



# WATTS 2020-07

Year 90 + 07m

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> [zs6pta@zs6pta.org.za](mailto:zs6pta@zs6pta.org.za)



**Bulletins : 145.725 MHz : Sundays from 08h45 / Sondag vanaf 08h45**  
Relays: 1.840, 3.700, 7.066, 10.135, 14.235, 51.400, 438.825, 1297 MHz  
and Echolink. Activated frequencies are announced prior to bulletins  
**Swoopshop : 2m and 7.066 MHz live on-air after bulletins**  
Bulletin repeats on Mondays / herhalings op Maandae : 2m 19h45



*Johan de Bruyn ZS6JHB en Greg Jarrett ZR6JDD by die ingang van die Radcliff fasiliteit waar een van die Pretoria Amateur Radio Klub se herhalers geïnstalleer is. Tydens 'n aantal inbrake waar die ingang deur afgebreek is, is die batterye en en kragbron van PARK se 2 meter herhaler gesteel. Johan en Greg het die nodige installering van 'n nuwe kragbron verrig. Meer op p5.*

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## Club Meetings / Klub Vergaderings

### Club Committee Meeting :

**The date of the next Meeting for the 2020/21 PARC Committee will be on the 23<sup>rd</sup> of July at 19h00 via zoom.**

## PARC Committee Members : 2019 – 2020 / PARK Komiteelede : 2019 - 2020

Name & Callsign	Portfolio/s	Email Address	Tel No	Mobile No
Louis de Wet ZS6SK	Chairman, Watts, SARL, ICASA	<a href="mailto:louis.zs6sk@gmail.com">louis.zs6sk@gmail.com</a>	012-349-1044	072-140-9893
Graham Reid ZS6GJR	Vice Chairman, Treasurer, Website	<a href="mailto:greid@wol.co.za">greid@wol.co.za</a>	012-667-2720	083-701-0511
Johan de Bruyn ZS6JHB	Rallies, Repeaters & Membership	<a href="mailto:zs6jhb@gmail.com">zs6jhb@gmail.com</a>	012-803-9418	079-333-4107
Irene Myburgh ZS6IEA	Club Secretary & Social	<a href="mailto:irene.myburgh@outlook.com">irene.myburgh@outlook.com</a>	012-304-5109	082-462-6001
Albert Schreuder ZS6SE	Contests, Social & Taxation	<a href="mailto:albert.schreuder.za@gmail.com">albert.schreuder.za@gmail.com</a>	012-361-6133	082-562-3825

## PARC Co-opted Members : 2019 – 2020 / PARK Ge-koopteerde Lede : 2019 - 2020

Name & Callsign	Portfolio/s	Email Address	Tel No	Mobile No
Alméro Du Pisani ZS6LDP	Flea-markets, SARL Bulletins	<a href="mailto:almero.dupisani@up.ac.za">almero.dupisani@up.ac.za</a>	012-420-3779	083-938-8955
Tony Crowder ZS6CRO	Auditor	<a href="mailto:tcrowder@telkomsa.net">tcrowder@telkomsa.net</a>	011-672-3311	
Pierre Holtzhausen ZS6PJH	Contests	<a href="mailto:zs6pjh@gmail.com">zs6pjh@gmail.com</a>		082-575-5799
Pieter Myburgh ZS6PAM	Repeaters	<a href="mailto:wooden@mweb.co.za">wooden@mweb.co.za</a>		076-140-7562
Hans Kappetijn ZS6KR (Hon.)	SARL Bulletins, Swop Shop	<a href="mailto:QRVservices@gmail.com">QRVservices@gmail.com</a>	012-333-2612	072-204-3991
John Minter ZS6LED	RAE Training, Technical	<a href="mailto:john.minter.za@gmail.com">john.minter.za@gmail.com</a>	012-349-0019	083-291-5422

## Birthdays and Anniversaries / Verjaarsdae en Huweliks Herdenkings

### Member's Birthdays July 2020 / Lede Verjaarsdae Julie 2020

06 Helen Newton ZR6HN	20 Roy Newton ZS6XN
13 Pieter Human ZS6PA	26 Frank Schneider ZS6GE
17 Jan (Pine) Pienaar ZS6OB	29 Lian McAllister ZS5IE
19 Theo Bresler ZS6TVB	30 Dawid Jansen van Rensburg ZS6VS

#### Spouse's July 2020 / Gades Julie 2020

01 Avida, gade van Theo Bresler ZS6TVB  
 12 Sharmaine, gade van Louis de Wet ZS6SK  
 17 Lyn, gade van André van Tonder ZS6BRC (Erelid)  
 17 Judy, spouse of David Botha ZS6O  
 22 Ria, spouse of Pete Smith-Curren ZS6PJ

#### Anniversaries July 2020 / Herdenkings Julie 2020

06 Elsa en Fritz Sutherland ZS6SF  
 26 Antoinette ZS6D en Daniel ZS6AW Liebenberg

### Member's Birthdays August 2020 / Lede Verjaarsdae Augustus 2020

03 Paul Sterling ZS6BMF (80)	08 Raymond de Wet ZS6ALG
05 Hans Gürtel ZR6HGTV	08 Tobie Jansen van Rensburg ZS6ZX
07 Whitey Joubert ZS6JJJ	16 Gerrie Leonard ZS6GTK
07 JB de Beer (Erelid) ZR6YY	25 Paul van der Hoven ZS6BAQ

#### Spouse's August 2020 / Gades Augustus 2020

09 Helga, gade van Hans-Peter Knoepfler ZS6AJS

#### Anniversaries August 2020 / Herdenkings Augustus 2020

07 Peggy and Edmar Willers ZS6UT  
 12 Geraldine en Jurie Ferreira ZS6JFE  
 29 Joydene en Albert Schreuder ZS6SE

## Lief en Leed / Joys and Sorrows

Dit is met leedwese dat ons verneem het van die afsterwe van Johan Classen ZS6IAM. Meer op bladsy 5.

Dit is met leedwese dat ons verneem het van die afsterwe van Martha, die gade van Attie Reynecke ZS6REY op die 25<sup>ste</sup> Junie 2020. Hiermee, namens al die lede van PARK ons innige meegevoel aan Attie en sy gesin en familie.

We have learned that Andre, the son of Andre Coetzee ZS6GCA was in hospital for treatment. Andre has since been released from hospital and is recovering at home. We wish Andre all the best and a speedy recovery.

## PARC Membership Fees / PARK Ledegelde

For the 2019-2020 year, there will be no increases in Club Membership fees. Club Fees therefore remain at R160 for Ordinary Members, and R60 for Pensioners and Spouse. Vir die 2019-2020 jaar sal daar geen toenames in die Klub Lidmaatskap gelde wees nie. Dus bly die gelde op R160 vir Gewone Lede, en R60 vir Pensionarisse en Gade.

PARC SUBS : PARK LEDEGELD : FROM / VANAF : 30-06-2018			
Bank	First National Bank	<b>Ordinary Members / Gewone Lede : R160 Spouses / Pensioners : R60</b>	<b>Your call sign must appear as statement text!</b>
Branch Code	25 20 45		
Account No	546 000 426 73		
Please remit your subs in time to our Treasurer, or pay per transfer into the PARC account Betaal asb. u ledegelde betyds aan ons Tesourier, of betaal per oorpasing in die PARC rekening			

Please Note : If your Club fees are not paid up to date, birthday details cannot be displayed in Watts

## PARC Bulletin Roster / PARK Bulletin Rooster

PARC Bulletins are presented on Sunday mornings at approximately 08h45, after the SARL Bulletins in English and Afrikaans, from 08h15. The Bulletin Presenters for the following two months are presented below. Please do contact the applicable presenter beforehand if you wish to make a contribution to the Bulletin. PARC Bulletins are broadcast on the 2-meter repeater on 145.725 MHz, and 70 cm on 438.025 MHz. Relays are done on 7.060 MHz by Hans Kappetijn ZS6KR and on Echolink by Johan Lehman ZS6JPL. A re-broadcast of the Bulletin is done the following Monday evening at 19h45 by Hans ZS6KR.

PARK Bulletins word op Sondagoggende aangebied om 08h45, na die SARL Bulletins in Engels en Afrikaans, vanaf 08h15. The Bulletin aanbieders vir die volgende twee maande word onder aangedui. Kontak gerus die toepaslike Bulletin leser indien u 'n bydrae tot die Bulletin wil maak. PARK Bulletins word uitgesaai op die 2-meter herhaler op 145.725 MHz, en 70cm op 438.205 MHz. Herleidings word gedoen op 7.060 MHz deur Hans Kappetijn ZS6KR, en op Echolink deur Johan Lehman ZS6JPL. 'n Heruitsending van die Bulletin geskied die opvolgende Maandag aand om 19h45 en word behartig deur Hans ZS6KR.

PARC Bulletin Presenters : July - September 2020			
Date	Presenter	Date	Presenter
5 July 2020	Albert Schreuder ZS6SE	23 August 2020	Louis de Wet ZS6SK
12 July 2020	Alméro Du Pisani ZS6LDP	30 August 2020	Albert Schreuder ZS6SE
19 July 2020	Johan de Bruyn ZS6JHB	6 September 2020	Alméro Du Pisani ZS6LDP
26 July 2020	Louis de Wet ZS6SK	13 September 2020	Johan de Bruyn ZS6JHB
2 August 2020	Albert Schreuder ZS6SE	20 September 2020	Louis de Wet ZS6SK
9 August 2020	Alméro Du Pisani ZS6LDP	27 September 2020	Albert Schreuder ZS6SE
16 August 2020	Johan de Bruyn ZS6JHB	4 October 2020	Alméro Du Pisani ZS6LDP

## PARC Fleamarket Dates 2020 / PARK Snuffelmark Datums 2020

**DUE TO LOCKDOWN REGULATIONS, NO FLEAMARKETS WILL TAKE PLACE IN 2020 UNTIL FURTHER NOTICE**  
**AS GEVOLG VAN INPERKINGS REGULASIES, SAL GEEN SNUFFELMARKTE PLAASVIND IN 2020 TOT VERDERE KENNISGEWING**

For more information, contact / Vir meer inligting, kontak  
[Alméro Du Pisani ZS6LDP at 083-938-8955](mailto:almero.dupisani@up.ac.za) or [almero.dupisani@up.ac.za](mailto:almero.dupisani@up.ac.za)

## Diary of Contests & Events / Dagboek van Kompetisies en Gebeure

Contests and Events - July 2020 / Kompetisies en Gebeure - Julie 2020 (UTC Times)	
01	RAC Canada Day Contest: 00h00Z - 23h59Z
04	SARL Newbie Party
05	ZS5 Sprint
04 - 05	Marconi Memorial HF Contest: 14h00Z - 14h00Z
11	RaDAR Challenge
11 - 12	IARU HF World Championship: 12h00Z - 12h00Z
15	SARL 80m Wednesday Club
18	Winter QRP Contest
19	ZS2 Sprint
18 - 19	CQ Worldwide VHF Contest: 18h00Z - 21h00Z
25 - 26	RSGB IOTA Contest: 12h00Z - 12h00Z
29 - 30	Delta Aquarids & Alpha Capricornids meteor showers
Contests and Events - August 2020 / Kompetisies en Gebeure - Augustus 2020 (UTC Times)	
01 - 02	10-10 International Summer Contest, SSB: 00h01Z - 23h59Z
01	European HF Championship: 12h00Z - 23h59Z
01 - 02	North American QSO Party, CW: 18h00Z - 06h00Z
02	SARL HF Phone Contest: 13h00Z - 16h30Z
08 - 09	WAE DX Contest, CW: 00h00Z - 23h59Z
10	SARL Youth Sprint: 12h00Z - 14h00Z
15	SARL 95 40m Club Sprint
16	SARL HF Digital Contest
15 - 16	SARTG WW RTTY Contest: 00h00Z - 16h00Z
15 - 16	North American QSO Party, SSB: 18h00Z - 06h00Z
22 - 23	International Lighthouse / Lightship Weekend: 00h00Z - 24h00Z
29 - 30	World Wide Digi DX Contest: 12h00Z - 12h00Z
29 - 30	YO DX HF Contest: 12h00Z - 12h00Z
30	SARL HF CW Contest: 14h00Z - 16h00Z
The Pretoria Amateur Radio Club does not accept responsibility for the accuracy of contest details listed above. For verification and more information, please visit the SARL website, <a href="http://www.sarl.org.za">www.sarl.org.za</a> , as well as the WA7BNM international contest calendar at the following website: <a href="http://hornucopia.com">http://hornucopia.com</a>	

### Pretoria Amateur Radio Club: Dates of Social Activities: 2020 Pretoria Amateur Radio Klub: Datums van Sosiale Aktiwiteite: 2020

**Annual General Meeting: 22 August**  
**Algemene Jaarvergadering: 22 Augustus**  
**Veterane Ontbyt: 10 Oktober**  
**Veteran's Breakfast: 10 October**  
**PARC 90'th Anniversary Celebration: 14 November**  
**PARK 90 Jarige Viering: 14 November**

For more information, contact / Vir meer inligting, kontak  
[Irene Myburgh ZS6IEA at 084-544-0618](mailto:irene.myburgh@outlook.com) or [irene.myburgh@outlook.com](mailto:irene.myburgh@outlook.com)

Please note: Due to National Lockdown regulations, dates can be changed  
 or postponed.

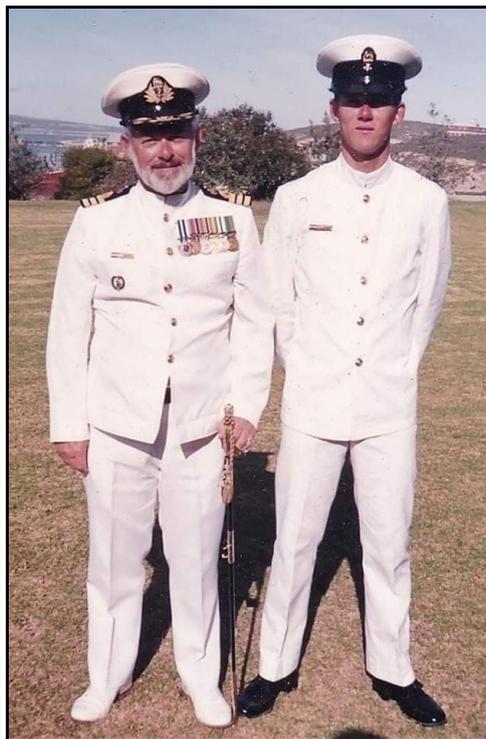
Neem asseblief kennis: As gevolg van Nasionale inperkings regulasies,  
 kan datums verander of uitgestel word.

## Willie Johan Marx Classen ZS6IAM (1943 – 2020)

Dit is met leedwese dat ons verneem het van die afsterwe van Johan Classen ZS6IAM. Johan was 'n bekende lid in die Pretoria Amateur Radio Klub, en het die stokperdjie saam met sy seun Uys ZS6UYS beoefen. Johan het sy radio amateur lisensie in Stanford verkry, en sy roepsein toe was ZS1WC. Hy was een van die stigterslede van die Overberg Amateur Radio Klub. Hy was 'n afgetrede kommandeur in die Suid-Afrikaanse Vloot. Benewens amateur radio, was hy 'n bedrywige fotograaf en het graag voëls gefotografeer. Tydens die Y2K oorgang was hy aangestel as een van die Y2K bystand stasies in die Overberg Wes-Kaap distrik vir Hamnet. Johan het die Jack Twain toekenning vir sy diens aan amateur radio ontvang. Namens die Pretoria Amateur Radio Klub wens ons sy gade Pikkie, sy seun Uys, en gesinslede ons innige meegevoel.



Johan Classen ZS6IAM in sy radiokamer



Johan en Uys in die SA Vloot

## Burglaries at the Pretoria Radcliff Repeater

Following several burglaries at the Radcliff repeater site, which included batteries and the power supply of the Pretoria 145.725 MHz repeater, a visit was conducted by Johan de Bruyn ZS6JHB and Louis de Wet ZS6SK on the 6<sup>th</sup> of June 2020 to replace the power supply. The power supply was installed by Greg Jarrett ZR6JDD who maintains the Radcliff site. PARC expresses it's sincere thanks to Johan, Greg and Louis.



# Renewal and Payment of ICASA Licences

**AMATEUR RADIO LICENCE RENEWAL – ICASA still operate the old system in parallel with the new online system.**

## **Legacy System**

If your licence was issued on the old system, you will receive an invoice. ICASA informed the SARL that the invoice will be mailed during the next few weeks. However with the huge postal backlog caused by the lockdown you may not receive it for some time.

You may pay it without the invoice as follows:

### **2020/21 Amateur Radio License fee:**

1 year licence - R 154.00.

2 year licence - R 294.00

3 year licence - R 422.00

4 year licence - R 537.00

5 year licence - R 642.00

Radio Amateurs are reminded that it is their responsibility to ensure their license is up to date. If for some reason no invoice is received, check that ICASA has been informed of any address changes.

Avoid the inconvenience of having to renew each year, opt for a multi-year licence. Simply, when renewing pay the appropriate amount. On the EFT state 5 Year licence and your callsign. Also send an e-mail to [specrev@icasa.org.za](mailto:specrev@icasa.org.za) and [dkuhrau@icasa.org.za](mailto:dkuhrau@icasa.org.za) with a copy of the EFT payment. The correct account for your ICASA Licence Fee is NEDBANK Account number: 14 62 00 29 27, Branch Code: 146245 - Corporate Client Services - Pretoria and in the reference field type in your **licence number and call sign.**

**ICASA Licence Fees - DO NOT pay the ICASA licence fee into the SARL bank account, all moneys wrongfully paid into the SARL account will be refunded less the bank charges associated with these transactions.**

## **Online System**

"The ICASA license renewal phase is very important for the new online system to work and for the protection of call signs issued to radio amateurs. The Authority extended the renewal date to 30 June 2020 and this is the process that we are busy with. The fact that a payment was made earlier in the year does not mean that the licence is renewed", Dewald Kuhrau told the SARL.

The new online system puts control over the licence in the licensee's hands. All amendments and/or renewals are done online by the licensee. For those radio amateurs who applied for their licences online the process is extremely easy. If you are not yet registered on the system then you need to register, create your legal entity, and then press the renewal button on the manage page. The system will then prompt you to indicate for how many years the licence must be renewed, and an invoice will be rendered after submission. Thereafter you can pay online through your manager portal or upload the proof of payment if payment is made through another method. Renewal for the following year will then be an easy exercise.

If this process is not followed, radio amateurs not only stand a chance to get the licence cancelled but more importantly lose their call signs. These call signs will then be available and assigned to other radio amateur which can cause much unhappiness.

To access the portal, go to <https://online.icasa.org.za/> . Please make sure that you have the Chrome browser installed first

Please do not call the SARL or any of the SARL officials as they cannot assist you. They do not have access to your ICASA account. The system is identity driven. **If you are experiencing any problems, send an email to [dkuhrau@icasa.org.za](mailto:dkuhrau@icasa.org.za)**

*Text for this message was copied from the SARL website. Please visit [www.sarl.org.za](http://www.sarl.org.za)*

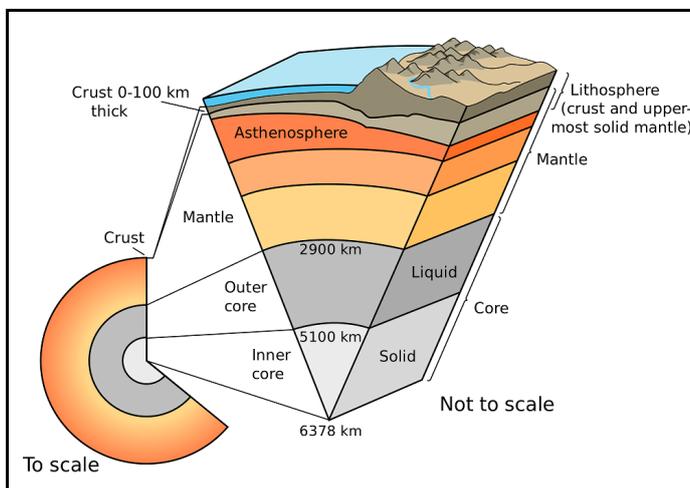
## Structure and Secular Variation of the Magnetic Field of the Earth : Part 1

### Introduction

Recently, various articles and discussions have appeared in the media regarding the weakening of the magnetic field of the Earth, as well as the possibility that the North and South poles might rotate or switch in the unknown future. Subsequent research into these phenomena have resulted in a variety of complex research- and informative papers and articles which had to be consulted in order to sketch a picture on what at first is the magnetic field of the Earth (Part 1), followed by various effects the magnetic field has on life on earth and technology. Lastly in the August Issue of Watts (Part 2), secular variations of the magnetic field in context with life on earth is discussed.

### Structure of the Earth

As the internal structure of the Earth has a critical bearing on it's magnetic field, a brief discussion is presented on the inner layers and composition of each. Based on the chemical properties of the Earth, five main layers or strata can be distinguished, namely the crust, upper mantle, lower mantle, outer core and inner core (Figure 1).



The outermost layer, or crust, ranges from 5 - 70 kilometers below the surface, and makes up 1% of the total volume of the Earth. The thicker part is known as the continental crust, while the thinner oceanic crust, which is 5 - 10km thick, underlies the oceans<sup>[2]</sup>. The upper section of the mantle and the crust constitute the lithosphere (Figure 1), which is an irregular layer approximately 200km thick. The mantle constitutes approximately 84% of the Earth's volume. Even though it is solid, it behaves as a very viscous fluid<sup>[2]</sup>.

**Figure 1 Layers (strata) of the Earth (Ref: USGS)<sup>[1]</sup>**

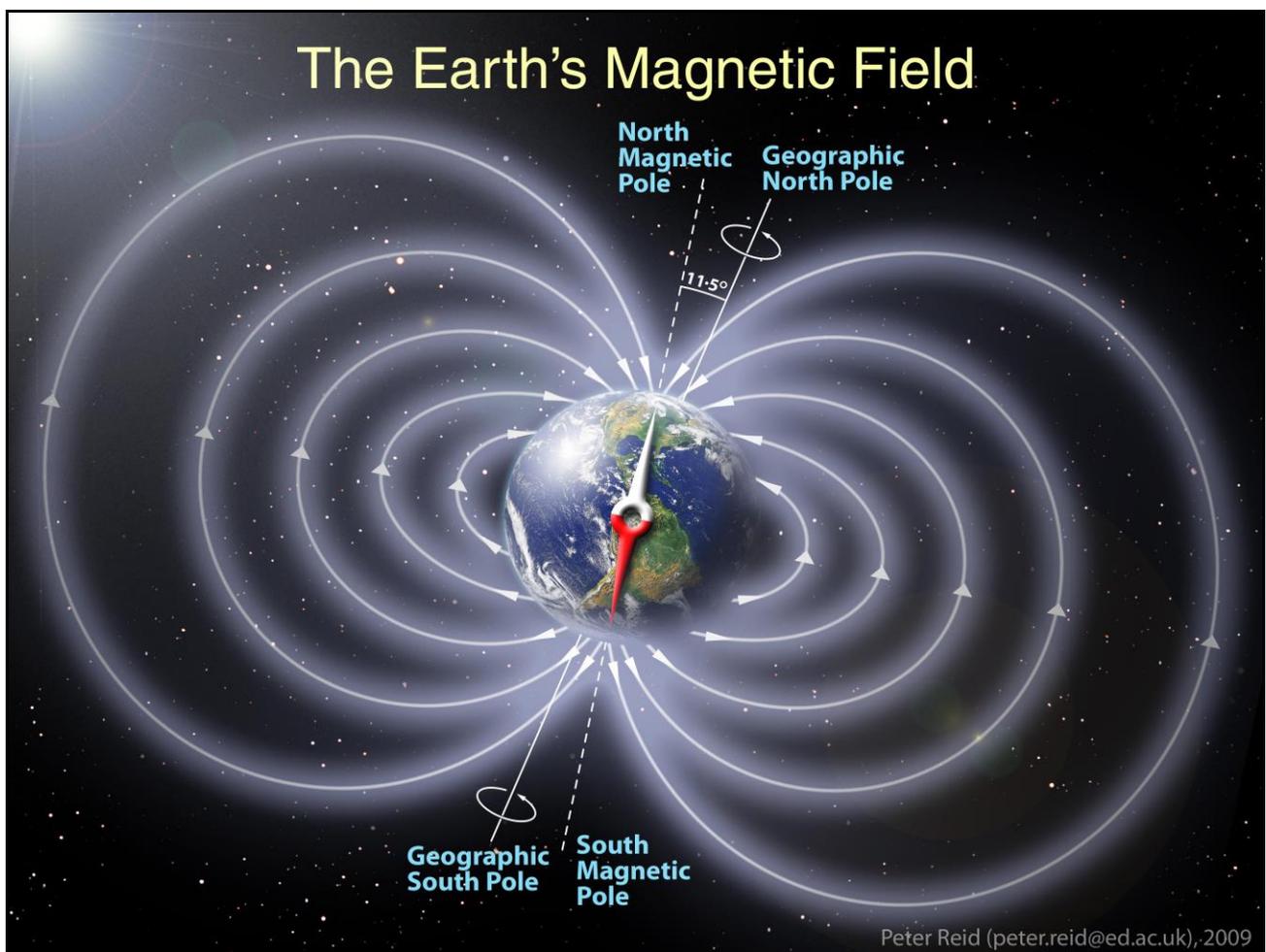
The mantle is the thickest layer, extending down to a depth of 2890km. The mantle is divided into the upper and lower mantles. The upper mantle starts at the "Mohorovicic (Moho) Discontinuity" originates at depths between 7 to 35km below surface and extends downwards to a depth of 410km. This layer is composed mainly of silicate rocks which are rich in iron and magnesium. Temperatures in this region range between 500 - 900°C. At these temperatures the silicate material is sufficiently ductile to flow over a very long timescale. The lower mantle lies between 660 and 2890 kilometers below surface, with temperatures reaching 4000°C at the boundary with the core, generally exceeding the melting points of mantle rocks<sup>[2]</sup>.

The liquid outer core is 2300km thick, extending to a depth of approximately 3400km below surface. While the average density of the Earth is 5515 kg/m<sup>3</sup>, the density of the outer core ranges between 9900 and 12200 kg/m<sup>3</sup>. It is believed that the outer core consists mostly of 80% iron, as well as nickel and other lighter elements. As the pressure is insufficient on the outer core, it is in a liquid form, but has the same chemical composition as the solid inner core. The temperature of the outer core ranges from 4000°C in the outer regions to 5730°C closest to the inner core<sup>[2]</sup>. Similar to the inner core, the outer core consists of iron and nickel, and has a radius of approximately 1220km. It's density ranges between 12600 - kg/m<sup>3</sup>, suggesting the presence of heavier elements such as gold, platinum, palladium, silver and tungsten<sup>[2]</sup>.

## Magnetic Field of the Earth

It is thought that the inner core is not rigidly connected to the Earth's solid mantle, raising the possibility that it might rotate slightly faster or slower than the Earth. Observations of seismic waves through the core have indicated that the inner core rotates between 0.3 and 0.5 degrees per year faster relative to the surface of the Earth. An interaction exists between the inner and outer core with regards to the generation and stabilization of the magnetic field of the Earth. The Dynamo theory states that the magnetic field of the Earth is generated by the combination of convection of molten metal (iron and nickel) in the outer core, combined with the Coriolis effect. Although the temperature of the inner core is too hot to maintain a permanent magnetic field, it still probably has a stabilizing effect on the magnetic field generated by the liquid outer core.

The resulting magnetic- or geomagnetic field extends from the interior of the Earth into space, where it interacts with a stream of charged particles originating from the Sun, known as the solar wind. The magnetic field of the Earth is a dipole tilted at an angle of approximately  $11.5^\circ$  relative to its rotational axis (Figure 2).



**Figure 2** Diagram of the Earth's Magnetic Field (Ref: NASA)<sup>[3]</sup>

Situated above the ionosphere of the Earth, the magnetosphere defines the extent of the Earth's magnetic field into space, which can be tens of thousands of kilometers. The magnetosphere protects the Earth by deflection from charged particles in the solar wind, as well as cosmic rays emanating from the sun. This prevents the loss of our atmosphere and ozone layer which protects the Earth from ultraviolet radiation (Figure 3). The stream of charged particles (solar wind) leaving the corona of the Sun accelerates to a velocity of up to 1000 km/s, distorting the magnetic field of the Earth.

The solar wind from the Sun could erode the Earth's atmosphere, should it reach it, but is kept under control by the opposite pressure of the Earth's magnetic field. The area where these pressures are in balance is known as the magnetopause, which is the boundary of the magnetosphere. The magnetosphere is asymmetric, with the sunward side having a size of approximately 10 Earth radii. On the opposite side, the magnetotail can be as long as 200 Earth radii due to an absence of solar wind (Figure 4).

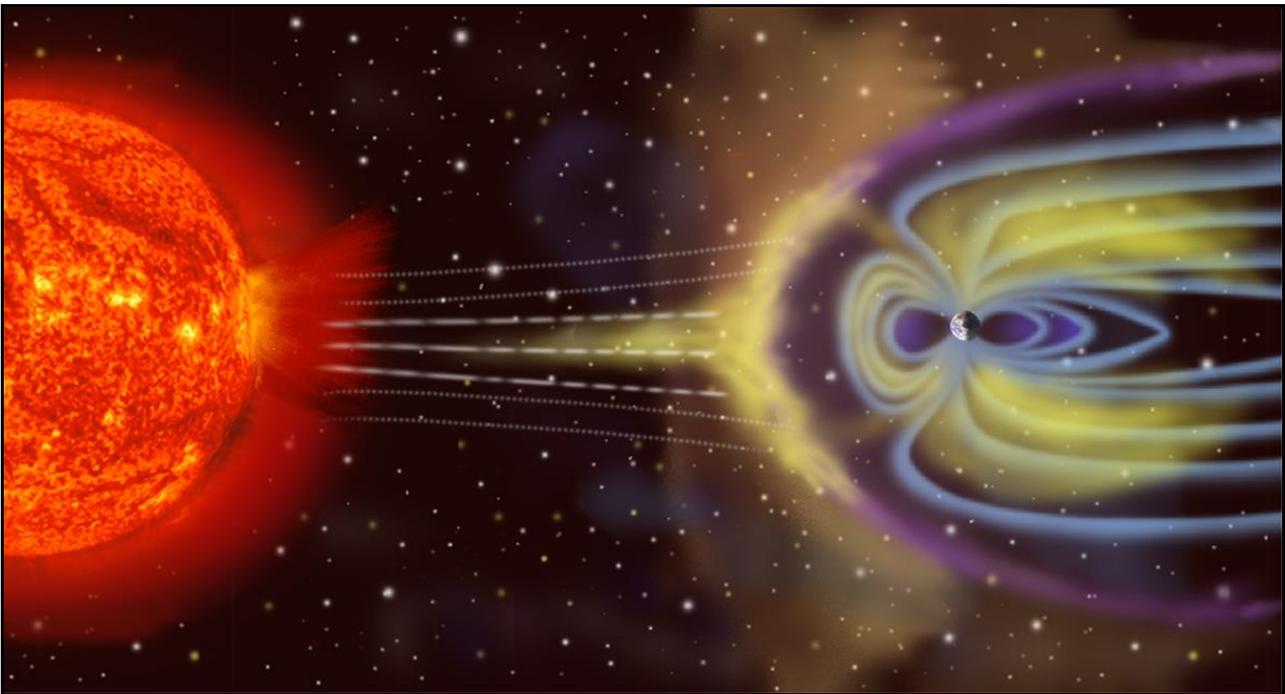


Figure 3 Interaction between solar wind and Earth's Magnetosphere (Ref: BGS)<sup>[4]</sup>

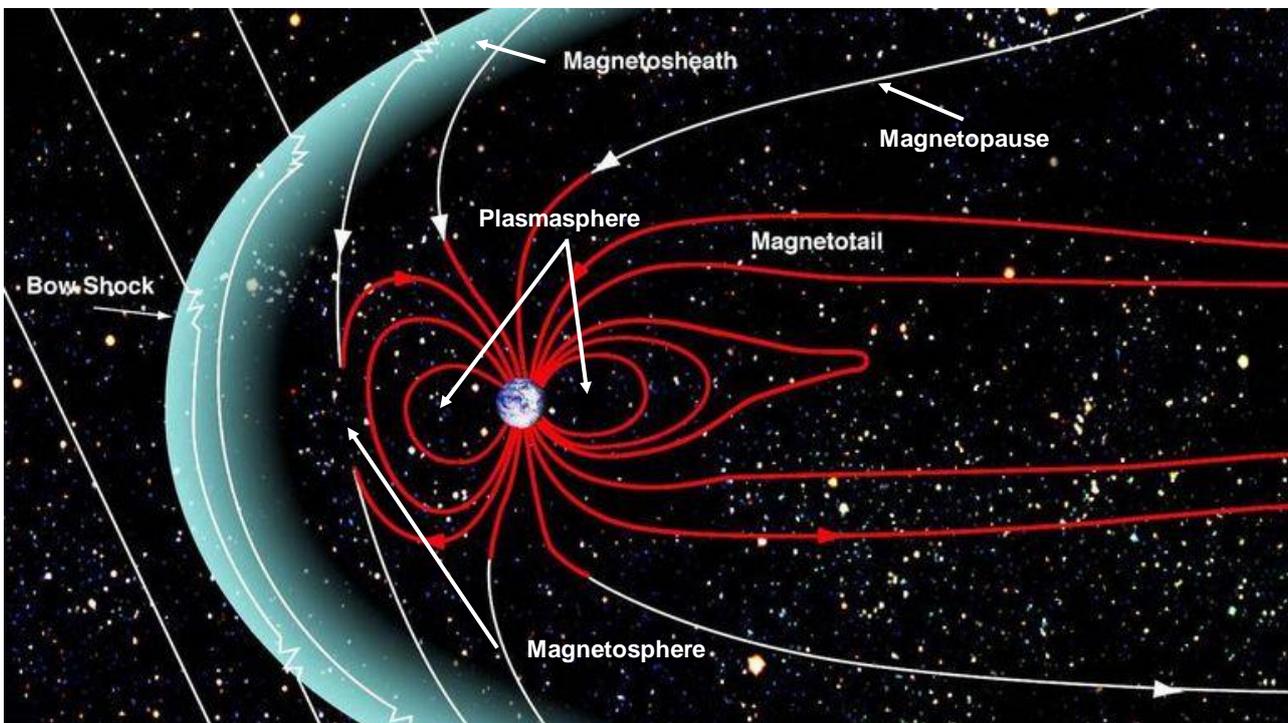


Figure 4 Structure of Earth's Magnetosphere (Ref: NASA)<sup>5</sup>

The donut-shaped plasmasphere is located within the magnetosphere, consisting of plasma, which are low-energy charged particles. The plasmasphere which rotates with the Earth, begins at a height of 60km, and extends to 3-4 Earth radii into space. The plasmasphere overlaps with the Van Allen radiation belts which consist of an inner belt (1-2 Earth radii) and an outer belt (4-7 Earth radii).

In the next issue of Watts, the phenomenon of secular variation of the magnetic field of Earth will be discussed in Part 2. The possibility of geomagnetic reversal and the possible effect on life on Earth will be placed under the magnifying glass. Lastly, the effects geomagnetic intensities on carbon dioxide concentrations in the atmosphere and climate change will be discussed.

## **References**

<sup>[1]</sup>USGS. (United States Geological Survey). Inside the Earth. <https://pubs.usgs.gov/gip/dynamic/inside.html>

<sup>[2]</sup>Williams, M. 2015. What are the Earth's layers? <https://phys.org/news/2015-12-earth-layers.html>

<sup>[3]</sup>[https://www.nasa.gov/sites/default/files/thumbnails/image/geomagnetic-field-orig\\_full.jpg](https://www.nasa.gov/sites/default/files/thumbnails/image/geomagnetic-field-orig_full.jpg)

<sup>[4]</sup>BGS (British Geological Survey). The Earth's Magnetic Field: An Overview. <http://www.geomag.bgs.ac.uk/education/earthmag.html>

<sup>[5]</sup>NASA, 2011. Earth's Magnetosphere. [https://www.nasa.gov/mission\\_pages/sunearth/multimedia/magnetosphere.html](https://www.nasa.gov/mission_pages/sunearth/multimedia/magnetosphere.html)

## **Thermoelectricity: by Hans Kappetijn ZS6KR (Hon. Member)**

Thermoelectricity is electricity generated directly by the action of heat and vice versa being the result of interactions between mobile electric charges and thermal conditions. These effects occur in liquids and solids, which may be metals, semimetals, semiconductors or ionic conductors.

There are three major effects:

### **1. SEEBECK EFFECT.**

If a homogeneous material having mobile charges has temperature  $T_1$  at one end and  $T_2$  at the other end while it is in an open circuit, then a difference in electric voltage will occur between the two ends directly proportional to the temperature difference and is independent of the detailed temperature distribution between the two ends.

This was first reported to the Prussian Academy of Sciences by Thomas Seebeck in 1822. He failed to understand the nature of his discovery, because in subsequent experiments he used closed circuits of dissimilar materials and claimed that the resulting deflections of nearby magnetic compass needles proved that heat currents produce the same effect as electric currents. Ohm's law, stated in 1827, showed that Seebeck's use of closed circuits had inadvertently produced electric currents.

### **2. PELTIER EFFECT**

Unlike the Seebeck effect, the Peltier effect only occurs at the junction of two dissimilar materials when an electric current flows. Heat, called Peltier heat is, is either emitted or absorbed at the junction, dependent on the direction of current flow. This effect was discovered by the French physicist Jean C.A. Peltier.

Once again the basic nature of the effect was at first misunderstood. Peltier believed that he had discovered a violation of Ohm's law. Only a few years later in 1838, Heinrich Lenz (Lenz' Law) demonstrated the true nature of this effect when he used a bismuth-antimony junction and froze a drop of water when passing electric current in one direction (absorbing heat) and melted the drop by reversing the current (emitting heat).

### **3. THOMSON EFFECT**

In 1854 William Thomson who later became Lord Kelvin for his contributions in laying the first transatlantic cable, used thermodynamic arguments to relate the Seebeck and Peltier effects. In the process he predicted a third effect - namely, that an electric current flowing through a homogeneous material that also has a temperature difference will cause the emission or absorption of heat in the body of the material. The direction of the electric

current would also determine heating or cooling. This effect was subsequently discovered and called the Thomson Effect.

### PRINCIPLES

The Seebeck and Peltier effects both lend themselves to qualitative description. Temperature differences causes mobile charges to deviate from a uniform distribution. This re-distribution causes electric forces. The final result is a steady-state situation where diffusive and electric forces balance each other and thus cause no net motion (no current) but have effected a non-uniform distribution of the mobile charges related to the temperature difference and causes the Seebeck voltage.

In the Peltier case a net motion exists and thus the charges transport energy. The energy associated with each charge differs in the two materials. When thus such charges move through the junction they emit or absorb energy. The Thomson effect is too subtle for such a qualitative description in this publication.

### USES

Metals show small Seebeck effects, but material properties dictate their use in thermo-sensors such as the thermocouple which is an open-circuit using two dissimilar materials. A semiconductor shows much larger Seebeck effects and is commonly used to generate electric power. Because any heat source is acceptable, a variety of methods are in use, such as kerosine lamps and firewood (in remote areas), heat from nuclear decays (in space and floating weather stations) and heat from direct sunlight ranging up to hundreds of watts.

The Peltier effect is used in refrigeration and heating, where 70°C below room temperature can be achieved. Peltier coolers have the advantage of very local heat transfer and no moving parts justifying its use in numerous special circumstances despite the disadvantages of lower efficiencies and higher costs. Some examples are the maintenance of temperature during the transport of biological samples and air conditioners in submarines.



The image shows a calendar for the 2020 Northern Regions Rally. The title is '2020 Northern Regions Rally Calendar' in large, bold, black font. Below the title is a table with four columns: Rnd, Date, Province, and Location. The table contains four rows of data, each representing a rally event. The background of the calendar is yellow with red diagonal lines.

Rnd	Date	Province	Location
1.	28 March	Mpumalanga	Delmas
2.	26 April	Mpumalanga	Sabie
3.	22 August	Mpumalanga	Bad Plaas
4.	17 October	Mpumalanga	Belfast

Please do contact Johan de Bruyn ZS6JHB or Graham Reid ZS6GJR for more information

## Long Term HF Propagation for July 2020: Courtesy Vincent Harrison ZS6BTY

The graph below shows the predicted F-layer Maximum Usable Frequency (MUF) for propagation from Pretoria<sup>[1]</sup> using monthly sunspot numbers from SILSO<sup>[2]</sup>.

**Local Propagation (up to 500 km):** The F or F2 critical frequency ( $f_oF_2$ ) is the MUF for short range, near vertical incidence sky-wave (NVIS) propagation.

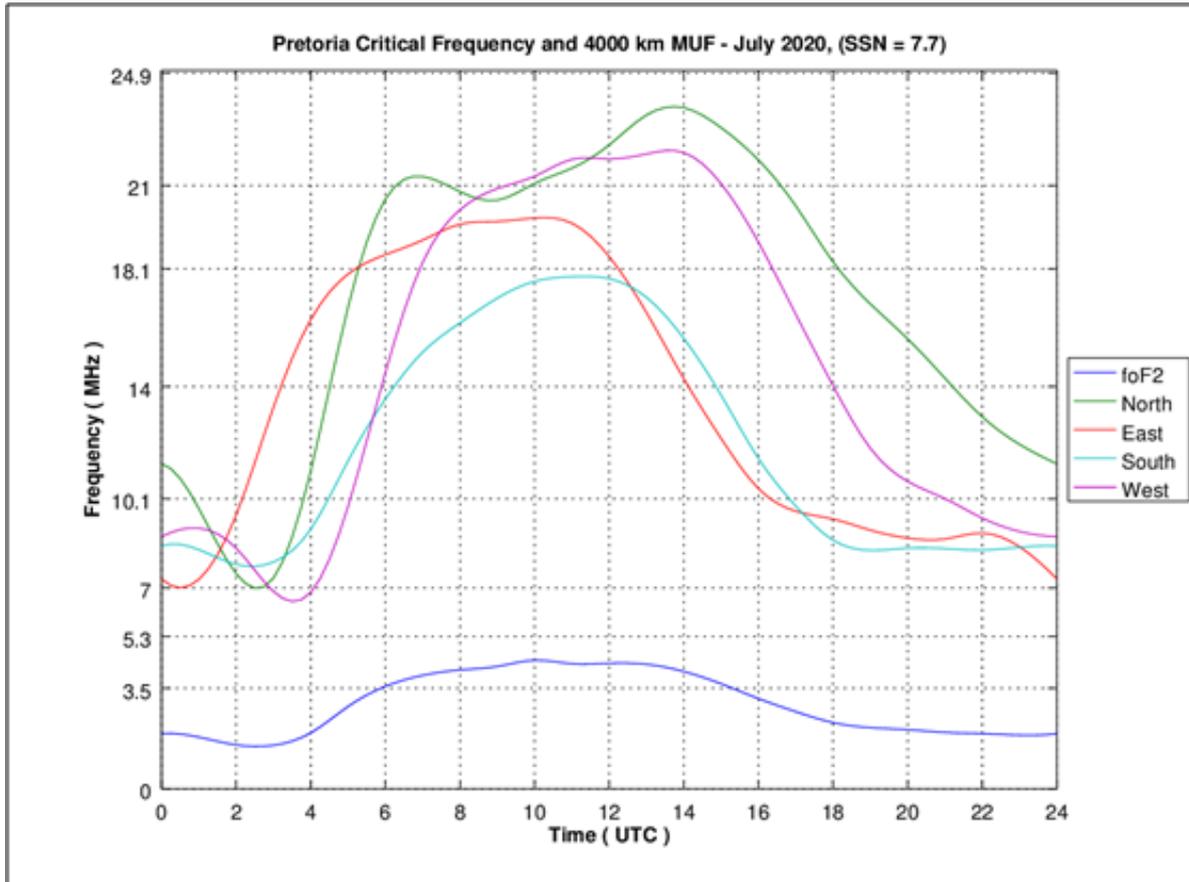
**Long Distance Propagation:** The MUF for a first hop of 4000 km in the cardinal directions is labeled North, East, South and West. They indicate the direction that propagation may be expected.

**Worldwide Propagation Maps:** <http://www.parc.org.za/index.php?page=propagation>

"Prediction is difficult, especially when dealing with the future". . . Danish Proverb. 73 Vincent, ZS6BTY

<sup>[1]</sup>FTZMUF2: A simple method of estimating the ionospheric parameters of  $f_oF_2$  and M(3000) with the aid of a home computer - Thomas Damboldt and Peter Süßmann, Deutsche Bundespost, December 1988.

<sup>[2]</sup> Silso 12-month forecasts of the monthly sunspot number ( <http://sidc.oma.be/silso/FORECASTS/prediML.txt>)



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