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**Antique
Wireless
Association of
Southern Africa**

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- * Secretary/PRO—
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- * Western Cape—John
ZS1WJ
- * KZN—Don ZS5DR

AWA Newsletter

96

January 2014

Reflections:

Already in to the first month of the New Year and we are starting to stare down another year of radio activity, rebuilding, re-furbishing and doing whatever it is that keeps us occupied and off the streets and out of trouble.

We have some exciting opportunities coming up for the AWA as we continue to reach in to the Amateur fraternity, with a few invitations to attend various gatherings and tell people more about the AWA.

There is of course the usual AWA activities coming up and hopefully we can get enough people to join in on those activities and make them a fun time for all.

The CW activity day on the 2nd of February, the AWA AM/SSB QSO party in May and October, and then all the other planned activities

to keep us busy over the weekends.

How well I remember the days when I was always looking for something to do in my shack. Time was always there and was often well spent on making QSO's local and DX and then sitting back with my thoughts dwelling on the few good QSO's I had just had.

What ever happened to that "time" ? What has changed in our lives that today one has to always try to make time to get out to the shack, never mind to still switch on and make some contacts.

Maybe its an age related thing ? You know, the older you get, the longer it takes to do things therefore the less time you have. Then the old adage of "Don't leave for tomorrow what you can do today", also goes west, because you are constantly

leaving more and more things for tomorrow because you can't finish them all today. Eventually one has such a backlog, that you start looking for ways to get rid of them. Make the list shorter.

Whatever it is, gone are the days of lounging around wondering what to do with your life. Unless of course, like me, you have reached the stage where you would rather think about what has to be done and then think about it properly so as to make sure there is nothing left out, before actually starting to do it. That way at least, one can ensure the job is done properly and to satisfaction.

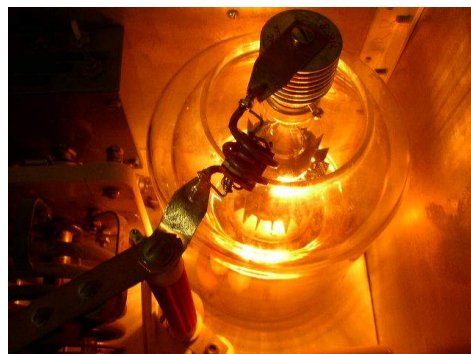
Looking forward to hearing many more of you on frequency than last year.

Best 73

DE Andy ZS6ADY

WIKIPEDIA

The tetrode has four concentric electrodes: the cathode, a narrow tube down the center, heated by a heating element; two grids, the control grid and screen grid, consisting of wire screens surrounding the cathode; and the plate (anode), a metal cylinder surrounding the grids. It functions similarly to the triode, from which it evolved. A separate current through the heater heats the cathode, which causes it to emit electrons into the tube. A positive voltage is applied between the plate and cathode, causing a flow of electrons from cathode to plate through the two grids. A varying voltage applied to the grid nearest the cathode, the control grid, can control this current, causing variations in the plate current. With a resistive load in the plate circuit, the varying current will result in a varying voltage at the plate. With proper biasing, this voltage will be an amplified (but inverted) version of the AC voltage applied to the control grid, thus the tetrode can provide voltage gain. The tetrode was developed to correct deficiencies in the triode tube. In the triode, the control grid was next to the plate. Capacitance between these two electrodes caused instability and oscillation, and several undesirable effects. To reduce this capacitance, a second grid was added between the control grid and the plate to make the tetrode.



4-1000A 1 KW power tetrode in an amateur radio transmitter

CW Net:

The AWA CW activity day is coming up on the 2nd February. I wonder if we are going to be able to motivate a few new call signs to come up and give away some points ?

Here is your opportunity, all of you who have been threatening to come back on to CW and get yourselves going again. No need to rag chew, just practice your call sign, name and grid locator and be able to read the other guys information, and you are well away.

I am afraid I don't have any money to offer to bribe or motivate anyone, but surely there must be some kind of incentive. Maybe we could extend the 10 year QSL card to all those who come up and get in contact with ZS0AWA/CW ? Seen as March was the anniversary date, we have not quite completed the year of celebration yet.

I am prepared to help out in any way to try and get this activity day back on track again. It would be so nice to hear the local bands alive with CW for a change. (that doesn't mean you can now break out in to singing)

I hear more and more of local hams who are finding their way back to CW, but are turning to the DX bands, because there is not enough activity locally. It would be such a pity to lose this section of the band to commercial users because we can't occupy it.

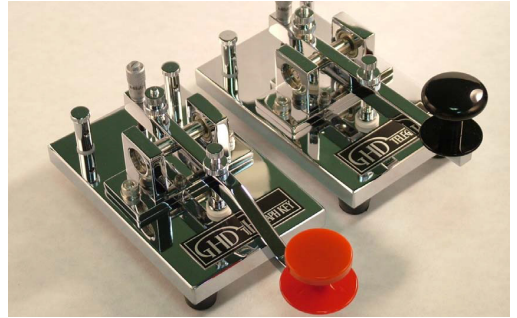
So get out your keys, bugs paddles, whatever it is that you use or used for CW and put in a bit of practice over the next few weeks.

One does not have to be perfect to get going again, and you will find that CW operators are very patient people. They

will take their time and repeat call signs and numbers for you if you don't get it right first time.

Here's hoping for a good report in the next Newsletter of how successful our CW activity day was and all the callers that were recorded.

De ZS0AWA/CW ...-.-...



Deluxe HG Hand Keys

SSB activity:

It would seem that bands just will not improve to the kind of conditions we have been long used to. Propagation to the Western Cape on 40 m tends to elude us after about 09:00 in the morning.

The 20m relay has proved to be quite useful, but unfortunately due to some gremlins creeping in, we have not been able to use this the last 2 weeks. We will of course always try to keep the relay going to encourage as many stations in the Western Cape to call in on the National net as we can.

As I write this article, I have found a glitch in my 20m beam after a rather big storm a week ago. It would seem that my tribander beam has taken a lightening strike and has some damage that will take a while to repair.

Unfortunately, this means I will not be able to keep the 20m relay running until some repairs can be carried out.

Keeping in touch with as many as possible on the AWA net is one of our prime objectives, so even if you just want to call in and then go walkabout, please do.

We do appreciate those who regularly call in on the nets and for most times, the rest of the land seems quite accessible on 40m.

The Western Cape net on a Saturday morning is still getting good attendance as more and more warm to the idea of a net where one can use your old valve rigs to chat with other likeminded hams.

With Don ZS5DR now being elected as the

Division 5 Liaison, perhaps the div 5 guys would like to get a net up and running there at a suitable time ? Suggestions would be welcome.

Look forward to hearing you on Frequency.



HRO 500

AM:

The AM net seems to be one that survives the best in the current conditions.

Saturday mornings are still good with quiet bands and fairly good conditions down to division 5 until the sun starts to have its way on the D layer.

But even after that, conditions locally stabilise for the duration of the net and the time we have is certainly well used.

There is certainly a return to AM more and more as more of the old rigs find their way back in to the hands of many restorers. Many of the rigs coming back are sometimes in good condition, but more often than not, they need good bit of TLC to get them back in to good operational condition.

It is thanks to many who decide to not throw

these fine old rigs on to rubbish dumps, but rather seek out someone or some organisation that is working to restore and use these bits of history and make them talk again.

Painstakingly put back together with minimal modifications to them, they are finding their way back on to the airwaves and certainly making their mark again.

I always admire those who have the technical ability needed to restore these rigs, although valves certainly do not have the complicated circuitry that today's modern rigs have, one still needs a good knowledge of electronics to get around them.

Often, a question asked is what will happen when we, who are so actively involved in restoring and using these rigs, pass on to

greener pastures ? Will there always be those around who will keep the glow of these rigs burning ? Will there always be someone who is interested in keeping this bit of our amateur heritage alive ?

I certainly hope so !



Hallicrafters SX28

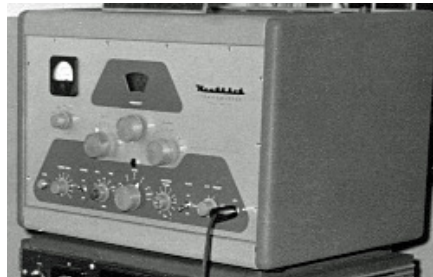
DX100 : Classic or Compromise ?

By Richard ZS6TF AWA Historian

The Heath Company began as an aircraft company in 1912 founded by Edward B Heath. Starting in 1926 it sold a kit form light aircraft, the Heath Parasol. Heath died during a 1931 test flight and the company declined into bankruptcy. Howard Anthony acquired the company in 1936 and focused on selling accessories for small aircraft. After World War II, Anthony bought a large stock of surplus wartime electronic parts with the intention of building electronic kits with them. In 1947 The Heath company of Benton Harbor Michigan introduced its first electronic kit, the O1 oscilloscope that sold for US\$50, when commercial scopes were 5 times the price, and it went on to become a huge seller.

Heathkit launched their first amateur radio kit in 1954 with the AT-1, a simple, three tube, crystal controlled transmitter. It was capable of operating CW on the six most popular amateur short wave bands, and sold for \$29.50.

The Heath company's first full featured transmitter kit, the DX-100, appeared in 1956. It filled two catalogue pages, including schematic diagrams, two interior pictures and a block diagram defining Heathkit's future commitment to the radio amateur market.



The original Heathkit DX-100 Amateur Transmitter had a more rounded case, 15 valves, with 100 to 140 watts output CW or AM on all seven short wave amateur bands. It had a built-in power supply and VFO, and weighed 100 pounds. It had a copper plated chassis which was soon replaced with a plated steel platform and a separate Aluminium top plate. Heathkit didn't compromise where it mattered like superior iron, and clamp valve protection on the finals, but the tacky plastic knobs with aluminium grub screws often got changed.

Priced at \$189.50, it was still hard for most amateurs to afford but compared to the Collins 32V3 having similar features priced at \$775 it was bargain. The circuitry had the advantage of simplicity over the Collins because it used a carrier frequency VFO instead of multipliers and modern high performance 6146's in the RF finals instead of the single war surplus 4D32 in the Collins.

The DX-100 was upgraded in 1959 to the DX-100B (there was apparently no DX-100A) and sold for the same price. (The Author's DX100B in good company, left)



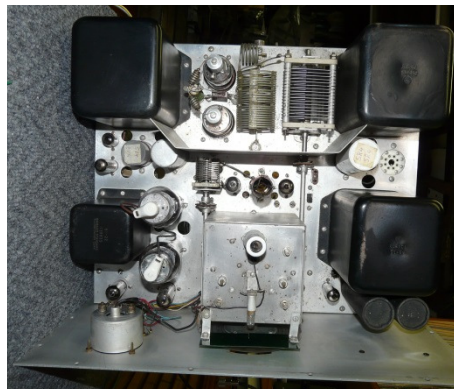
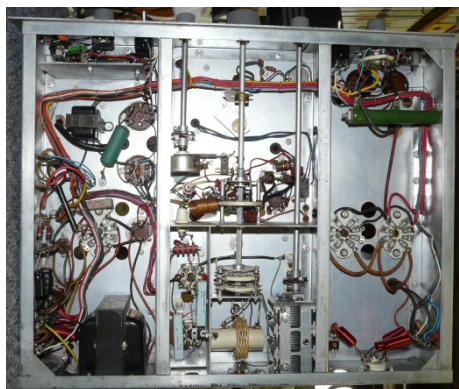
The DX 100U (for "Universal") was the international version of the DX 100B produced by Heath (UK) and was sold out of their operation Daystrom Limited in

Gloucester, like all model numbers with the "U" suffix.

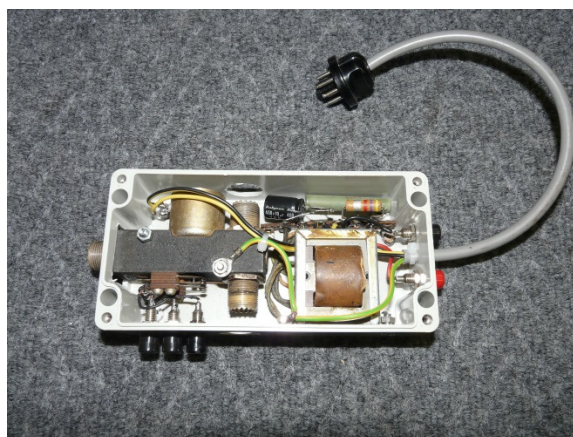
The main difference with its progenitor for the American market was that the mains transformer had primary taps for European mains voltages. American transformers were made by Stancor or Hammond whereas the British transformers came from Woden. Other differences were different front panel paintwork, and a different tube complement. 6CH6 tubes are used as the audio and RF drivers in place of the 12BY7 and 5763 respectively, and KT88 modulator final valves instead of the 1625's. The rear apron was fitted with a toggle switch used to reduce the PA input to 10 watts for 160 metres to suit the British regulations. (ZS6TED's unit below right)



ZS6TED's Unit (above)



The "open plan" chassis lent itself to easy assembly by unskilled owners but it could be a great TVI producer due to the non-shielded final stage. The transmitter had no automatic switching internally and the mains switch to the plate supply transformer has an extra contact routing mains voltage to an octal auxiliary socket on the rear apron. It was left to the owner to cobble up whatever antenna switching and muting arrangements suited his receiver. The classic Dow-Key relay did the job the best.



The arrangements for the 75A4 require a +20 volts DC for muting.

The most often molested area in DX100's is the speech amplifier and modulator where misguided and inexpert creativity has taken its toll. There are sensible enhancements to the audio quality which are well documented and for the CW operator the grid block keying mod is a worthwhile improvement to eliminate chirps or clicks from the keyed oscillator. The VFO has come under a lot of criticism but on test the authors rig after a 30 minute warm up period was stable, the VFO only drifted down from 3615.19 to 3615.04 ie 150 Hz in 4 hours.

Building a Heathkit required time, patience, and the ability to follow directions; given these, the risk of failure was small. Heathkits were absolutely complete except for tools and solder. The instruction books were regarded as the best in the industry, extremely clear, beginning with basic lessons on soldering technique, and proceeding with explicit instructions, illustrated with line drawings called "pictorials", and a box to tick as each task was accomplished.

On March 30, 1992, the end came. Heath announced that it was liquidating its kits and leaving the business after 45 years, an event important enough that it was reported on the front page of the New York Times.

Built to last another war, with maintenance these transmitters will run for another 100 years! Today nearly 60 years after launch there are many DX100's still doing sterling service due to the increasing popularity and interest in AM transmission, de facto recognition for a transmitter which became a "Classic" in it's time.

Tuning up a tube-type amplifier properly.

By Matt Erickson KK5DR

Introduction

This guide is primarily written for those who are new to HF tube-type amps, or anyone who wishes to get the most out a Linear amplifier.

I have found that this procedure works well with all HF amps that I have used, regardless of the type tube used.

First, we must understand why a Linear amplifier must be tuned in this manner.

Plate impedance

The voltage used, relates to the "Plate impedance", each amp is designed to operate at a given plate impedance. The plate voltage can be reduced, or increased, but the plate current must be increased or decreased, to meet the plate impedance level. A person can think of a tube type RF amplifier much like a antenna tuner, matching the tubes plate impedance, to the output impedance which is usually 50 ohms on the output end. The relationship of plate voltage to plate current creates the plate impedance level, which can range anywhere from 500 to 5000 ohms or more, dependent on the voltages used and the plate current needed to reach full power output. Changes in plate voltage, can create plate impedance mismatches, which cause output waveform distortions, and loss of efficiency. Large swings in plate voltage, due to a poorly designed power supply, or a power supply that is operating beyond it's capacity, can also create this same type of distortion. In my judgment, a swing that exceeds 500 volts is enough to cause distortions in the output signal.

To tune an amp at a lower voltage, then increase the voltage to operate on, creates a mis-match in the plate impedance.

Problem; Many amps can't stand a steady carrier tune up in high voltage mode, due to limitations of the power supply design and components.

Solution; Use a reduced "duty cycle" method to tune the amp in high voltage mode. Hence, the "pulsed" tune method, which has a duty cycle of about 50%.

One can use a store bought "pulsar, cricket", or a CW keyer, many of the transceivers available today have built-in keyers too. For using a CW keyer (which is more commonly available), set the keyer to about 40-50wpm, then tune the amp with it.

Step 1. Set the amp in the voltage mode, you intend to use on the air, low or high, it does not matter. For a person wanting to run lower power most of the time, use the lower voltage, it will be more efficient.

Step 2. Set the exciter to whatever level that increases the plate current by double above the idle "zero-signal" current level.

Step 3. Preset the amp, to the manufacturers suggested settings, if available. Set the exciter to CW mode, ready to start transmitting a "string of dits" (30+ WPM).

Step 4. Begin tuning the amp, by "dipping" the plate current (while transmitting), this resonates the plate circuit.

Step 5. While still transmitting into the amp, tune the load control, for "peak" RF out put. Un-key when this is done.

Step 6. Repeat the tune cycle by again doubling the plate current, or until the maximum plate current is reached.

Step 7. Increase the exciter's output until maximum plate current is reached. (Note; care must be used, not to exceed the amp's plate & grid current ratings, if you reach MAX, plate current before reaching MAX exciter RF drive level, that is it, you can't drive the amp any farther.) (ie. If your amp has a MAX. plate current rating of 900ma. & 225ma.grid current, do not exceed these ratings, if you do, reduce exciter drive level.)

Step 8. At this point leave all settings where they are, now tune the "load" control to "over-couple" the amp loading, refer to ("**Grid current Rule # 1**"). Heavy loading is known as "over-coupling". This is the final tuning step.

Step 9. Switch the exciter to the mode that you wish to operate on. SSB is usually used on the high voltage setting, low voltage, is used for all other modes, but SSB can be used there also.

Step 10. You can reduce the RF drive power, if you wish to run at lower than full output. Do not change the voltage, unless you retune at that voltage level.

Now that you have tuned up, the amplifier is operating at maximum efficiency, and linearity.

Tetrode tuning; A small variation for these amps is that most run a rather high level of idle plate current relative to a triode type amp (typically 20% of the full load current). So, rather than doubling the plate current, one should add drive signal until about 1mA. of grid current is observed, or max plate current is reached, then tune as one would a triode amp with the steps above.

ALC!

Any ham operator that does not use an ALC feedback circuit to control the exciter RF output to the amp, is an **idiot**. It is there

for a reason. Most amplifier manufacturers have installed an ALC output on their units. It does not matter if your exciter can put out enough RF to overdrive the amp or not. Drive level is only one item the ALC system controls. Should the amp be loaded into a high SWR, the ALC will reduce the drive level to a safer level. Every ham has had a "lapse" in memory, and left the RF drive level too high when using an amp, and this can cause unseen damage to the grids of the tube. This is especially true of delicate metal/ceramic tubes. The ALC system will act as a "safety net" should an error be made or a failure in the antenna system happen. It is inconceivable that someone would knowingly do without it.

Most ALC systems can be set in the following manner;

1. Load the amp in the normal manner to full output, with full RF drive needed to reach max RF output level.
2. Adjust the ALC threshold (usually a pot on the back of the amp), until the RF output is reduced slightly, then back up the adjustment slightly.
3. You're done. No further adjustment is needed. If the ALC system was designed correctly, the system will operate without re-adjustment on all bands.

Now you can rest easy, knowing that your amp is protected from overdrive, or other problems.

Grid current; Rule # 1, Less is better!

Once you have tuned the amp for max output, you can reduce the grid current, by increasing the loading. (Loading is increased by reducing the load capacitor capacitance, this couples the RF to the antenna where it should be.) This will reduce the grid current drastically, with a small drop in RF output power. (OK, you ask how much of a drop in RF output? The general rule is 10%, (i.e. 1000watts out, reduced by 100watts or more.) The drop in RF output, is well worth the lower grid current, which will greatly increase the life of the tube (especially metal/ceramic tubes). The drop in grid current should be somewhere in the area of 30-50%, (ie. full drive grid current of 200ma, should be reduced to 150-100ma.) This is for triode type class AB2 amps.

For a tetrode type amps running class AB1, **NO** grid current is the rule. In these amps any level of grid current indicates over drive or a mis-tune condition.

If you turn the load control the "wrong way" the RF output will "peak", and the grid current will remain high, but if you turn the load control the correct direction, the RF output will drop slowly, but the grid current will drop quickly. This can vary from one make of amp to another, to verify the correct tune direction, look inside the unit to see which direction "un-meshes" the load capacitor, that is the direction of "heavier loading", the "correct" direction.

Care must be taken not to "over-load" the amp, as this will cause as much problems as "under-loading" can. Do not exceed the levels stated above.

A good rule of thumb is; Tune for peak RF output, and lowest plate current, then load the amp slightly to lower the grid current slightly.

Peak RF output and minimum plate current should happen at the same tune point (if the amp is designed properly and has no instability problems).

Now that you have tuned up using this procedure, your amp will now operate cooler, and with a lower IMD level, for a "cleaner" output signal & your tubes will last longer.

The use of the CW keyer puts a lower stress on the tube, power supply, and all RF components. The speed of the pulses, gives a good meter indication, and makes it easy to tune.

Nearly all HF linear amplifiers can benefit from these methods. Even if your amp has only one voltage setting, you can use the procedures.

A suggestion: Make a "cheat-sheet", or chart, with the tuned up, settings at a given frequency. In this way, you can set the amp by number, and fore-go, the tune-up procedure, less tune time, means longer tube life. (not to mention on-air QRM) With some HF amps, the tune dials are marked, 0-100. I found that "setting by number", is fast, and works very well, with no noticeable drop in output power. A cheat sheet for high voltage, and low voltage, are needed, as the settings **WILL**, be different.

Caring for your RF power amp [tubes](#).

Why does the plate current dip, at the same point the RF power output peaks?

This is called "energy transfer" due to plate/load "over-coupling". Imagine a round topped hill with a "dimple" in the very top of it. This depression at the top of the hill is where the plate current dip happens. If there were no antenna/load circuit, the plate current would peak, like a hill with no "dimple" at the top, but no output would take place since all the energy in the DC current returns as DC back to the B+ side of the PSU. Since all amps have an antenna/loading circuit, the RF energy flows to the load, and DC energy returns to the PSU. DC energy is converted inside the tube to RF energy, then couples to the load/antenna. The EIMAC "Care and feeding-" article goes into much greater detail on this topic. I hope this info helps the understanding.

Neutralization?

This applies only to "grid-driven" power amplifiers. This circuit reduces the stage gain slightly, and cancels out any instabilities in the PA. Generally, this circuit is used in grid-driven tetrode amps, where the stage gain in grid-driven service can be extremely high and therefore can be unstable. The circuit damps any tendency for the PA to oscillate. The PA must be re-neutralized on each band it is used on, it IS a tuned circuit. Some older PA(s) were neutralized only on the band that was most likely to cause oscillations when used.

None of the currently available tetrode PA(s) are neutralized, since they all use cathode-driven, passive resistor input networks. This lowers the stage gain, and stabilizes the PA. It also means the exciter drives into a 50 ohm resistive load on all bands. This is not really the best way to do it, as it provides no harmonic suppression in the input network, and it leaves the [exciter vulnerable](#) to a parasitic.

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Some of the more well known Linears:



Collins 30L1—4x811A



Yaesu FL2100B/Z—2x572B



Heathkit SB200—2x572B



Yaesu FL1000—4x6KD6

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**Antique Wireless Association
of Southern Africa**

Mission Statement

Our aim is to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yester-days radio's and associated equipment. To encourage all like minded amateurs to do the same thus ensuring the maintenance and preservation of our amateur heritage.

Membership of this group is free and by association.

Notices:**Net Times and Frequencies:**

Saturday 06:00—AM Net—3615
Saturday 07:00—Western Cape SSB Net—7080
Saturday 08:30— National SSB Net— 7140; relayed on 14140
Saturday 14:00— CW Net—7020
Wednesday 19:00— AM Net—3615, band conditions permitting.

Sunday 02 February:

AWA CW Activity.
Time 15:00 SAST to 19:00 SAST
Bands: 80m, 40m and 20m
Certificates will be issued for the highest scores.

AWA Western Cape Active Weekend Saturday 08 and Sunday 09 February.

The OAR Club will be holding the SARL field day activities at the farm of OM John ZS1DI, and being the good AWA members we decided to have our AWA outing at the same time and make it a real party.

We intend to have a couple of the old rigs operational plus some displays of the old equipment - we have been doing a lot of advertising on the news bulletins thanks to OM Matt ZS1MJJ so we are hoping for a good turnout.

There are camping facilities and places to park caravans as well as power points for those that need them.

I doubt that we will actually take part as serious contestants in the field day events but will certainly be there to give away points.

There will be a small Boot sale so maybe some bits will surface the could be of interest.

AWA at KARTS February Meeting, 08 February :

KARTS club meeting on Saturday the 8th February 2014 at 14h00.

The venue is at the Impala Voortrekker Centre in Allan Grove where we hosted the KARTS and AWA Combined Flea Market & Open Day event last year.