



# WATTS

**04-2016**  
Year 86 + 4m

Monthly Newsletter of the Pretoria Amateur Radio Club  
Maandelikse Nuusbrief 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 on Sundays / Sondag at 08:45**  
 Relays: 1.840, 3.700, 7.066, 10.135, 14.235, 51.400, 438.825, 1297 MHz  
 Activated frequencies are announced prior to bulletins  
**Swopshop : 2m and 7.066 MHz live on-air after bulletins**  
 Bulletin repeats on Mondays / herhalings op Maandae : 2m 19:45



Foto deur Eugene

**Motor 88 van Robbie Coetzee en Chris Coertse in aksie tydens die Goldfields Tydren gedurende 4-5 Maart 2016. Meer hieroor op bladsy 3.**

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**Club Meetings / Klub Vergaderings**

**Club Social Meeting :**  
 Saturday 2<sup>nd</sup> of April 2016 from  
 14h00 at SAM. Talk by Louis  
 ZS6SK on Poisons, Venoms and  
 Endocrine Disrupting Chemicals

**Committee Meeting :**  
 Thursday 17<sup>th</sup> of March 2016  
 from 19h00 at SAM

## PARC Committee Members / Komiteelede : 2015 - 2016

### Elected Members

<b>Chairman, Social &amp; Rallies</b>	Johan de Bruyn	ZS6JHB	<a href="mailto:zs6jhb@gmail.com">zs6jhb@gmail.com</a>	012-803-7385	079-333-4107
<b>Vice Chairman, Contests</b>	Pierre Holtzhausen	ZS6PJH	<a href="mailto:zs6pjh@telkomsa.net">zs6pjh@telkomsa.net</a>	012-655-0726	082-575-5799
<b>Treasurer</b>	Andre van Tonder	ZS6BRC	<a href="mailto:andre.vtonder@absamail.co.za">andre.vtonder@absamail.co.za</a>	012-361-3292	082-467-0287
<b>Secretary, Bulletin Coordinator</b>	Jean de Villiers	ZS6ARA	<a href="mailto:zs6ara@webmail.co.za">zs6ara@webmail.co.za</a>		083-627-2506
<b>Public Relations, RAE, Bulletins</b>	Etienne Naude	ZS6EFN	<a href="mailto:etienne@afriqrid.com">etienne@afriqrid.com</a>		082-553-0542
<b>Web co-ordination</b>	Graham Reid	ZR6GJR	<a href="mailto:greid@wol.co.za">greid@wol.co.za</a>		083-701-0511
<b>Repeaters</b>	Craig Symington	ZS6RH	<a href="mailto:zs6rh@hotmail.co.za">zs6rh@hotmail.co.za</a>		081-334-6817
<b>Competitions</b>	Jaco Cronje	ZR6CMG	<a href="mailto:jacocronje@yahoo.com">jacocronje@yahoo.com</a>		081-474-2220
<b>Clubhouse &amp; Contests</b>	Whitey Joubert	ZS6JJJ	<a href="mailto:zs6jjj@gmail.com">zs6jjj@gmail.com</a>		072-120-4516
<b>Technical, Web &amp; Repeaters</b>	Gawie Marais	ZS6GJM	<a href="mailto:zs6gjm@gmail.com">zs6gjm@gmail.com</a>		083-663-2222
<b>Repeaters</b>	Andre Coetzee	ZS6GCA	<a href="mailto:Johncoetzee@absamail.co.za">Johncoetzee@absamail.co.za</a>		082-772-5811
<b>WATTS, RAE &amp; Clubhouse</b>	Louis de Wet	ZS6SK	<a href="mailto:louis.zs6sk@gmail.com">louis.zs6sk@gmail.com</a>	012-349-1044	072-140-9893
<b>Co-Opted Members</b>					
<b>Fleamarkets</b>	Alméro Dupisani	ZS6LDP	<a href="mailto:almero.dupisani@up.ac.za">almero.dupisani@up.ac.za</a>		083-938-8955
<b>Auditor</b>	Tony Crowder	ZS6CRO	<a href="mailto:tcrowder@telkomsa.net">tcrowder@telkomsa.net</a>	011-672-3311	
<b>Historian, Archives, Awards</b>	Tjerk Lammers	ZS6P	<a href="mailto:zs6p@iafrica.com">zs6p@iafrica.com</a>	012-809-0006	083-976-4387

### Birthdays – April / Verjaarsdae – April

01 Melanie, daughter of Peggy and Ed ZS6UT	04 Dino Cottis ZS6DNO
08 Klasie, seun van Sylvia en Tjerk Lammers ZS6P	13 Liam, son of Heather and Vincent ZS6BTY
19 Etienne Naude ZS6EFN	

#### Spouse's Birthdays – April / April

10 Joey, sw of Graham Reid ZS6GJR  
 15 Joanne, sw of Evan Seligmann ZS6ELI  
 22 Marita, eggenoot van Roy Alexander ZS6MI  
 29 Heather, sw of Vincent Harrison ZS6BTY

#### Anniversaries / Herdenkings – April / April

06 Andre ZS6BRC en Lyn van Tonder  
 10 Evan ZS6ELI and Joanne Seligmann  
 30 Graham ZS6GJR and Joey Reid

#### April Birthstone: Diamond

*Diamonds are thought to provide those who wear them with better relationships, balance, clarity, abundance, and an increase in inner strength.*



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

#### Contests and Diary of Events – April 2016 / Kompetisies en Dagboek van Gebeure – April 2016 (UTC Times)

02	SARL RaDAR Challenge
02 – 03	SP DX Contest : 15h00 – 15h00
07	SARL 80m QSO Party : 17h00 – 20h00
09 – 10	JIDX CW contest : 07h00 – 13h00
10	Hungarian Straight Key Contest : 15h00 – 17h00
15 – 16	Holyland DX Contest : 21h00 – 21h00
16 – 17	YU DX Contest : 21h00 – 05h00
23 – 24	10-10 International Spring Digital Contest : 00h01 – 23h59
23 – 24	SP DX RTTY Contest : 12h00 – 12h00
23 – 24	Helvetia Contest : 13h00 – 12h59

#### PARC SUBS / LEDEGELD FROM / VAN 31-10-2015

Bank	First National Bank	Ordinary Members / Gewone Lede : R150 Spouses / Pensioners : R50	<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 oorplasing in die PARC rekening**

### PARC Fleamarkets for 2016 are scheduled for the following dates:

**5 March ; 28 May ; 27 August ; 5 November**

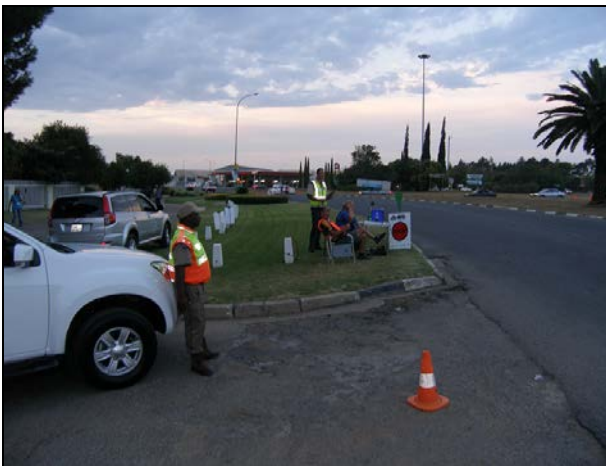
Please do contact Alméro du Pisani ZS6LDP ([almero.dupisani@up.ac.za](mailto:almero.dupisani@up.ac.za) 083-938-8955) for more information or to book a table, or if you wish to donate any old equipment to PARC

## Die Goldfields Tydren, Welkom : 4 -5 Maart 2016

Die 2016 tydren seisoen het in volle swang afgeskop met die Goldfields tydren gehou in Welkom vanaf die Phakisa renbaan. Vrydag oggend die 4de Maart het 'n groepie van ons by die vulstasie net voor Krugerdorp ontmoet en die tog aangepak Welkom toe. Net buite Potchestroom het ons gestop vir 'n lekker ontbyt langs die pad, en daarna was dit weer fort verby Vierfontein en Bothaville op paaie wat letterlik gemaak is van slaggate. So teen 2 uur die middag het ons by die Phakisa renbaan aangekom, bene gerek en deurgestap om die deelnemers se tydelike werkswinkels en motors te bewonder. Na 'n vinnige afpak en stort by die gastehuis is ons na die tweede trajek wat om 19h00 sou afskop in sentraal Welkom.



Vir die wat Welkom ken met sy unieke straatuitleg, kan jy jousef voorstel watter uitdaging dit moet wees om teen volspoed deur middelman kruisings te snel, om te draai aan die einde, en weer volspoed kris krus weer terug te jaag in die pikdonkerte. Glad nie vir die swakhartiges nie! Die publiek het wonderlik saamgewerk en skarebeheer was 'n plesier gewees. Maar soos dit werk, vyf minute voor die aanvang van die tydren was daar 'n huislose man reg in die middel van die trajek met 'n klomp plastieksakke, salig onbewus, wat ek eers moes help na veiligheid. Willie ZR6WGR (onder) was druk besig met sy koplamp om tyd resultate bymekaar te kry en reg oor te skryf terwyl gekontroleerde chaos rondom hom geheers het.



Die volgende oggend vroeg is ons uit na die onderskeie trajekte met Johan ZS6JHB en Louis ZS6SK op Harmony 1 & 2, Tony ZS6CRO en Pieter ZS6CN op Esperanza 1 & 2, Brian ZS6YZ en Anette ZR6D op Buks 1 & 2, en Pieter ZS6PAM en Willie ZR6WGR op Nooitgedacht 1 & 2. Mobiel 1 was beman deur John ZR6JAO, terwyl Menno ZS6AGC Kar 0 was. Ben ZR6BVB was Marshal 1, terwyl JB ZR6YV die beheerkamer beman het. Irene Muyburgh en Annatjie Fourie het saam met Pieter ZS6PAM en Pieter ZS6CN op die trajekte gewerk en gesorg dat die manne se kele nie te droog word nie. Natuurlik soos altyd was stof en adrenalien 'n groot deel van die pret gewees wat enige tydren 'n heerlike ervaring maak.



Na die oggend se aksie by die trajekte is ons terug na die Phakisa renbaan waar Johan en Louis die Phakisa 2 trajek beman het. Daar was baie geleenthede vir aksieskote en videos (wanneer tyd dit toegelaat het) wanneer die motors teen meer as 160 kilometer per uur voor die hoofpawiljoen verbygesnel het.



Pretoria Amateur Radio klub bedank hiermee graag met groot waardering lede en nie-lede vir hul bydraes tot die Goldfields tydren. Die volgende tydren is die SASOL wat vanaf 22 April sal plaasvind in- en rondom Sabie. Vir meer inligting aangaande die komende en ander tydrenne, kontak gerus vir Johan ZS6JHB.



Saterdag aand na die tydren aksie was almal rasend honger en het ons heerlik gekuier by 'n plaaslike restaurant.



Na die ete het PARK en Magalies Klub lede die dorp rooi geverf...

Die volgende oggend 5 uur is ons fort huistoe en het teen so 9 uur ontbyt genuttig in Potchefstroom. Onder is Eugene, seun van Louis, Brian ZS6YZ, Anette, ZR6D, Pieter ZS6CN en gade Annatjie.



## Does the kilogram need to be re-defined?

The kilogram is the last of the SI (International System) base units to be defined by a physical object or artefact. The kilogram is defined as “the mass of a particular cylinder of platinum-iridium alloy, called the International Prototype Kilogram (IPK), which is preserved in a vault at Sevres, France, by the International Bureau of Weights and Measures” (CRC, 1998 ; NIST, 2001 ; BIPM, 2006). It is the only SI base unit which has the prefix “kilo”, and the only unit which is defined by an artefact, rather than a fundamental physical property which can be reproduced in any laboratory. Other base units which are affected by the definition of the kilogram include (i) the Ampere, whose definition relates to the Newton; (ii) the Mole, whose definition refers to 0.012kg of carbon-12, and (iii) the Candela, which relates to the Watt.



The international prototype of the kilogram, officially sanctioned in 1889, and designated as  $\mathfrak{K}$ , is a platinum (90%) and iridium (10%) cylinder of diameter and height roughly 39mm (left centre). The IPK was commissioned by the General Conference on Weights and Measures (CGPM) under the authority of the Metre Convention in 1875. The original artefact ( $\mathfrak{K}$ ) as well as six official copies are stored in a vault at the Bureau International des Poids et Mesures (BIPM), and is only accessible by permission of the International Committee for Weights and Measures (CIPM).

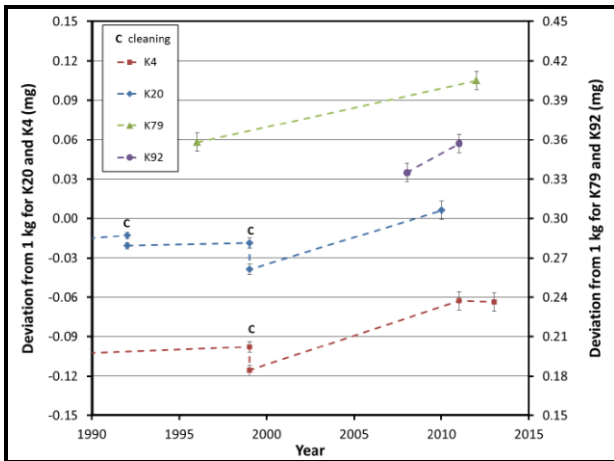
In order to ensure international compatibility, the unit of mass is disseminated throughout the world by comparisons with  $\mathfrak{K}$ , made indirectly through a hierarchical system. The first comparisons are made with a subset of “official copies” of  $\mathfrak{K}$ . This is followed by calibrations of additional copies known as “national prototypes”, which ensures that countries worldwide can ensure that the mass of its prototype and all measurements that derive from it are traceable to  $\mathfrak{K}$ .

Ten years after the initial distribution of the national prototypes, member states were invited to send their prototypes to the BIPM to check their stability. In the period 1899 - 1911, measurements were conducted on 25 prototypes. The international prototype was not used during this exercise. This was a true “verification” as now new certificate was issued unless the mass value calculated at the end of the verification changed by more than 0.05 mg from the value certified in 1889.

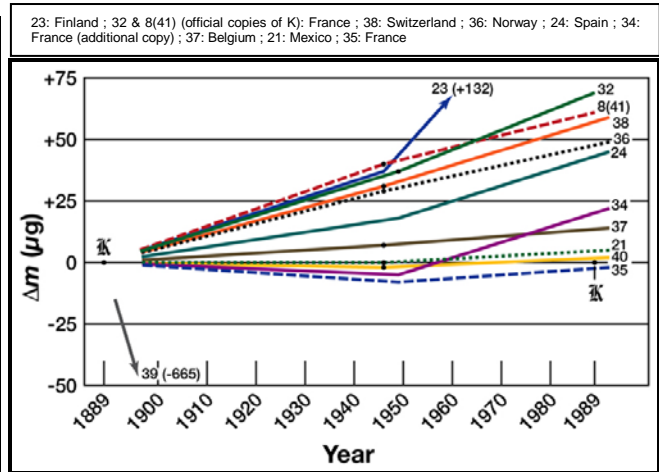
In 1939 the CIPM authorized a comparison between  $\mathfrak{K}$  and its six official copies. The 1939 study is notable for the first mention of a hypothesis that  $\mathfrak{K}$  may have lost some tens of micrograms since 1889, relative to that of the copies. During the war years methods were developed to clean the copies with ethanol and bi-distilled water steam washing, as it was thought that they may gain mass through adsorption of atmospheric contamination on their surfaces.



Subsequent comparative verification exercises during the 1947 – 54 and 1988 – 92 periods have shown the masses of worldwide prototypes of  $\mathfrak{K}$  to be slowly but inexorably diverging from each other. Relative to the prototype mass pieces and official copies, it was evident that the mass of the IPK decreased by at least 50  $\mu\text{g}$  over the past century. In the press however, this relative change of mass has often been misreported which stated that the IPK “lost 50 $\mu\text{g}$ ”, and did not mention that this apparent mass decrease was “in comparison with its official copies” or other prototypes. The United States, for example, originally purchased prototypes 20, 4, 79, 85 and 92, of which K20 is designated as the primary national prototype, and K4 the check standard. Prototypes K79 and K92 serve as additional checks for K20. In the period 2010 – 2011 when K20 and K4 were sent to the BIPM (no cleaning was done), significant changes in their masses were recorded, being +0.045 mg for K20 and +0.053 mg for K4, which were unprecedented in the history of both artefacts. Similar deviations, were recorded for K79 (+0.047 mg) and K92 (+0.022 mg), necessitating the recalibration of all prototypes. Similar deviations have also been recorded for other countries participating (Figures next page).



History of the calibration of the US National Prototype K20, check standard K4 and other (K79 and K92) at the BIPM. The uncertainty bars ( $k=1$ ) for each number are the uncertainties reported by the BIPM calibration certificates



Mass drift for several national prototypes as well two copies (K32 & K8) of the IPK. All results are relative, as the starting value offsets relative to the IPK have been nulled.

It has therefore become apparent that the definition of the kilogram, based on a 120 year old platinum-iridium cylinder should be redefined in more modern scientific terms, as the mass of the IPK could be changing over time. The replacement of the classic definition by an intrinsic (non-artifact) definition thus has been deemed a high priority. Mills *et al.* (2005 ; 2006), who are representatives of the BIPM and the U.S. National Institute of Standards and Technology (NIST), including the head of the Consultative Committee on Units (CCU) advisory committee to BIPM, and the head of the Fundamental Constants Data Center at NIST, have proposed new definitions of the kilogram and other SI units. Since the perceived weakness of the current SI definitions of other units such as the ampere, mole and candela “derives in large part from their dependence on the kilogram... the definition of the kilogram is thus central to the more general problem of improving the SI (Mills *et al.*, 2006).

The CCU/NIST (2005) subsequently described two possible methods to redefine the kilogram:

- Fixing the value of Planck’s constant ( $h$ ), and then using a watt-balance, and
- Fixing the Avogadro constant  $N_A$  and then using a silicon-sphere (XRD – X-Ray crystal Diffraction) method to realize the definition.

In a subsequent paper (2006) the authors settle on the fixed- $h$  method, which is based on two fundamental physics equations:  $E = mc^2$  (special relativity) and  $E = hf$  (quantum mechanics). Using both equations for  $m$  yields  $m = hf/c^2$ , and solving for  $f$  yields  $f = mc^2/h$ . Using the equation solving for  $f$ , three concrete definitions were proposed:

- The kilogram is the mass of a body whose equivalent energy is equal to that of a number of photons whose frequencies sum to exactly  $(299792458^2 / 66260693) \times 10^{41}$  Hertz.
- The kilogram is the mass of a body whose de Broglie-Compton frequency is equal to exactly  $299792458^2 / (6.6260693 \times 10^{-34})$  Hertz.
- The kilogram, or unit of mass, is such that the Planck constant is exactly  $6.6260693 \times 10^{-34}$  joule per second.

The above definitions, although scientifically thorough, sincerely complicates the definition of the kilogram for the average person beyond understanding, and a sound understanding of quantum mechanics is required to fully understand the theory behind the proposed definitions. The two above definitions for the kilogram require vastly different approaches, one being the Watt balance, and the other a spherical crystalline silicon mass piece, which redefines the kilogram in terms of Avogadro’s constant, which relates an element’s atomic mass to it’s bulk weight. In next month’s issue of Watts we will cover the Watt balance and the silicon sphere in more detail. *Louis de Wet ZS6SK*

BIPM, 2006. The International System of Units. 8<sup>th</sup> Edition. International Bureau of Weights and Measures. Sevres Cedex. France.  
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 MILLS, I., MOHR, P., QUINN, T., TAYLOR, B. & WILLIAMS, E. 2005. Redefinition of the kilogram. *Metrologia* 42: 71 – 80.  
 MILLS, I., MOHR, P., QUINN, T., TAYLOR, B. & WILLIAMS, E. 2006. Redefinition of the kilogram, ampere, Kelvin and mole: a proposed approach to implementing CIPM recommendation 1 (CI-2005). *Metrologia* 43: 227-246  
 NIST, 2001. The International System of Units (SI). Special Publication 330. National Institute of Standards and Technology.  
 PRATT, J.R. 2014. How to weigh everything from atoms to apples using the revised SI. *J. Meas. Sci.* 9(1): 26 – 38.

## PARK VHF / UHF Kompetisie

Die PARK VHF / UHF kompetisie het gedurende die naweek van die 19de tot 20ste Maart plaasgevind. PARK lede het 'n wel toegeruste basis opgerig en die terrein by SAM was volgepak met antennes en voerlyne wat oor die grond geloop het en met tye soos 'n spinnerak gelyk het. PARK was goed verteenwoordig deur ons Voorsitter Johan ZS6JHB en sy gade Doreen, ZR6DDB, Pierre ZS6PJH, Jaco ZR6CMG, Ryan ZS6GGR, Pieter ZS6PA asook Kallie ZS6KCS en Ina. So tussendeur die kompetisie werk het Ryan tyd gemaak om sy energieke honde die nodige daaglikse oefening te gee, en ons het met tye 'n "Vreemde Vlieende Voorwerp", of is dit nou 'n weerballon...?.. dopgehou... PARK moedig u aan om by ons kompetisie aan te sluit en nie net radio te geniet nie, maar ook 'n bietjie kampering en braaivleis ook as u vir die dag net wil wegkom van alles. Kontak gerus vir Jaco Cronje ZR6CMG vir meer inligting oor komende kompetisies.



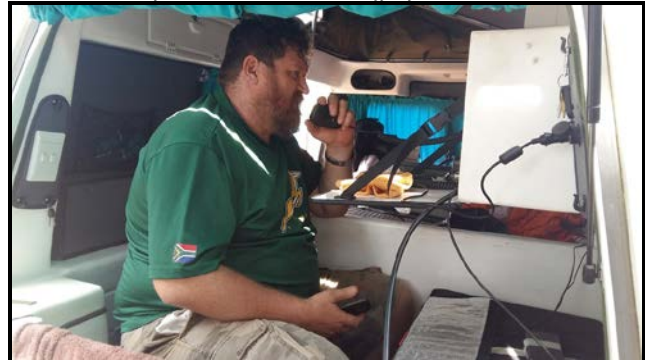
Doreen en kleindogter, Ryan, Pierre, Jaco, Pieter, Ina en Kallie



Antennes, voerlyne en radios net waar jy kyk...



Pierre se legendariese karavaan



Pierre in aksie



Kallie en Ina Marais wat saam luister



Is dit 'n weerballon of 'n VVV?



CQ kompetisie... ZS6PTA...

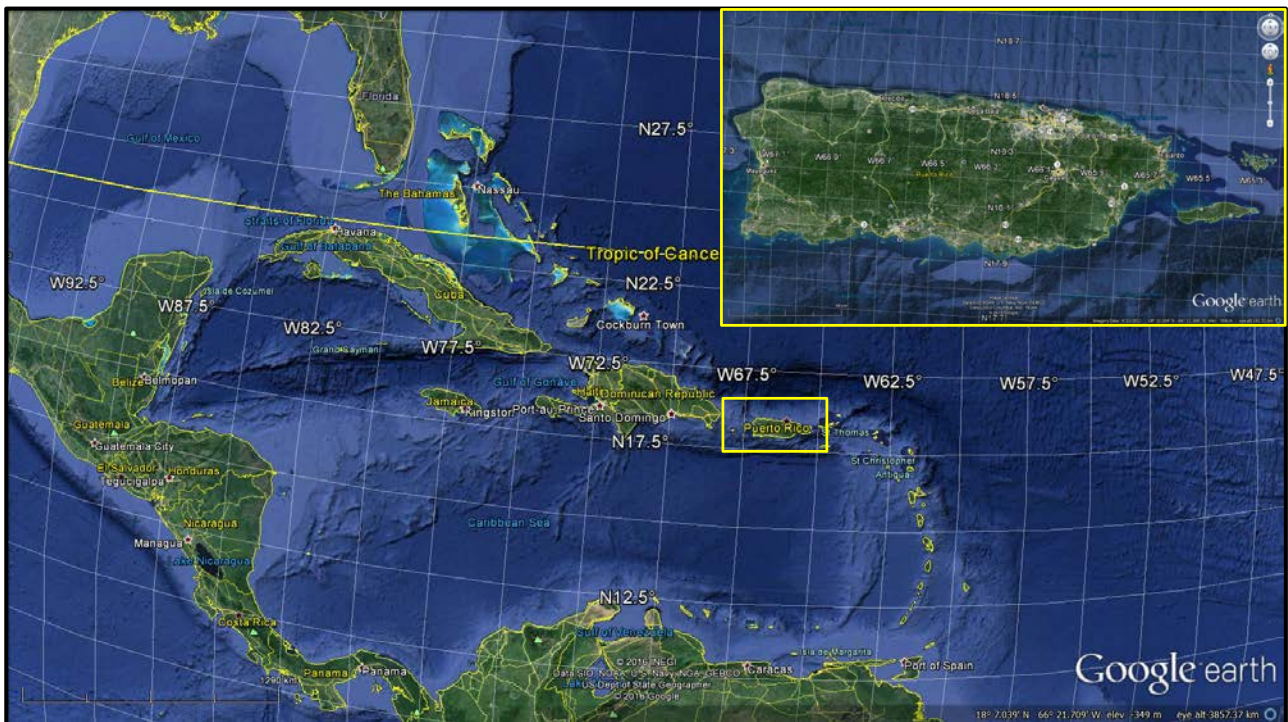


Ryan met Alpha en Batman



## The Arecibo Observatory

The Arecibo Observatory, located on the island of Puerto Rico, is since 1962 the largest single dish radio telescope in the world. The spherical primary reflector is 305 meters in diameter, 49 meters deep and covers approximately 7.3 hectares. The spherical surface of the primary reflector consists of 38 788 perforated aluminium panels. Constructed from 1960 to 1963 by Cornell University under contract to the U.S. Air Force, it was operated by Cornell for the Air Force initially, and then for the National Science Foundation (NSF), which took over the facility from the Department of Defence in 1969. Since 1971, the observatory has been part of the National Astronomy and Ionosphere Centre (NAIC). Research is conducted primarily in astronomy, planetary studies, as well as space and atmospheric sciences.



Location of Puerto Rico relative to the Dominican Republic, Jamaica and Cuba



Incoming signals are reflected by a parabolic antenna to a single focus. As the primary reflector surface of the antenna is fixed, the receiver above it needs to be moved in order to examine different parts of the sky. Due to imperfections or spherical aberrations in the reflector surface, signals are not reflected to the principal focus, but to points at various heights above the reflector surface. Subsequently, line feed receivers were initially utilized to collect signals.

The receivers are mounted on a rotating azimuth arm, which is in turn suspended from a large supporting platform approximately 150 meters above the reflector surface (left and next page).

The entire structure, with a mass of approximately 900 tons, is supported by 18 steel cables strung from three reinforced concrete towers placed around the antenna with 120° separation. When completed in 1963, the primary reflector surface consisted of wire mesh, which limited operating frequencies to lower than 600 MHz. During an upgrade in 1974, perforated aluminium panels (1 x 3m each) were installed to replace the wire mesh surface. They are supported by a grid of cables, which are in turn held in place and shape by 2000 additional cables attached to concrete blocks (or tieback points) on the ground below the reflector.

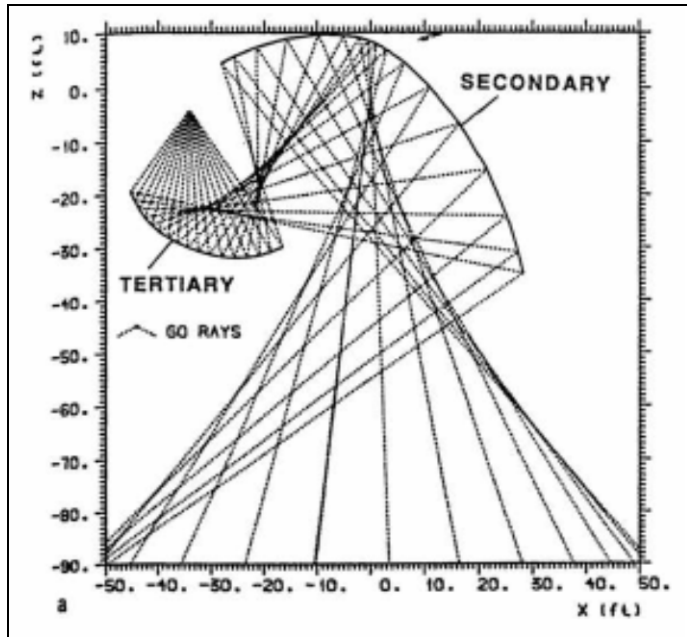
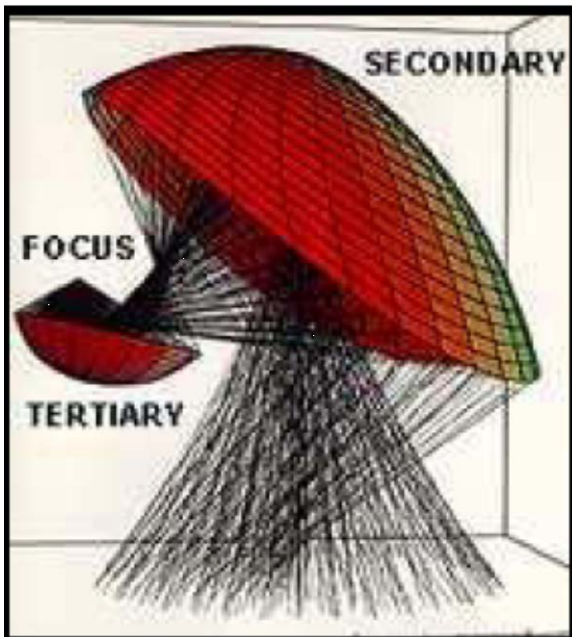


Suspended platform with azimuth arm supporting the radome (left) and line feed receiver on the right. The secondary and tertiary reflectors and horn feeds are housed within the radome



View underneath the primary reflector showing the tieback cables and concrete blocks

This upgrading of the parabolic antenna, which enabled operators to adjust the surface, increased the upper operating frequency to 3 GHz. However still, line feed receivers could not be constructed to specifications allowing operation at the highest usable frequencies. During a second upgrade in 1992, all but one feed receiver were replaced by a Gregorian reflector system permitting operation up to 8GHz and even higher.

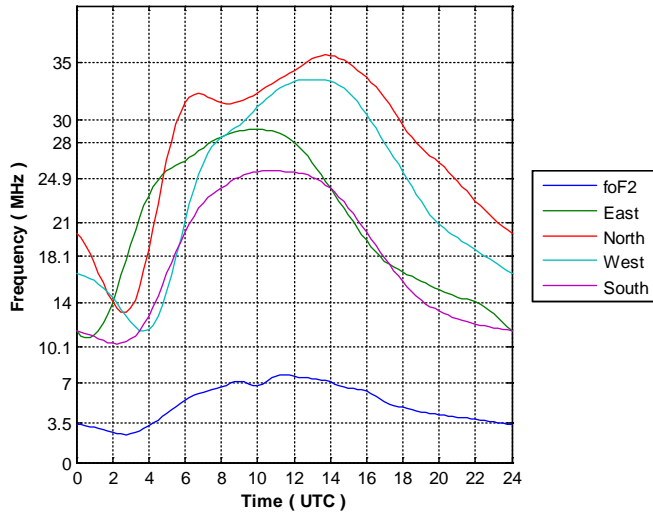


The Gregorian reflector system showing the reflection of radio waves through three surfaces before reaching the focal point

Specially shaped secondary and tertiary reflectors are housed within a 90-ton radome designed to protect them from the tropical weather. The radome is suspended from the azimuth arm, approximately 137 metres above the primary reflector surface. Incoming radio signals are brought to a single focus point of 3 millimeter by the new reflector combination.

For the past 53 years, the Arecibo Observatory has been instrumental in a large amount of scientific research in radio astronomy, planetary studies (via radar and passive observation), as well as space and atmospheric science. To the scientific community it is well known for its many contributions to science, one of which earned the Nobel Prize in Physics in 1993. The Arecibo also featured in two films, namely Golden Eye where James Bond and the villain settled their score on the reflector surface. In the film Contact Jodie Foster features as 'n young scientist making contact with alien intelligence. The Arecibo Observatory has been actively involved with the Search for Extreme Terrestrial Intelligence (SETI) project for many years. The Arecibo Observatory Amateur Radio Club (AOARC) also managed to successfully achieve EME (Earth-Moon-Earth) on 432 Mhz using the large parabolic antenna. More on this and the important scientific research being conducted at Arecibo in the next Issue of Watts.  
*Louis de Wet ZS6SK*

Pretoria Critical Frequency and 4000 km MUF - April 2016



## Long Term HF Propagation for April 2016

### 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 F-layer frequency for short range communications.

See also the Propagation tab at <http://www.parc.org.za/>

Courtesy Vincent ZS6BTY

C/O NELSPOORT & 801 MALMESBURY STR, WINGATE PARK, PRETORIA [S25.49.36 & E28.16.07]

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- Ham radio and solid state amplifier repairs
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#### Products:

- Legal limit 30m and 40m dipole traps
  - Linear power supply O.V. protection kits
  - 30A DC switching supplies
  - 30A DC Anderson Power Poles
  - Connectors RF and Audio
  - Plug-in triple sequential industrial timers
- Contact Hans at 012-333-2612 or 072-204-3991

**48 hour digital contest**

By Hans ZS6KR and Johan ZS6JHB

F1! F1! F1!

http://e4joy.com/TheMedJoker

Your trial period is over!  
 Please register to continue using this software!  
 OK

**Customer Service:** What is wrong with it?  
**Caller:** Mouse is jammed.  
**Customer Service:** Mouse? ...  
**Printers don't have a mouse!!!**  
**Caller:** Mmmm??.. Oh really? ... I will send a picture.

hp LaserJet