule 40 plastic pipe. Scrap pieces of 1/4-inch-thick acrylic are used for the insulators inside the coils. You can buy these items in most hardware or electrical -supply stores.

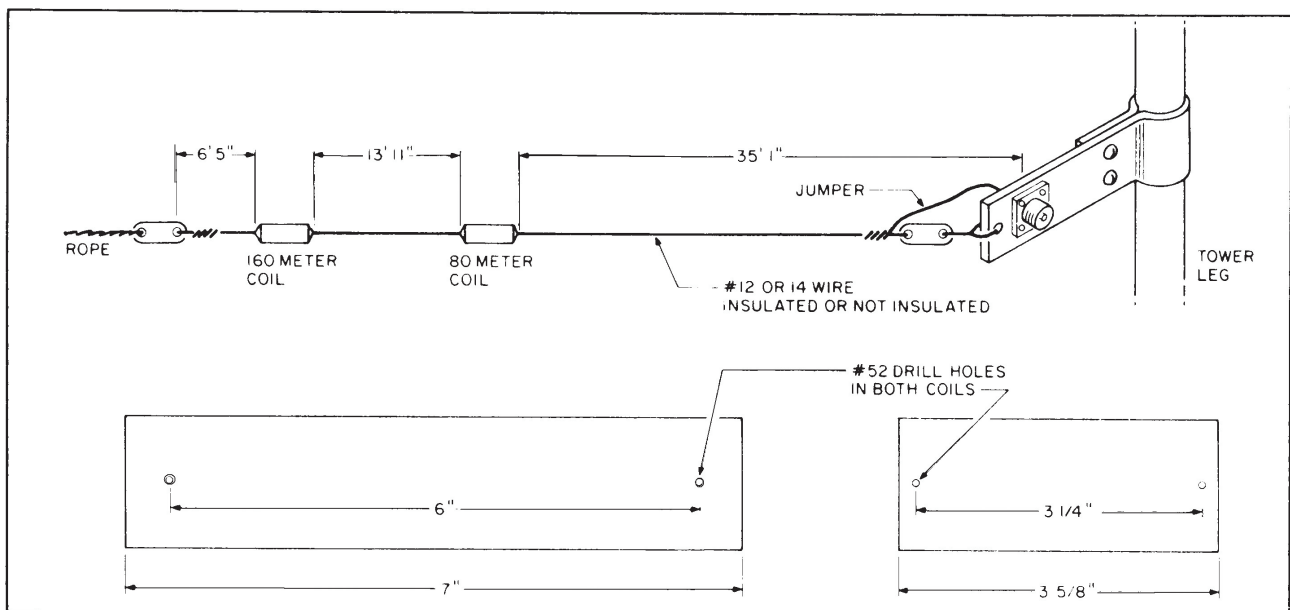


Figure 1. Diagram of the half-sloper showing details of the assembly and coils.

The 7 band sloper described was built by my own club member, Joe Gabor WA8WEQ. Joe is retired and has built a dozen or so of these antennas for members of the Steubenville-Weirton Amateur Radio Club. (Don't you wish you had him in your club!)

### Building the Half-Sloper

First, make the loading coils by winding the #16 stranded, insulated magnet wire. Next, fasten the end of the antenna wire coming from the tower to one end of a piece of Acrylic that has been cut to fit inside the 80-metre coil. Take the other end of this piece of Acrylic and put it through the coil; then fasten it to the beginning end of the 13-foot 11-inch

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## The Half Sloper Antenna

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length of antenna. Solder jumper wires from each end of the coil to the antenna (Figure 1).

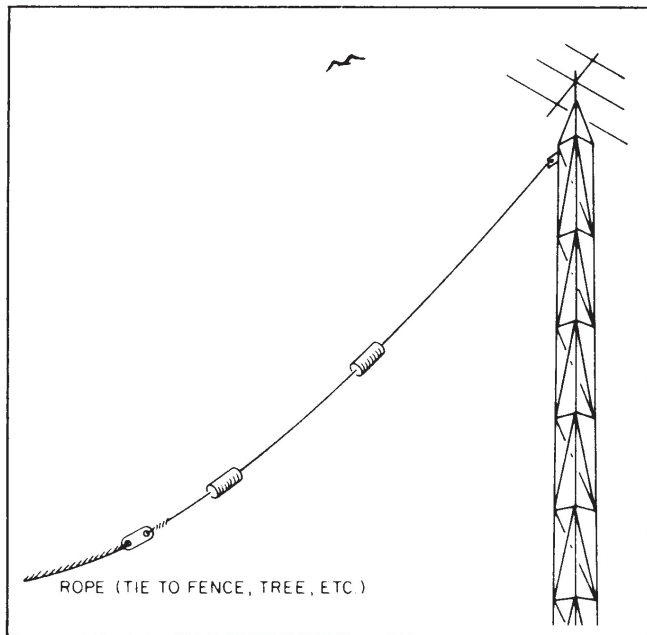


Figure 2. Half-sloper in position on tower.

Now, fasten 13-foot, 11 -inch piece of antenna to the next coil (the 160-meter coil) in the same way, and then fasten last length of antenna to the other end of the 160-meter coil. Make this last piece of antenna a few feet longer than the 6-foot, 5-inch length needed so you have wire to play with when you are adjusting the antenna. Solder jumpers to the coil ends as before.

A piece of scrap aluminium or other metal can be used to fabricate a clamp that can be fastened to the tower leg to hold the antenna and the SO-239 to which the RG-58 feed line is attached. There will be a jumper from the centre of the SO-239 to the antenna, of course.

### Operation

Having a sloper makes for some lively discussions on the ham bands. Some swear by them; others wouldn't own one. But it's a great

antenna to experiment with.

My sloper angles down from a 30-foot tower (Figure 2) on which are mounted a 4-element tri-bander and an 11-element, two-meter beam. I also have a 160-meter dipole that is only 35 feet at the apex.

While writing this article, I disconnected the sloper from the antenna tuner and connected it directly to my Yaesu 757 to check the swr. I got 1.3 on 1925 kHz, 1.5 on 3860 kHz, and 1.1 on 7150 kHz. The swr changed rather rapidly as I changed frequency on 160 and 80 meters, but remained almost flat over the entire 40-meter band. I felt these results were to be expected with this length antenna. Received signals, especially in the direction of the slope, the favoured direction, were as good as and often better than they were with my dipole.

All installations are different. Your results could be totally different from mine. Variations in height, grounding, and surrounding objects certainly affect antenna performance. But try it! Experimenting with antennas is part of the fun!

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**Bulletins** (Sundays at ...)  
11h15 Start call in of stations  
11h30 Main bulletin start

**Frequencies**

439.000MHz 7.6MHz split  
Input: 431.4MHz (West Rand Repeater)  
145,625 MHz (West Rand Repeater)  
10,135 MHz (HF Relay)

**Radio Amateurs do it with more frequency!**

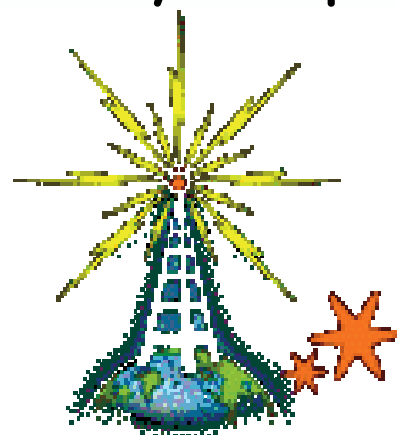
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## West Rand members - we need your input!

To make this the best ham radio magazine in South Africa we need your input. Please submit articles, comments, suggestions etc.

Please send plain text with no formatting to the email address below.

In July 2003, we re-published an Anode Compendium on CD. It has the issues from July 2000 until June 2005. This included the new Adobe reader. It has been updated, check with the chairman for details.



**We need your input! Email us articles, comments and suggestions please.**  
[john\\_brock@telkomsa.net](mailto:john_brock@telkomsa.net)