5 May:  Presentation by Roy ZS6XN on Battery State Indicators

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May 5 Mei

- Sasol Rally
- Baluns
- Antenna hardware considerations.

Notules Ledenuus

Tegnies

Blad sy tien

In hierdie uitgawe

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**Next Meeting**

2 June 2007
Time: 13:30 for 14:00
PARC Clubhouse
South Campus
University of Pretoria
SE cnr University and Lynnwood roads.
Minutes of the monthly club meeting of the Pretoria Amateur Radio Club held at the South Campus of the University of Pretoria on 5 May 2007

Welcome/Verwelkoming. Almero ZS6LDP declared the meeting open and welcomed all present.

Attendance/Bywoning. The meeting was attended by 23 members and 4 visitors.

Apologies/Verskonings.

Edwin Peer ZR6ESP, Hilary Peer ZR6HAP, Brendan Smith ZR6BM, Tobie Janse van Rensburg ZS6XZ, Roy ZS6MI, Mike ZS6AFG, Molly ZR6MOL, Malcolm ZR6OLM, Helen Newton and Ivan ZS6CW.

Personal Matters / Lief en Leed.

Don ZS6CRT is seriously ill. Bernie ZS6ANU is recovering after a long illness. Mike ZS6AFG is in hospital for a small operation. Ivan ZS6CW running a high fever and is advised by his doctor to rest.

Matters arising from previous minutes / Sake voortspruitend uit vorige notule. None / Geen.

Approval of previous minutes / Goedkeuring van vorige notule.

The minutes of the previous meeting as published in Watts were approved. Proposed by All ZS6ABA and seconded by Chris ZS6BGH.

Club Activities/ Klub Bedrywighede.

Rallies/Tydrenne. Johan ZS6JHB.

Johan thanked everybody who assisted with comms during the Sasol Rally. The next event will be the Zulu Rally in KZN which is scheduled for 26th and 27th May in Durban and surroundings. Thirteen amateurs will be providing communications during the event, three in Command Centre and ten doing duty as field stations.

Foxhunts / Jakkalsjag. Richard ZS6UK: Due to the approaching winter Foxhunt activities have been put on hold till September.

Social / Sosiaal. Johan ZS6JHB.

Bring en braai na afloop van elke klubvergadering.

Hamnet / Vlooimark. Johan ZS6JHB.

Hamnet Gauteng Noord se bulletin vind plaas op Maandag aande om 19.00 op 145,725.

Approval of previous minutes / Goedkeuring van vorige notule.

The minutes of the previous meeting as published in Watts were approved. Proposed by All ZS6ABA and seconded by Chris ZS6BGH.


Finances in order.

Technical / Tegnies.

Craig ZS6RH reported on the current status of the repeater network.

Fleamarket / Vlooimark. Almero ZS6LDP.

Almero ZS6LDP informed the meeting that the next fleamarket will take place end June 2007.

Projects/Proekte.

Hans ZS6KR reported that no new project is at hand.

General / Algemeen.

Hans ZS6KR, requested members expecting QSL cards to make arrangements to get the cards from the SARL.

Presentation / Aanbieding.

Roy Newton ZS6XN did a presentation on LED battery state indicators which will be available soon.

Next meeting / Volgende vergadering.

The next meeting will be on the 2nd of June 2007. Starting time 14:00. Remember the braai afterwards / Onthou die braai na afloop van die klubvergadering.

Closure / Sluiting.

The meeting closed at 15.00.
Editorial

A club newsletter is surely not only for its members, but also by its members. I can count the number of members that have contributed over the past 3 years on the fingers of both hands and find that very disappointing. Surely most of you have a digital (cell-phone) camera to show other members what is potting in your station, your mobile or on the workbench? Any project you are busy with? Document it so we can all harvest knowledge from your activities and at the same time show us what you yourself look like doing it. What may be uninteresting to you, can be informative to others. Is it inwardsness, modesty or lack of interest that has stopped you? Please reconsider and let us have something that others can read or see about fellow club members.

On another note: Did you think SARL fees are expensive or not worth while? Proportionally we are paying little. Countries with many thousands more members are paying as much - and more:
USA $39 (=R284)
Britain £44 (=R620)
Due date for membership fees of both our club and the SARL is the end of June. Your support will be appreciated.

Redaksioneel

‘n Klub nuusbrief is tog sekerlik nie net vir sy lede nie, maar ook deur sy lede. Ek kan op altwee hande se vingers die aantal lede tel wat bydraes oor die laaste 3 jaar gemaak het en dit is baie teleurstellend. Julle het tog sekerlik ‘n digitale (selfoon) kamera om ander lede te kan wys wat skud by julle stasie, mobiel of op die werksbank? Dokumenteer dit tog dat ons almal kennis kan neem van jou bedrywighede en hoe jy self kyk terwyl jy dit doen. Wat vir jou oninteressant is, is vir ander dalk nuus vir ander. Is dit teruggetrokkenheid, beskeidenheid of te min belangstelling wat jou keer? Heroonweeg asseblief en laat ander ook iets kry om te lees of sien van mede-klublede.

Op ‘n ander noot: Het jy gedink die SARL fooie is hoog of nie die moeite werd nie? Proporsioneel betaal ons eintlik weinig. Lande met baie duisende meer lede betaal net so veel - en meer:
USA $39.00 (=R284)
Brittanje £44.00 (=R620)
Einde junie is ledegeld-tyd vir beide ons klub en die SARL – U ondersteuning sal waardeer word.
**Birthdays | Verjaarsdae**

02 Elma, sw of Chris ZS6LOG
05 Louis ZS6LVW
06 Herman ZS6SN
07 Chantel, dogter van Marlite en ’3B’ ZR6YV
08 Ronel, sw van Pieter ZR6PSR
11 Nadia, daughter of Pat ZR6AVC and Frank ZS6GE
14 Attie ZR6REY
14 Hilary ZR6HP, daughter of Molly ZR6MOL and Richard ZS6UK
17 Lynette ZR6LHT, dogter van Elize en Pieter ZR6AH7
20 Malcolm ZR6QLM, son of Retha and Roy ZS6NX

**Anniversaries | Herdenkings**

07 May and Wally ZS5WP ( ),
24 Marieta and Roy ZS6M1 (36)
22 Richard ZS6UK
23 Annemie, dogter van Bernice en Pieter ZR6KSA
25 Angie, sw of Trevor ZS6-2510
26 Pieter ZR6PSR
27 Jac ZS6QA
27 Selma, sw of Joe ZS6TB

**Sick Parade | Krukkelys**

Bernie ZS6ANU is being treated for leukaemia
Mike ZS6AFG underwent a minor operation

Helen, daughter of Roy ZS6SN underwent a back operation
Don ZS6CRT is under treatment for lung cancer
Carl ZS6NCC is in frail care
Ivan ZS6CCW was confined to bed for a while

**Diary | Dagboek**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 02-03</td>
<td>IARU Region I Field Day, CW 1500-1459</td>
</tr>
<tr>
<td>09</td>
<td>Portugal Day Contest 0000-2400</td>
</tr>
<tr>
<td>16</td>
<td>Youth Day</td>
</tr>
<tr>
<td>16-17</td>
<td>All Asian DX Contest CW 0000-2400</td>
</tr>
<tr>
<td>17</td>
<td>Father’s Day</td>
</tr>
<tr>
<td>22</td>
<td>Inland schools close</td>
</tr>
<tr>
<td>23-24</td>
<td>King of Spain Contest SSB 1200-1200</td>
</tr>
<tr>
<td>23-24</td>
<td>ARRL Field Day 1800-2100</td>
</tr>
</tbody>
</table>

**PARC SUBS / LEDEGELD 30-06-2007**

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

- Bank : FNB
- Ordinary members/ gewone lede R70
- Spouses, pensioners R50

Betaal asb. u ledegedel betyds aan ons tesorier of per oorplasing aan:

- Branch : 25 20 45

Your call sign must appear as statement text!

**Snippets | Brokies**

- **Jaco ZR6JLL** het met sy expeditiesie die koerant gehaal en ook die radio.

- Our next PARC Fleamarket will be in mid-winter on June 30.

- After every club meeting there will be a bring-and-braai in the quadrangle below the clubhouse

- Note that all HF operators should now on send SASE’s to the SARL QSL Bureau in order to get incoming QSL cards posted to you.

The service to club meetings by Hal ZS6WB cannot any more be guaranteed.

Paper donations are again invited. We will acknowledge your gift by placing your call sign below our logo on page 1.

**Blinde pak die berge**

Uitdagings is kos vir Grinrte-werkmnere

**Tshwane Beeld**

Jaco ZR6JLL
This pile of cards were from overseas stations QSLing contact with ZS75PTA in 2005. These are mainly the result of QSO’s with our Field Day stations, Hans ZS6KR in the BERU Contest, and Ivan ZS6CCW who put in a big effort.

This striking shot is of Ed ZS6UT’s magnetic loop (described in WATTS Aug 2003). Here an incandescent tube was placed close to the feedpoint and was greatly exited due to the high voltage field running 200w PEP on 80m. Ed says you can actually read the light semaphore effect.

SASOL RALLY May 2007
Ruthroff balun

From "Transmission Line Transformers" by Jerry Sevick W2FMI

A commercial W2AU (Ruthroff design) balun using 8 trifilar turns of no. 14 wire on a 2½-inch long rod. The characteristic impedance is 43 Ω. The third wire, winding 5-6 in Fig 9-1B, is placed between the other two windings. Without this third wire, which acts as an electrostatic shield, the characteristic impedance of a tightly wound bifilar winding of no. 14 would be 25 Ω. This balun has been widely used on triband (10, 15 and 20-meter) Yagi beams. At much lower frequencies, the performance becomes marginal. It is recommended that this balun not be used below 3.5 MHz.

Guanella balun

A Guanella balun using 12 bifilar turns of no. 14 wire on a 4-inch long rod (a 3-inch long rod would do as well). The treatment of the wire is the same as (B) above. This balun is capable of operating from 1.7 MHz to 30 MHz. If operation is limited to the 40, 80 and 160-meter bands, then 14 bifilar turns are recommended. This would allow for more margin on 160 meters.

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.

Long Term HF Propagation Prediction for June 2007 (courtesy Vince ZS6BTY)

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.
Notes on Home-Built Antenna Hardware

These notes represent a set of practices that I prefer. The collection is not the only way to do things, but it is one fairly good way among many acceptable practices. Nevertheless, I recommend that you examine various antenna handbooks for alternatives. We all have different skills and our access to materials may vary. The more techniques that you have at your disposal, the easier it will become to find the ones that fit your circumstances.

**Beam Antenna Hardware**  
My preferences for beam construction all focus upon one word: quality. Quality construction is a synonym for durability, that is, the ability of the beam antenna to perform for a long period with all of the capabilities it had when you first put it in place. Quality beam construction breaks down into three main materials: stainless steel, aluminum, and polycarbonate.

**Stainless Steel**  
I prefer to use only one material for all antenna hardware: stainless steel. Not many years ago, we had to use mail order or on-line sources for stainless steel nuts, bolts, and washers. However, these items are now regular stock in many home centers. The reason why I prefer stainless steel is simple. Virtually all beam antennas bring together at least two materials: aluminum and copper.

Dissimilar materials are subject to electrolysis, the corrosion of materials due to a difference in the atomic electrical potential of each material. Copper and aluminum are both conductors, but we cannot durably join the two at a connection point. When some home builders resorted to cheaper aluminum AC wire, they had to find connectors that would prevent electrolysis between the aluminum wire and the brass (mostly copper) screws at the terminals. Only power companies use aluminum wire these days and homes have returned to an all-copper status.

The rate of corrosive effects between dissimilar metals depends on their "nobility." The more distant the metals on the chart (see **Table 1**), the greater the potential between them, even in the most weather-protected conditions. As the table notes, a difference of only +/−0.3 volts between the atomic potential of two metals at a junction indicates the strong possibility of significant corrosion at the junction.

<table>
<thead>
<tr>
<th>Atomic Potential of Various Metals that Might Come into Contact with Each Other</th>
<th>Potentials in volts</th>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>Magnesium</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.03</td>
<td>-0.71</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Zinc</td>
<td>1.61</td>
<td>0.99</td>
</tr>
<tr>
<td>Iron</td>
<td>1.93</td>
<td>1.22</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1.97</td>
<td>1.26</td>
</tr>
<tr>
<td>Nickel</td>
<td>2.12</td>
<td>1.41</td>
</tr>
<tr>
<td>Tin</td>
<td>2.23</td>
<td>1.52</td>
</tr>
<tr>
<td>Lead</td>
<td>2.24</td>
<td>1.63</td>
</tr>
<tr>
<td>Copper</td>
<td>2.71</td>
<td>2.00</td>
</tr>
<tr>
<td>Silver</td>
<td>3.17</td>
<td>2.46</td>
</tr>
<tr>
<td>Palladium</td>
<td>3.36</td>
<td>2.65</td>
</tr>
<tr>
<td>Gold</td>
<td>3.67</td>
<td>2.82</td>
</tr>
</tbody>
</table>

**Notes:**  
1. Accelerated corrosion can occur between unprotected joints if the algebraic difference in atomic potential is greater than +/−0.3 volts.  
2. Metals are considered more noble as they move from Magnesium to Gold.  
3. For any two metals in contact, a less noble metal is considered more "anodic" and will give up metal in a contact joint.  

Note how far apart that aluminum and copper fall on the table.

Stainless steel is generally inert to electrolysis. Hence, it makes the best simple buffer between different metals that might show significant corrosive effects. **Fig. 1** shows a sample connection at possibly the feedpoint of a beam's driven element. Note that the system uses not only a stainless nut and bolt, but also stainless washers. Hence, the copper wire is isolated physically but not electrically from the aluminum tube.

Two washers deserve special mention. I place a washer under the bolt head to spread the force that the head exerts on the softer aluminum tube. Excess tightening will not result in the bolt head widening the hole in the tubing. In most cases, I add a fiberglass rod within the rube to strengthen the assembly. If I butt-join tubes, I add an inner tube for the same reason.

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**Anatomy of a Workable Multi-Metal Connection**

![Diagram of a Workable Multi-Metal Connection](image)

**Fig. 1**
The other notable washer occurs next to the nut. I use a stainless lock washer to ensure that the assembly does not come apart after a season of flexing in the weather.

**Aluminum**

The subject of aluminum bothers many a newer antenna builder because of its cost if we buy it new from reputable sources. Due to cost, many builders resort to wire beams, while others build only antennas for which they can find used TV antenna elements. At one time, home centers carried a large and varied stock of aluminum tubing, but in recent years, the centers have shifted their stocking philosophies from "do-it-yourself-in-your-own way" to "do-it-as-pre-packaged." Some antenna builders have shifted to the use of L-stock and square stock.

First, round tubing is the best material available for HF antenna elements, since it tends to slip the wind best. Flat surfaces tend to increase wind resistance. Second, I do not recommend even home-center tubing for antennas designed to withstand many seasons of rough weather. The tubing available in home centers is of dubious lineage, and its strength data is often wholly unavailable. Most of all, I do NOT recommend the use of aluminum conduit for antenna elements. Conduit is a form of softer pipe. It not only weighs more than tubing, it also bends permanently under loads.

The best material for U.S. antenna builders is 6063-T832 aluminum tubing, available from various outlets. The tubing is strong, and the most common wall thickness for the home antenna builder is 0.058". It is also available in outer diameter increments of 1/8" (0.125"). If we used a wall thickness of 0.0625" -- that is, 1/2 the increment between tubing sizes -- we would ideally have a perfect fit from one size to the next. However, this approach fails to recognize that even computer-controlled industrial processes have allowances. Hence, the 0.058" wall thickness allows the closest practical size for nesting one tube inside the next larger size, as suggested in Fig. 2.

The lower portion of the figure suggests the use of home-center tubing, which usually has a wall thickness of 0.050" or less. Note the larger spacing between the nested segments. The larger spacing yields more wiggle room, which calls for special measures to ensure a tight mechanical bond between element sections. The upper portion of the sketch with the standard 6063-T832 tubing would allow the use of a simple pair of sheet metal screws to bond the sections-stainless steel sheet metal screws, of course.

The sketch also specifies an overlap of 2" to 3" at the junction. There are special cases in which it is wise to double tubing. For example, the centermost part of a 20-meter beam element might use about 3' of 1.25" stock. The next exposed length might be only 24" or so, but the 1.125" tubing would go all the way to the element center, giving the middle of the element extra strength to bear higher wind loads. Where we do not need doubling strength, 2" to 3" of overlap is sufficient to provide a strong connection without adding unnecessary weight to the element.

Some antenna makers prefer to use thinner-wall tubing to create equally strong but lighter and more flexible element assemblies. Other makers use swaging techniques to decrease the element diameter by either 1.5 or 2 steps, relative to our standard 1/8" increments. In most cases, the home builder does not have access to the necessary equipment to handle such techniques, and the lighter tubing in the requisite aluminum type may not be readily accessible. Hence, the use of the tubing that we have noted is almost the *de facto* American standard. In contrast, European antenna makers tend to prefer heavier tubing (in metric increments, of course). Their antennas tend to bear larger ice and snow loads, but may require a larger rotator to turn effectively.

**Polycarbonate**

Since I use antenna modeling software to design antennas that I build, I always plan on insulating and isolating the elements from the supporting boom. NEC and MININEC calculate only axial currents along an element and hence cannot show the effects of the boom, were we to make a direct connection. All beam designs that appear at this site either use non-conductive booms or use plates to insulate and isolate the elements from the boom.

At HF, the best plate material in my experience is polycarbonate. Lexan is a GE trademark and trade name for the material. Do not confuse the material with acrylic materials that ball up under a saw blade. As well, polycarbonate differs from Plexiglas, another trademarked material. All of these materials are related chemically, but we can obtain "true" polycarbonate from on-line sources in convenient size sheets that we can then saw and drill with woodworking tools. Simply be certain that the polycarbonate is UV protected.

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**Table 2.** Key to elements in the construction sketches (See Fig. 3 and Fig. 4)

<table>
<thead>
<tr>
<th>Letter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Polycarbonate element-to-boom mounting plate</td>
</tr>
<tr>
<td>B</td>
<td>Boom</td>
</tr>
<tr>
<td>C</td>
<td>Stainless-steel U-bolts and saddles</td>
</tr>
<tr>
<td>D</td>
<td>Driven element tube</td>
</tr>
<tr>
<td>E</td>
<td>Driven element gap insulating rod or tube</td>
</tr>
<tr>
<td>F</td>
<td>Stainless-steel U-bolts and saddles</td>
</tr>
<tr>
<td>G</td>
<td>Stainless-steel nuts/bolts/washers/soldering lugs</td>
</tr>
<tr>
<td>H</td>
<td>Reflector or director element tubes</td>
</tr>
<tr>
<td>I</td>
<td>Inner linking conductive tube</td>
</tr>
<tr>
<td>J</td>
<td>L-stock coax connector mounting plate</td>
</tr>
<tr>
<td>K</td>
<td>Through-chamber coax connector</td>
</tr>
<tr>
<td>L</td>
<td>Stainless-steel sheet-metal screws</td>
</tr>
</tbody>
</table>
The plate size will vary with the amateur band, which generally determines element size and weight. ¼" thick material generally satisfies most upper HF requirements. Although polycarbonate is satisfactory well into the lower UHF range, many VHF and UHF beam builders prefer Delrin and other materials for insulating plates and shapes.

To use polycarbonate plates effectively requires that we design an assembly that makes best use of their strengths. The assembly requires a variety of parts. Table 2 provides a key to the parts that appear in the sketches in Fig. 3 and Fig. 4. The plate itself is oblong, extending 6 to 12 inches along the element axis and perhaps 4 to 6 inches along the boom axis. The larger numbers, of course, apply to bands like 20 and 17, while the smaller dimensions are for 12 and 10 meters. As suggested by Fig. 3, the use of a longer dimension along the element axis places the element U-bolts at a larger distance to allow for assembly work at the element center.

![Diagram of assembly parts](image)

Stainless steel U-bolts attach the element to one side of the plate, while similar U-bolts clamp the plate to the boom on the other side. I prefer the type of U-bolt that comes with a cast saddle over other types. The absence of any saddle tends to allow element slippage over time. Muffler-clamp type saddles contact the element in two lines, which can more easily deform the element tube than the solid cast saddle. In most cases, the boom U-bolts will be larger than the element U-bolts, since booms may range from about 1.25" for lighter beams to perhaps 2" for longer ones. Boom materials can be either 6063-T832 or 6061-T6. For anything heavier than a 2-element beam, it is useful to use thicker tube walls, perhaps 0.125". For smaller beams, you can nest 1.125" tubing with 0.058" walls inside 1.25" tubing with the same wall thickness. If you need a longer boom than the stock available, you may stagger the junctions of the inner and outer tubes to achieve a stronger boom with a uniform diameter.

For parasitic elements, you may use a single center element section or you may link two sections with an inner strengthening tube. Even where you do not need doubling, the inner tube should extend at least to the edges of the polycarbonate plate so that the U-bolts go around a double thickness of tubing to help avoid crushing. The driver element replaces the linking tube with a non-conductive rod or tube, such as fiberglass. The rod helps align the element and provides for the required driven element gap. Note that the gap in any antenna is a part of the total element length. It is NOT an addition to the length. The gap size is not critical, since the leads from either side of the gap to the feedline connector make up any missing length. Essentially, the final gap size is the spacing between the conductors in the feedline.

All hardware (except for U-bolt cast saddles) is stainless steel. Fig. 4 shows an exception to this rule. The support for the coax connector consists of a short length of 1" by 1" by 1/16" thick L-stock. The length is just enough to serve as a U-bolt keeper bar. At the center, a 5/8" hole allows you to mount a through-chassis coax UHF connector. Leads to the element are short and direct. Use a "liquid" (plastic) electrical tape product to seal the coax connector rear end—and the coax junction once you install the feedline. The general ideas in these sketches permit any number of variations. Besides studying alternative techniques that appear in articles and handbooks, you may also examine various commercially made beams that you encounter. Very often, manufacturers place their assembly manuals on line for the benefit of prospective buyers and those who obtain beams second hand. These manuals are excellent sources of ideas ready for your local adaptation.

Whichever system of mounting that you use, be certain that the assembly has the quality necessary for durable service. Most beams operate at the tops of expensive towers with equally expensive rotators to direct them. The antenna itself should not be a weak link in this otherwise sturdy system.
"We don't like their sound, and guitar music is on the way out" - Decca Recording Co. rejecting the Beatles

"I think there is a world market for maybe five computers" - Thomas Watson, chairman of IBM 1943

"The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?" – David Sarnoff's associates in response to his urgings for investment in the radio in the 1920's.