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WATTS

08 - 2008

Year 78 +8m

Monthly newsletter of the Pretoria Amateur Radio Club
Maandelikse nuusbrieff van die Pretoria Amateur Radio Klub.



PARC, PO Box 73696 Lynnwood Ridge 0040, RSA



<http://www.parc.org.za> mail: zs6pta@zs6pta.org.za

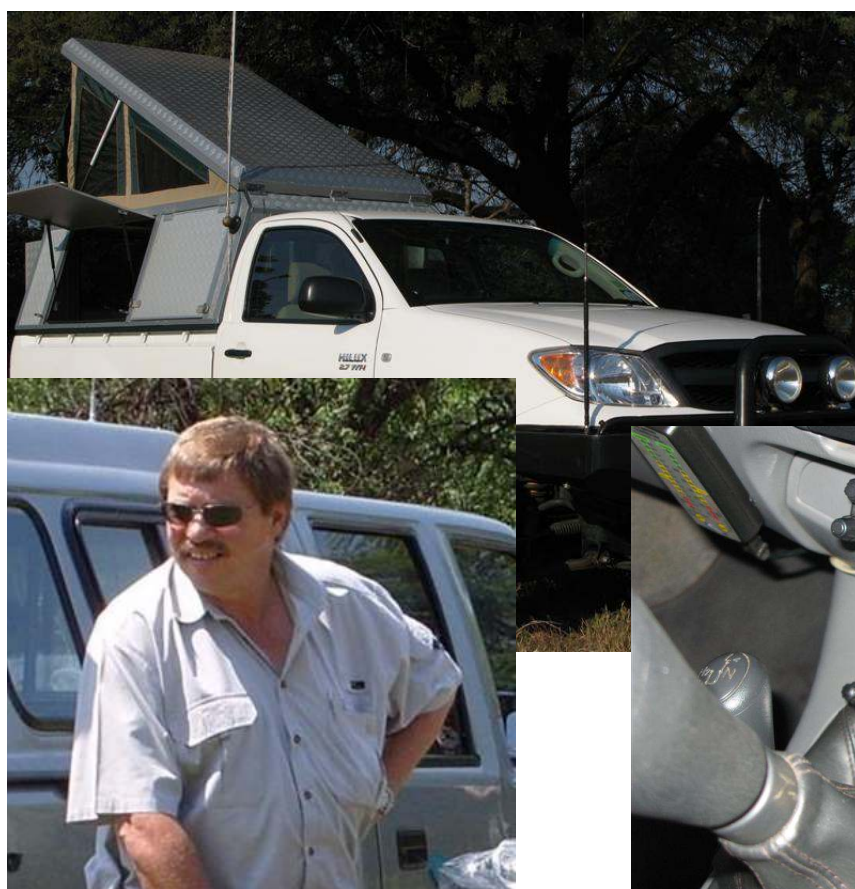
Bulletins :145,725MHz 08:45 Sundays / Sondae

Relays : 1840, 3700, 7066, 10135, 14235, 51400, 438825, 1297000kHz

Activated frequencies are announced prior to bulletins

Swapshop: Live on-air after bulletin 2m and 40m

Bulletin repeats | herhalings : Mondays 19:45 on 145,725 MHz



Mobiling members Mobiele lede

Lourens ZS6KRT is aktief op HF
mobiel en geniet ook die
buitelewe.

Sy voertuig is volledig toegerus
vir enige buite-geleentheid soos
uitkamp, visvang of net 'n
rondry-vakansie.

(nog fotos op ons gallery en
nuttige wenke op bl.6)

In this issue

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- Technical | Mobile wiring and fusing | Tegnies
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- Minutes | Notule
- Page eight 2007 AGM 2007 AJV Bladsy agt

In hierdie uitgawe

AGM Meeting 09 Aug 2008

Time: 13:00 for 14:00
PARC Clubhouse
South Campus
University of Pretoria
SE cnr University and
Lynnwood roads

PARC Management team / Bestuurspan Oct. 2007- Sept 2008:

Committee members					
Chairman, Fleamarkets	Alméro Dupisani	ZS6LDP	chairman@zs6pta.org.za	012-567-3722	082-908-3359
Secretary, Vice Chairman	Johan de Bruyn	ZS6JHB	secretary@zs6pta.org.za	012-803-7385	082-492-3689
Rallies, Social, Hamnet					
Treasurer, Database, DF hunts	Richard Peer	ZS6UK	treasurer@zs6pta.org.za	012-333-0612	082-651-6556
Repeaters, Technical	Craig Symington	ZS6RH	technical@zs6pta.org.za	083-259-3233	083-259-3233
SARL liaison	Pierre Holtzhausen	ZS6PJH	zs6pjh@qtsp.co.za	012-655-0726	082-575-5799

Co-opted / Geko-opteer:

Auditor	Position open				
Newsletter/Kits	Hans Kappetijn	ZS6KR	editor@zs6pta.org.za	012-333-2612	072-204-3991
Asset control	Andre v Tonder	ZS6BRC	andre.vtonder@absamail.co.za	361-3292	082-467-0287
Klubfasiliteite, vlooiemark	Willie Greyling	ZR6WGR	willie@up.ac.za		082-940-2490
Webmaster (non-member)	Chris		webmaster@parc.org.za		
Hamnet, projects	Roy Newton	ZS6XN	newtonr@telkomsa.net	012-547-0280	
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	Thobile Koni	ZS6TKO	toko40@mweb.co.za		082-493-2483
Tea	Molly Peer	ZR6MOL	molly@peer.co.za	012-333-0612	
	Doreen de Bruyn	ZR6DDB		012-803-7385	082-857-9691

Minutes of the monthly club meeting of the Pretoria Amateur Radio Club held at the South Campus of the University of Pretoria on 9 July 2008

Welcome: The chairman welcomed all present.

Present: See register, 22 members.

Apologies: Johan ZS6JHB, Ivan ZS6CCW and Sw.

Personal: Nico ZS6AQ has his tower up. Alméro ZS6LDP will not be standing as chairman next year. He had a near hijacking after the last committee meeting.

Minutes: The minutes of the previous meeting were accepted. Proposed by Alf ZS6ABA and seconded by Willie ZR6WGR.

Matters Arising: Deryck ZS6KQ had mentioned the roger beep, but it was not a complaint.

Meeting Time: A discussion followed on the meeting time. Members are asked to give the matter some thought, and to respond in writing by email to zs6pta@zs6pta.org.za or by fax to 0865186414. This will also be put on the Sunday club bulletin.

Correspondence: None.

Finances: The sum of the cash in the bank and on hand was reported to be R4390. The books are almost ready for the audit. Subscriptions will not change this year.

Club activities

Rallies: Johan ZS6JHB was not present. The next rally is 19 July at Bronkhorstspruit, the following one is 2 August at Witbank.

Fox Hunts: The fox is in hibernation.

Social: The next social will be the AGM with a bring and braai.

Projects: Roy ZS6XN reported that he had kits available for the both the 3 and 10 LED versions of the battery kits. There are various projects on the forum on the PARC website. Hans ZS6KR suggested better liaison with the SARL and other clubs on available kits.

Technical: Craig ZS6RH report that there is breakthrough averaging 3 minutes per day. This is caused by intermodulation products, one of which has an 88.5 Hz CTCSS tone.

Flea Market: The PARC winter flea market will be held on Saturday 26 July at the south campus of the University starting at 08:30.

Contests: The heritage day, 24 September, social and fun event will be a fiel station at Kranskop. The VHF/UHF contest is coming soon.

Ham Diary: There are SARL phone and CW contests in August.

General: No items.

Editorial

The AGM is upon us and a committee has to chosen by you, the members. Amongst you there should be volunteers to serve in the committee for the coming FY. Put personal animosities aside and consider only the perpetuation and image of your club that has to go on into the future and reach beyond these current 78 years of existence.

Make yourself available on the nomination form sothat our AGM formalities can pass quickly and effiiciently with a winning team.

Redaksioneel

Die AJV is op ons en 'n komitee moet verkies word deur julle, die lede. Tussen u behoort daar vrywilligers te wees om in die komitee te dien vir die volgende FJ. Stel persoonlike gevoelens tersyde en oorweeg net die voortsetting en aansien van u klub wat die toekoms moet ingaan en verby die huidige 78 jaar van bestaan moet reik.

Maak uself beskikbaar op die nominasievorm sodat ons AJV formaliteite vinnig en doeltreffend kan verbygaan met 'n wenspan.

Birthdays

Verjaarsdae

Aug



- 02 Marelise, sw van Pierre ZS6PJH
- 03 Paul ZS6BMF
- 04 Ceciel, lv van Flip ZS4GE/ZS6BSO
- 05 Hans ZR6HVG
- 05 Kara, dogter van Rita en Sarel ZS6AC
- 06 Estelle, lv van Simon ZS6AST
- 06 Edwin ZR6ESP, so n of Molly ZS6MOL and Richard ZS6UK
- 07 'JB' ZR6YV
- 08 Ray ZS6ALG
- 08 Marnix ZS6MCM

- 08 Tobie ZS6ZX
- 10 Anne ZS6AUL, daughter of Frances ZR6AUT
- 11 Lorraine, sw of Stan ZS6SDZ
- 14 Harry ZS6HRD
- 15 Roger ZS6RJ

Aug

Anniversaries Herdenkings

- 07 Peggy and Ed ZS6UT ()
- 09 Vlasta and Ivan ZS6CCW ()
- 18 Zdena and Ivo ZS6AXT (52)
- 20 Bertha en Hans ZS6KR (42)
- 27 Anne and Jac ZS6AQ ()

- 15 Molly ZR6MOL sw of Richard ZS6UK
- 16 Daniel ZS6AUS
- 16 Marie, dogter van Poppie ZS6BCP en Hansie ZS6AIK
- 22 Hal ZS6WB
- 22 Neville ZR6NBA
- 23 Otto OE9OFW
- 25 Doppies ZS6BAQ
- 26 Sinéad, daughter of Heather and Vince ZS6BTY
- 28 Jean ZS6ARA

Joys and Sorrows | Lief en Leed

- **Ivan ZS6CCW** lost his mother. Our condolences.
- **Jean ZS6ARA** het sy pa verloor na 'n lang siekbed.
- **Ivan ZS6AUT** is reportedly on the mend.
- **Mike ZS6AFG** is on the mend and was heard on HF.

Diary | Dagboek (UTC times)

- Aug 03 SARL SSB HF Contest 13:00-16:30**
- 02-03 Lighthouse-Lightship Weekend 00:01-23:59
- 02 European HF Championship 12:00-23:59
- 09 PARC AGM Sat. afternoon 14:00 local**
- 09-10 WAEurope DX Contest CW 00:00-23:59
- 20 Moon Contest Digi-CW 18:00-20:00
- 30-31 Yo (Rumania) DX HF Contest 16:00-04:00
- 31 **SARL HF CW Contest 14:00-16:00**
- Sept 06-07 All Asian SSB DX Contest 00:00-24:00**
- 06-07 IARU Region1 SSB Field Day 13:00-12:59
- 06-07 RSGB Field Day SSB 13:00-13:00
- 10 PARC Club (evening) meeting**

PARC SUBS / LEDEGELD 30-06-2008

Please remit your subs to our treasurer or by transfer to:

Betaal asb. u ledegeld aan ons tesourier of per oorplasing aan:

Bank : FNB Ordinary members/ gewone lede R70
Branch : 25 20 45 Spouses, pensioners R50
Account : 546 000 426 73
Your call sign must appear as statement text!

FUTURE MEETING DATES

Even months:	Odd months:
Saturdays 14:00	Wednesdays 20:00
Aug 09 2008	Sept 10 2008
Oct 11 2008	Nov 12 2008
Dec 13 2008	

Snippets | Brokkies

- Our **PARC treasurer** also has a fax number **086-518-6414** for **new applications** and **proof of subs payments**.
- **Heritage Day on 24 September** will see various stations talking to each other from historical sites all over the country. PARC has possible access to Skanskop just east of the Voortrekker Monument. Envisaged is a 2-5pm 'social' QSO event with portable stations. Everyone is invited for a pleasant afternoon.
- **Pine ZS6OB** reported that the Maputo leg of the **EME for Africa project** has been postponed and further notice will be given. Satellite contacts were recently possible with Bill C91NZ who used a dual-band hand-held and an Arrow antenna. Pine also reports that funds have been found for the EMEFA antenna trailer and work on that will also start soon.
- **Ed ZS6UT** came second in the recent SARL Top Band Contest.

GRATIS E-POSADRESSE EN DOMAINS!

Lede: Aktiewe lede wie tans nie oor e-pos beskik nie, of miskien 'n duur e-posadres het, kan aansoek doen vir 'n gratis e-posadres - roepsein@parc.org.za; beskikbaar stel aan lede wie graag hul eie webwerf wil skep.

PARC bied die volgende dienste aan:

Domeine: PARC kan gratis domeine

FREE E-MAIL ADDRESSES AND DOMAINS!

Members: Active members without e-mail or with an expensive e-mail address, are offered a free e-mail address - callsign@parc.org.za;

PARC is offering the following services:

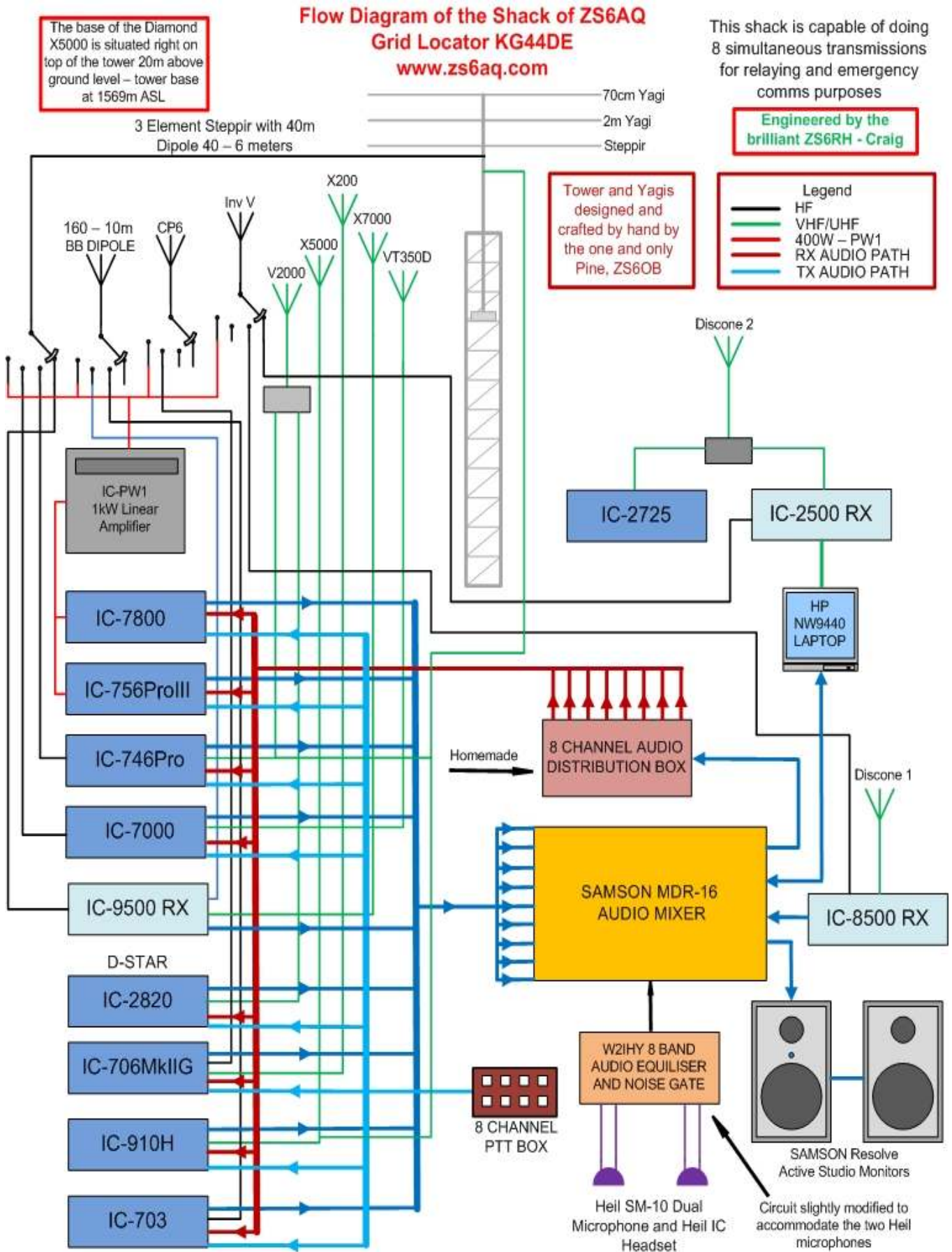
Domains: PARC can also

supply free domains to members wishing to create their own websites.

Navrae / Enquiries : Nico - 082-326-9345.

ZS6AQ SUPER-STATION ALMOST COMPLETE

Nico ZS6AQ has established this super amateur station over some 2 years with the engineering assistance of Craig ZS6RH. All antennas should soon be up now that the tower has been completed



Mega-Fleamarket 26 July

truly a mega- event



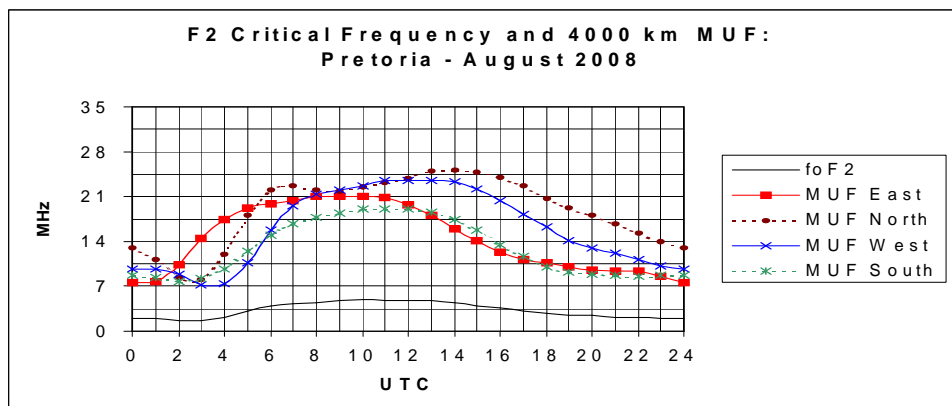
Long Term HF Propagation Prediction for July 2008 (courtesy Vince ZS6BTY)

DX Operating

The graph shows the 4000 km maximum useable frequency (MUF) to the East, North, West and South from Pretoria for the first hop using the F2 layer.

Local Operating

The F2 critical frequency (foF2) is the maximum frequency that will reflect when you transmit straight up. E-layer reflection is not shown





Mobile Wiring Protection - extract from the K0BG website

Installing an amateur transceiver in a vehicle entails a lot of work, and attention to detail. This includes proper wiring, protecting that wiring, and ultimately protecting the equipment as well. Far too often the details are overlooked, or circumvented, resulting in erratic operation, ground loop problems, and other maladies not easily traced or repaired.

Besides the wiring issues, proper fusing is also an important consideration. While the factory wiring harnesses are adequately fused, it's a rare mobile installation that doesn't have some ancillary equipment (SWR meter for example) requiring power. When there is, each device should be fused according to the manufacturer's recommendations.

Fusing and a Thing Called Hysteresis

It seems, no matter how many times a myth is dispelled, they keep raising their ugly head. One common myth is that power cable fuses protect the radio from damage. They don't. Myth number two is, that a fuse will open instantly as soon as the current exceeds the fuse's rating. It won't. Myth number three is, it's always okay to use fuses designed for 120 volts AC, in a nominal 12 volt DC system. It isn't.

Fuses are there to protect the cabling. For example, the Icom IC-7000 has a 5 amp (system) fuse mounted inside the radio, and 30 amp fuses in the cabling (plus and minus). If you short out a supply connection (pin 3 of the tuner port for example), a circuit board trace and/or switching transistor will fail long before the 5 amp fuse opens. The 30 amp fuses will never open in this particular case. It can be argued that the power cable fuses do protect the radio if something fails catastrophically, a final perhaps, but chances are some other component in the circuitry will be damaged beyond repair before the power cable fuse(s) opens.

The definition of a fuse is relatively simple. It is a wire, that when subjected to too high of a current, melts. When it does, the circuit opens... hopefully. I say hopefully, because if you've chosen the incorrect size for your application, it may not open. Or, it may open after a long delay. In any case, you want the fuse to do its job, well before your wiring becomes its own fuse.

All fuses exhibit hysteresis. This is the time lag between any given ampere overload and when the fuse opens. For example, a nominal 20 amp fuse will handle a 30 amp load for about 90 seconds. It will hold a 100 amp load for about 1 second. This is one reason slow blow fuses are not recommended for amateur devices. Unless you're an engineer, you don't hear the word hysteresis very often. Hysteresis is used to describe a phenomenon, in which the value of a physical attribute lags behind changes in the effect causing it. I use it here because fuses have a hysteresis effect. This fact figures heavily on our choice of fuse amperage ratings, the wire size we choose as a result, and ultimately how safe our installation is should a dead short occur.

So, hysteresis is the time lag between applying an overload, and the fuse opening to protect the wire. In the mean time, the wire being protected is getting rather warm. If it gets too warm, hot really, it could cause a fire. For a better understanding, let's look at some specific cases.

Most amateur transceivers' DC power cords are built using 10 AWG, or an equivalent (e.g.: Metric 6). Further, most are about 9 feet long, and most are fused with 30 amp fuses. If you subject them to 22 amps of current (nominal input for key down full power), they'll exhibit about a half volt drop (including the drop caused by the internal resistance of the fuse, and that of its holder). This means the power cable will be dissipating about 11 watts.

If we subject the cable to a load of 100 amps (not a dead short) where the fuse would nominally require 3 seconds to open, our voltage drop is 2 volts, and our wire has to sustain 200 watts of dissipation for 3 full seconds! Now you know one of the reasons why it is so important to choose the correct wire size. To reiterate, the wire must be capable of handling the nominal ICAS load with a minimal amount of voltage drop, and it must also be capable of handling an impressive overload, albeit briefly.

Fuse Size

So, if the radio draws just 20 amps peak, why not use a 20 amp fuse instead? Here's why. Subjecting any given fuse to pulsed loads close to their current rating will eventually cause them to fail due to element fatigue (sometimes referred to as erosion). Depending on the load characteristics (steady or varying), fuses are sized from 25% to 50% larger than their impressed loads.

In some cases, peak loads will exceed the rating of the fuse, like those encountered when starting an electric motor. Depending on the application, the designer may use a slow-blow fuse with an appropriately longer hysteresis rating. However, in an amateur application, it is only necessary to keep the average current draw below about 60% of the rating for any given fuse to avoid element fatigue.

The correct wire size should be based on the peak current, not the average, if you want to keep I^2R losses low. In any case, should a dead short occur, the wire size needs to be large enough to carry the current imposed by the fuse's hysteresis time delay without exceeding the wire's temperature rating. After all, you don't want to turn the wire itself into a fuse!

As stated, part of the sizing calculation is the temperature rating the protected wire is designed for, as well as its ambient operating conditions. In other words, the fuse must open before the wire reaches its maximum rating for any given overload. Remember, underhood wiring should have a temperature rating of at least 90C, and preferably 105C.

For any given ampere rating, fuses designed for high voltage (nominal 250 volts maximum) service typically have lower resistance than those designed for low voltage (nominally 32 volts maximum). Thus, their low voltage hysteresis time is elongated, which means they take longer to open under a given overload. While these facts alone don't preclude their use in low voltage applications, the bottom line is, you should select fuses specifically designed for the voltage range in use.

Lastly, fuses protecting your wiring should be as close to the battery as possible. Remember, that short length of wire from the battery to the fuses is NOT protected. It should be mounted out of harms way (in case of a crash), and protected with an outer sheathe such as plastic split loom.

Circuit Breakers

If you're thinking out loud to yourself about now with the admonition, I use circuit breakers, so I don't have this problem, you're kidding yourself! Fact is, circuit breakers exhibit a much longer hysteresis than any fuse except some specially designed slow-blow fuses. What's more, most circuit breakers will fail closed on dead shorts if the current exceeds 2,000 amps or so. A standard SLI (Starting, Lights, Ignition) car battery in good condition can easily supply this amount of current when subjected to a dead short.

What Size Wire To Use

There are more standards and rules of thumb applied to wire and fuse selection than just about any other subject you can name. The problem is, very few of them take fuse hysteresis into account. What you read here is purposely conservative, so if you decide to push the envelope, you're on your own.

First of all, you need to know your average current draw. For FM application, this is steady state, and you can use the manufacturer's current specification. For SSB applications, we need to know the average, as well as the peak power as we shall learn shortly.

For example, a 50 watt output FM transceiver will draw about 7 amps, but this isn't the whole story. Both the wire size and length are important. Using the aforementioned [calculator](#), enter the length of your cable run, the amperage draw, and select a size that has less than a half a volt drop, and preferably less than one quarter volt drop. If you want to calculate it yourself, here is the formula:

$(2Rw \cdot l) + 2k \cdot A \cdot .001 = Vd$ where:

Rw = the 1,000 foot resistive value from the Handbook Chapter 7.

k = nominal resistive value for one fuse and its holder. Note: most power cables have two fuses. If yours doesn't, use 1k in the formula. (If you don't know the fuse and holder resistance, use a conservative value of .002 ohms.)

l = Overall length of the cable assembly including connectors.

A = Peak current draw in amperes, or steady state for an FM transceiver.

Vd = Cable assembly voltage drop.

There is a good reason for minimizing voltage drop. The FM transceiver in question only puts out 50 watts when the input voltage is about 13.8 or so. At 12.8 volts, its output will drop to perhaps 30 watts. This same reduction in power also effects SSB transceivers, but it is less noticeable. For the record, voltage drop is frequently referred to in amateur literature as I²R (current squared times resistance) losses, but I²R actually refers to power loss.

Another reason to shoot for less voltage drop is temperature rise. Since an automotive environment is hotter than a base station one, over-sizing the wire (less resistance) will keep temperature rise to a minimum. Too high a temperature rise, and the insulation could melt.

A more extreme case is an HF, 500 watt mobile [amplifier](#). Most draw between 25 and 40 amps average, and peak at a maximum of about 100 amps. The wire selection should be based on the peak power draw, not the average. Minimal voltage drop is very important, as we're trying to minimize IMD (read that as splatter). Voltage drop considerations are why a second, trunk-mounted battery are a mainstay for high-power installations.

The main feed from the front SLI battery should be at least number 6 AWG, and preferably 4 AWG. Without the second battery, 2/0 wire would be needed to achieve the same minimal voltage drop. Remember too, in most cases the transceiver and the amplifier will be supplied by the same cable, so you need to take both into account when sizing your wire.

If you want to get critical, you should take the internal resistance of the fuse (and the contact resistance) into account. In the case of a 60 amp Maxi fuse, that's .00089 ohms, and the holder will account for about .0004 ohms. In our case, we needn't be this critical especially if you follow the suggestions outlined here.

CEBIK website preserved

The website of the late L.B. Cebik, the guru of antenna design (now recently deceased) has been preserved for posterity.

Go to www.cebik.com/radio.html and register free to get indefinite access.

This site has a magnitude of antenna info.

It's a great supplement to the Antenna Handbook!



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Minutes of the Pretoria Amateur Radio Club 77th AGM held at the University of Pretoria on 29th September 2007.

Welcome/ Verwelkoming: The Chairman Almero du Pisani ZS6LDP, declared the meeting open and welcomed all who attended.

Visitors/Besoekers: Almero extended a special word of welcome to Hans van den Groenendal ZS6AKV and Gawie ZS6GJJ.

Apologies/Verskonings: Apologies were received from Frances de Souza ZR6AUT, Allen de Souza ZS6AVC, Ann de Souza ZR6AUL, Deryck van Loggerenberg ZS6KQ, Alf Joubert ZS6ABA, Graham Reid ZR6GJR, Richard Peer ZS6UK and Molly Peer ZR6MOL.

Personal matters/Lief en leed: Almero requested the meeting to maintain a moment of silence to remember those members who passed away during the year.

Kworum: Die vergadering is by gewoon deur 28 opbetaalde lede wat aan die vergadering n kworum besorg het.

Minutes of previous meeting/Notule van vorige vergadering: The minutes of the previous meeting were read and accepted. Proposed by Andre ZS6BRC and seconded by Chris ZS6BGH.

Matters arising from previous minutes: None.

Guest speaker/Gas spreker: Hans van den Groenendaal our guest speaker dealt with two issues namely the current state of PLT regulations in South Africa and the future of amateur radio .

Chairman's report/Voorsitters verslag: Almero ZS6LDP read his report and reflected on the highlights the club achieved during the year.

Financial report/Finansies : The financial report was read and after a discussion on a financial aspect which was not relevant to the AGM the report was accepted. Proposed by Tjerk ZS6P and seconded by Brian ZR6BJS.

Motion/Mosies: No motions were received.

Awards/Toekennings:

Honorary memberships were awarded to Tjerk Lammers ZS6P and Nico van Tonder ZR6VT.

Trophies/Trofees.

ZS6BLY Trophy – Best technical talk/lecture – Roy ZS6XN.

Sonny Don Trophy – assisting other radio amateurs – Almero ZS6LDP

Ham Spirit Trophy – Craig ZS6RH.

Roy Alexander Trophy – Top support on rallies – Johan ZS6JHB.

Hansie Meyer Trophy – for participation – Richard ZS6UK

Piet Roos Trophy – Best contribution to WATTS – Hans ZS6KR

Jack Bennet Trophy – 6m activity – Pine ZS6OB.

ZSL Trophy – Most progressed listener – Suzette van Wyk.

Long Membership certificates were awarded to:

Bill Ingleson ZS6KO – Dave Williams ZS6JW – Stan Zway ZS6SDZ – Mike Rowland ZS6AFG – Bernie Ginsberg ZS6ANU – Joe van der Lingen ZS6AIC – Ivan Lister ZS6AUT – Hansie Meyer ZS6AIK – Paul Sterling ZS6BMF – Robert Boulanger ZS6ARC – Andre van Tonder ZS6BRC – Roy Newton ZS6XN – Jac Roux ZS6QA – Hal Lundt ZS6WB – Tjerk Lammers ZS6P – Johann de Beer ZR6YV – Hans Kappetijn ZS6KR – Viv Prince ZS6BZS – Alf Joubert ZS6ABA.

Rally certificates/Tydren sertifikate.

Roy Newton ZS6XN – Pierre Holtshauzen ZS6PJH – Hans Gurtel ZR6HVG – Johann de Beer ZR6YV – Chris Bothma ZS6LOG – Menno Havelaar ZS6AGC – Doreen de Bruyn ZR6DDB – Johan de Bruyn ZS6JHB – Andre van Tonder ZS6BRC – Chris Nagel ZS6BGH – Ivan Jancuska ZS6CWW – Richard Peer ZS6UK – Frank Schneider ZS6GE – Willie Greyling ZR6WGR – Graham Reid ZR6GJR – Craig Symington ZS6RH – Jaco Lubbe ZR6JLL – Sander Wissing ZS6SWW – Pat Schneider ZR6AVC – Edwin Peer ZR6ESP.

Election of Committee/Verkiesing van Komitee.

Tjerk ZS6P het oudergewoonte die voorsitterstoel oorgeneem vir die verkiesing van die nuwe komitee en voorsitter.

Die volgende lede is benoem en verkies tot die komitee:

Richard Peer ZS6UK, Pierre Holtshauzen ZS6PJH, Craig Symington ZS6RH, Almero du Pisani ZS6LDP en Johan de Bruyn ZS6JHB.

Election of Chairman/Verkiesing van Voorsitter .

Slegs een benoeming vir voorsitter naamlik Almero du Pisani ZS6LDP is ontvang en is hy eenparig herkies as voorsitter.

Die vergadering het verdaag na Almero se aanvaardings toespraak en is daar heerlik gebrui. Dankie aan Pieter ZS6PVW wat die vuur aan die gang gehou het en al die dames wat gesorg het dat almal n tjoppie, slaai en wat nog meer ontvang het.