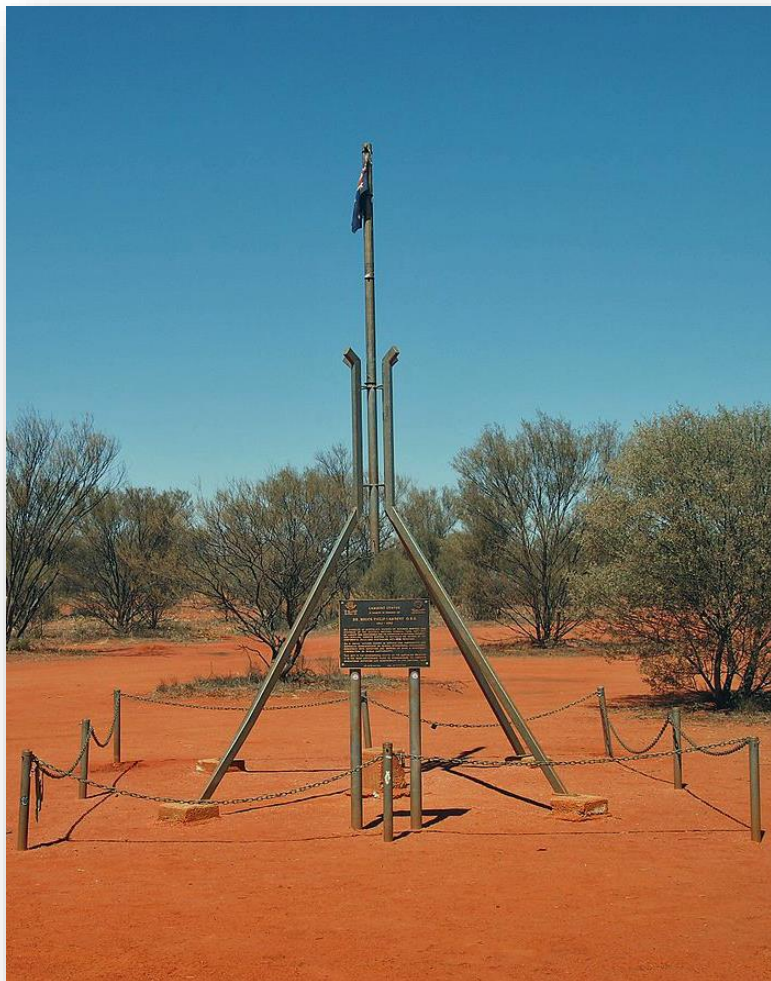


LAMBERT CENTRE PROJECT

The Geographic Centre of Mainland Australia



Lambert Centre Monument. Photo courtesy Australia for Everyone

ROYAL GEOGRAPHICAL SOCIETY
OF QUEENSLAND

LAMBERT CENTRE PROJECT

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Date	Rev.	Authors	Notes
24/06/2018	0	Dave Carstens, Les Isdale, Ian Francis	Original Issue of Lambert Centre Project report for the RGSQ website, data sourced from RGSQ archives, Les Stuart and others

Introduction

Lambert Centre was created as a Geographical Icon to commemorate the Bicentenary of Australia in 1988.

The monument is a flagpole. It is modelled on the flagpole on Parliament House Canberra. The flagpole was erected by Members of the (now) Royal Geographical Society of Queensland (RGSQ) on 15 September 1988 on Lilla Creek Station, Northern Territory. It was erected in association with a Permanent Survey Mark (PSM) which was placed at the nominated geographical coordinates of the "Centre".

The flagpole represents the Geographic Centre of mainland Australia. "Lambert Centre" is a Place Name formally gazetted by the Northern Territory Lands Department.

The location of Lambert Centre was computed using mathematical modelling. The most accurate mapping data available was used in the complex calculations. The modelling provided a Latitude and Longitude with a probability that the Geographic Centre of Australia lies within 2.5 kilometres of the calculated value. This accuracy is a high-level achievement given the mapping and computer power available in 1988.

The establishment of Lambert Centre was made possible by the co-operation and contribution of many individuals and by organisations. The contributors are acknowledged on the plaque which was mounted at the site, on a plinth under the flagpole structure.

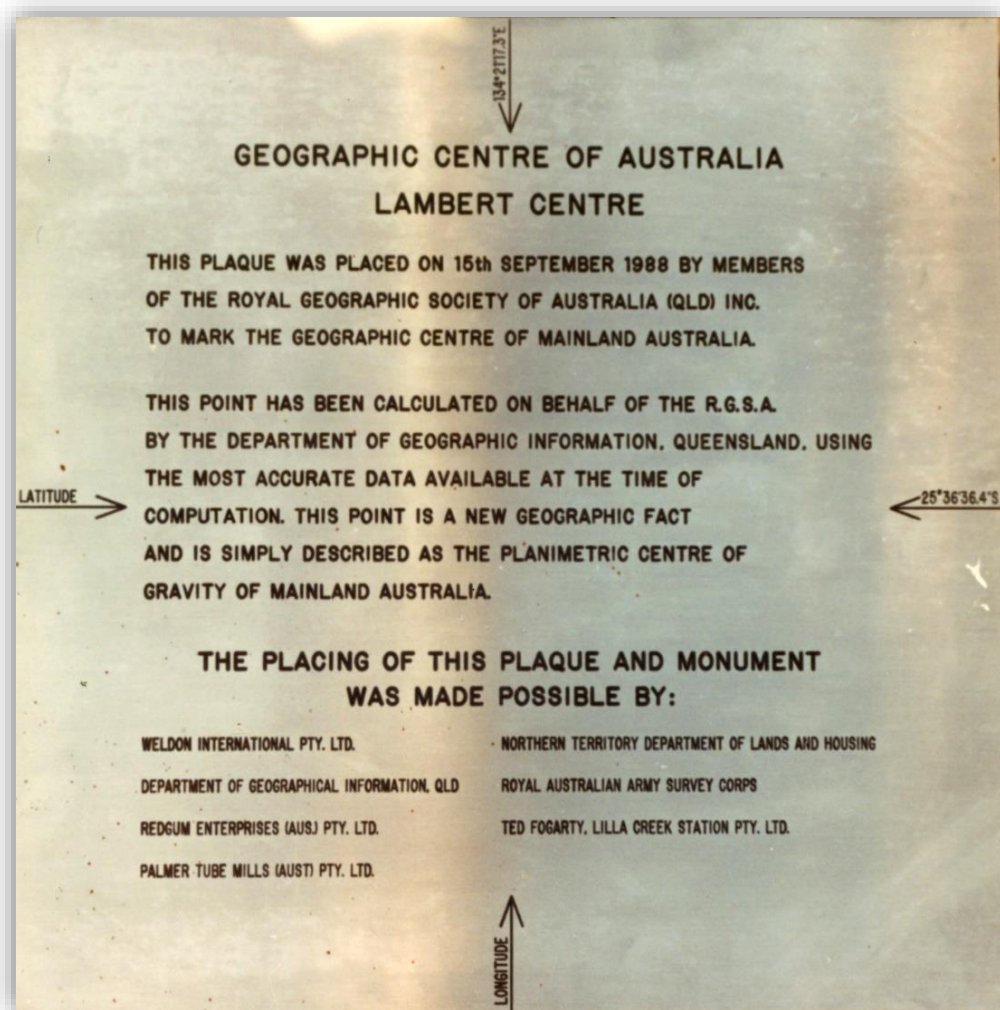


Figure 1. Lambert Centre Plaque

It is significant to note there was a subsequent challenge concerning the wording “Planimetric Centre of Gravity”. More about this is explained later. Note that in the second line of the plaque text, “Australia” should read “AUSTRALASIA”.

Very early after the monument was established, the wording on the plaque was challenged. Wide-ranging debate and correspondence ensued. The plaque was, in fact, partially defaced by scratching over the challenged text “**PLANIMETRIC CENTRE OF GRAVITY**”. (figure 2)

RGSQ acknowledges that the description should be limited to the fact that the Lambert Centre is the Geographic Centre of Mainland Australia.



Figure 2. Defaced Lambert Centre Plaque

Nevertheless, for a figure the shape of Australia, the Centre of Gravity, assuming equal land densities across the continent, would be close by. This is indicated by (less rigorous) studies, refer to the “Computations” section below.

At an unknown time, the plaque which was affixed to a concrete plinth under the flagpole was souvenired and has never been recovered.

It is noted here that in 1990 the RGSA changed name to Royal Geographical Society of Queensland (Inc.), the present corporate body.

Project Conception

The idea was developed by the Queensland Branch of the (then) Royal Geographical Society of Australasia Inc. RGSA(Q). Queensland Branch member Leslie James Stuart, whilst sitting around a camp fire at Yaramulla Station suggested that “we place a flagpole somewhere in Australia to celebrate the historic occasion of the Bicentenary”. This developed to “can we visit and place a flagpole at a Geographic Centre”. At that time RGSA was identifying, and had members visiting, geographical features associated with early exploring and mapping in Australia.

The idea was taken up by the Society and notable influences can be identified. The Surveyor General of Queensland, Mr. Kevin Davies was a Vice-Patron of the Society at the time and involved his Department in the planning. President at the time was Mr. Peter Lloyd, Vice Presidents Mr. R.T.Francis and Mr. Les Isdale. Lt. Col. Dal Anderson, Mr. Grant Epple, Mr. Paul Feeney, and Mr. Les Stuart from the Council are readily recognised as contributors. Mr Neil Divett, and Mr. Paul Mc Donald of the DMS are identified in communications.

Computations

The records and reports held by the RGSQ contain the debate on definitions of “Centre” and the mathematics used to calculate the Lambert Centre is recorded.

The computation by the Department of Mapping and Surveying in Queensland, using (the then) modern computer facilities, established the Latitude and Longitude of a position which for the continent of Australia (mainland, excluding Tasmania for practical reasons) had equal areas in each segment formed by two great circles passing through the centre point. The orientation of the Great Circles adopted is not specified and these are not necessarily at right angles. For detail see *Queensland Surveyors Bulletin* of August 1988 (Appendix 1) and Dr. NG Divett, the then Department of Lands letter of 2 April 1991 (Appendix 2)

In establishing the concept “LAMBERT CENTRE” the recognition of other Centres was, and is, acknowledged. Examples are: - Centre of Gravity (various values), Uluru, Central Mt. Stuart, Alice Springs, Johnston Geodetic Station, Median Point, and Tidal Centre.

Based on the accuracy of the map data available in 1988, it is estimated that the Lambert Centre falls within a circle of up to five kilometres diameter. This provides an explanation of the physical layout of marking of the Lambert Centre. The surveyed value, shown on the plaque, is marked on the ground by a Permanent Survey Mark (PSM) set in a concrete block on a sand dune. The Flagpole Monument has been constructed on a flat piece of easily accessible ground some 600 Metres East of the PSM.

Surveyed values shown on the Plaque are at the PSM, the actual result of the computed Latitude and Longitude. This is quoted to a resolution of ± 3 metres although not a practical surveyed value at that time.

For any person using a personal GPS navigation unit wishing to identify positions on the ground, it is necessary to recognise the shift of some 200 metres north-easterly between the Geocentric Datum of Australia AGD84 and GDA94, by selecting Australian Map Grid AMG84 setting to relate to the original coordinates. For the Flagpole Monument the 600 metre offset to the east of the PSM needs to be considered.

Location

Lambert Centre is located 22 kilometres West-Southwest of Finke in Northern Territory. The cooperation and interest of the landholders at this site is noted. (see Figure 3)

Lambert Centre is some 230 kilometres south of Alice Springs.

Lambert Centre is recognised on official maps. It is a gazetted place name, a recommended and well visited tourist attraction and is described in many websites. The Centre of Gravity description, or similar, persists in much of this information, including Geoscience Australia which reports in some detail on the RGSQ Lambert Centre and other "Centres".

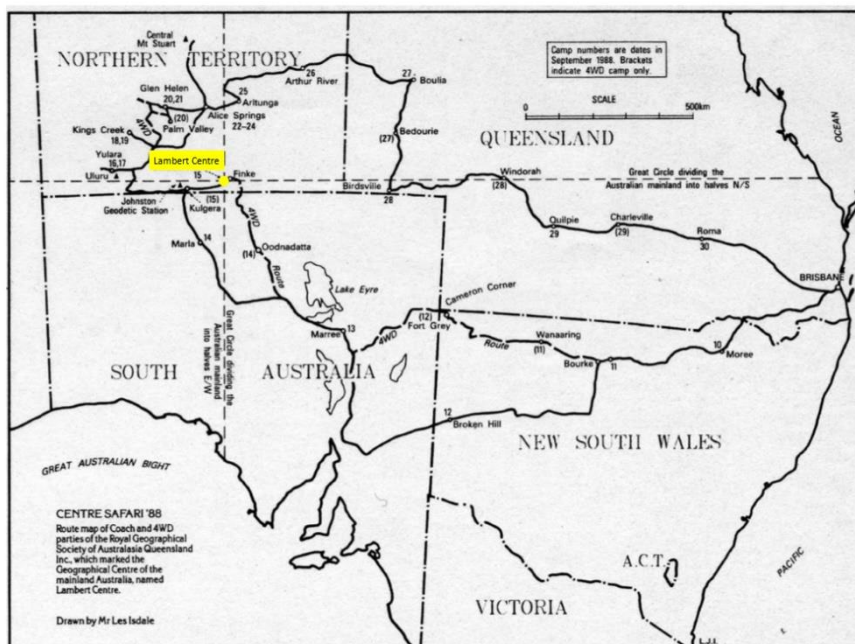


Figure 3. Lambert Centre location

As a result of the objections, based on well argued parameters, the RGSQ accepts that the description should be Geographic Centre of Australia". "The DGI paper at Appendix 1 describes a centre of gravity computation which actually gave us this location.

For a figure the shape of the Australian Continent, the location is not expected to be very different. Some indication of this is reported from practical estimates using cut-out shapes for the continent and assuming equal densities across the continent. However, one website suggests 11 kilometres west, and another is reported as some 200 kilometres north-west. A rigorous evaluation would be interesting.

Trek and Monument Erection

Report: *RGSA(Q) Visit to establish Lambert Centre in 1988*. This report is available on the Royal Geographical Society of Queensland website and outlines the Trek to Lambert Centre, giving wide detail of the travel and people involved and the erection of the flagpole.



Figure 4. Monument erection 15th September 1988

The Trek Party consisted of 82 people from RGSA(Queensland), 44 people from RGSA (South Australia), 3 persons from the Northern Territory Government, 5 members of the Royal Australian Army Survey Detachment and 7 staff of Redgum Productions.

Dr Bruce Lambert attended the ceremony of declaration of the site and received the Silver Medal of the RGSA (Q) for his work in the mapping of Australia'.

The Australian Army Survey Detachment used Global Positioning

Survey (GPS) Equipment to record the position (of the PSM).

Naming

The official naming of **Lambert Centre** for Dr. Bruce Lambert, former Director of National Mapping, is recorded in detail. The naming was gazetted by the Northern Territory Administration. It is interesting to note that Lambert Glacier, a major feature in the Australian Sector of Antarctica, was named for Bruce Lambert in 1957. In 1994 a second Plaque was mounted at the Monument by the Institution of Surveyors and the Institute of Cartographers, honouring the work of Dr Bruce Lambert. (***This plaque has an incorrect date for Dr Lambert's death which was 2nd April 1990***). There are further memorials at the site provided by 4WD Clubs and other touring Organisations.

In 2013 Mr Ian Lambert, son, was in attendance and placed the ashes of his Parents at the survey plinth under the flagpole Monument.

Subsequent Visits

RGSQ Visit to Lambert Centre in 2013.

RGSQ Members revisited Lambert Centre in 2013, as a 25-year Anniversary event/ exercise/ celebration.

An Army Survey Detachment (1 TOPO SVY SQN Survey Section) repeated measurements carried out in 1988, using the most modern GNSS Equipment. Their work is covered in a series of reports.

The nominated value of the Centrepoin PSM established in 1988 is:-

(As shown on the original plaque)

Latitude 25°36'36.4" and Longitude 134°21'17.3" AGD84.

This converts to **Latitude 25°36'36.37" and Longitude 134°21'17.31" for GDA 94.**

The 2013 value for Centrepoin is

Latitude 25°36'31.158" and Longitude 134°21'21.929".

The Interesting Result from this visit, showing Continental Drift, is covered in detail in the Report by the Army Survey Detachment.

It was proposed in the Report of the RGSQ visit to Lambert Centre that the Plaque be replaced with appropriate corrections and information, including recognition of the 2013 Visit.

Army Survey Detachment Report produced 2015.

This is a very detailed summary of computations and results.

The Survey Report, covering the observations and computations carried out in September 2013, indicate a change in position of the Permanent Survey Mark (PSM) at the Lambert Centre of 0.625 metres east and 1.154 metres north in the last 25 years. That is a bearing and distance of 28°25' for 1.312 metres. This is 53 millimetres per annum which is consistent with the result from Geodetic observing for continental drift, 60 millimetres per annum.

The Report from 1 Topo SVY Squadron for 2013 gives the high precision value for the Permanent Survey Mark (PSM) at the Lambert Centre in GDA94: -

Latitude: **25° 36' 31.15823"** (where 0.00001" = 0.3 millimetre)

Longitude: **134° 21' 21.92880"** (similarly = 0.3 millimetre)

Height: 308.578 metres Australian Height Datum (AHD).

This is quoted to compare with the record for the PSM as quoted in AGD84 in 1988: -

Latitude: **25° 36' 36.4 "** (0.1" = 3.1 metres)

Longitude: **134°21' 17.3 "**

Analysis and Summary of information from 1988 to 2013 Site Visits.

In 2016 an analysis of records, actions, understandings and accuracies of survey methods was compiled.

This (long) report brought together much relevant detail, especially analysing records which had been transcribed incorrectly, had errors in the record, and key points of the discussion on original computations and understanding of Geographical Centre.

Documentation

RGSQ Records

Considerable detail of the establishment, visits and variations in results, including notation about incorrect records are contained in a series of Reports, Documents and Film Documentaries held by RGSQ.

Geoscience Australia

The Geoscience Australia website discusses Lambert and other Centres of Australia. Further website search also provides photographs and discussion.

Queensland Geographic Journal

The comprehensive record of the original establishment of Lambert Centre is published in "Queensland Geographical Journal" 4th Series, Vol 4 of July 1989, under the title "Centre Safari".

It is well documented that the Latitude and Longitude of the Lambert Centre were computed in 1988, by the then Survey Section of the Department of Geographic Information, now in the Department of Natural Resources and Mines. The computations utilised the power of available computers and the, then, recently

established National Mapping digitised outline of the Australian continent. This was based on 1:5,000,000 mapping and 24,417 digitised points were used. At this scale, one millimetre represents five kilometres.

Queensland Surveyor's Bulletin

The mathematics used for the determination of the value of the Lambert Centre are published in the "Queensland Surveyors Bulletin" of August 1988. The calculations were carried out on the sphere and the assumptions necessary for accuracy of coastline, mean high water mark boundaries and coastal estuaries and lakes are recognised. The adopted Latitude and Longitude of Lambert Centre is the intersection of two great circles which divide the continent into equal areas, North / South and East / West.

Notes on Survey and Mapping Techniques.

The following information is contained in the 2015 Report.

As explained in the Survey Report by 1 Topo Svy Detachment, changes in values are caused by changes in the parameters for the shape (or figure) of the earth, especially as it has been deemed best to adopt a uniform mathematical model for northern and southern hemispheres. This requires transformation formulae to relate old Australian values to one another: - GDA 84, GDA 94 to AGD and AHD to AHD Derived and so on.

Reference to Frequently Asked Questions at "<http://icsm.gov.au/gda/faq.html>" provides explanations for these geodetic references.

Transformations have been applied in the 2013 Report. Extensive description and mathematical manipulation facilities are available online at the Geoscience Australia Website for anybody who wishes to follow the mathematics.

References and Papers

Review of Survey Records for Lambert Geographical Centre, 2015.

Report on September 2013 Survey, by Australian Army Survey Detachment

Lambert Centre Trek Report 2013.

Lambert Centre Trek Report 1988.

Redgum Film 1988. (RGSQ Library.)

Northern Territory Official Place Names. (No Survey Station Records found.)

Geoscience Australia Website.

(Other Documentation is also available but above are the key references.)

Queensland Geographical Journal Series 4 Vol. 4 July 1989.

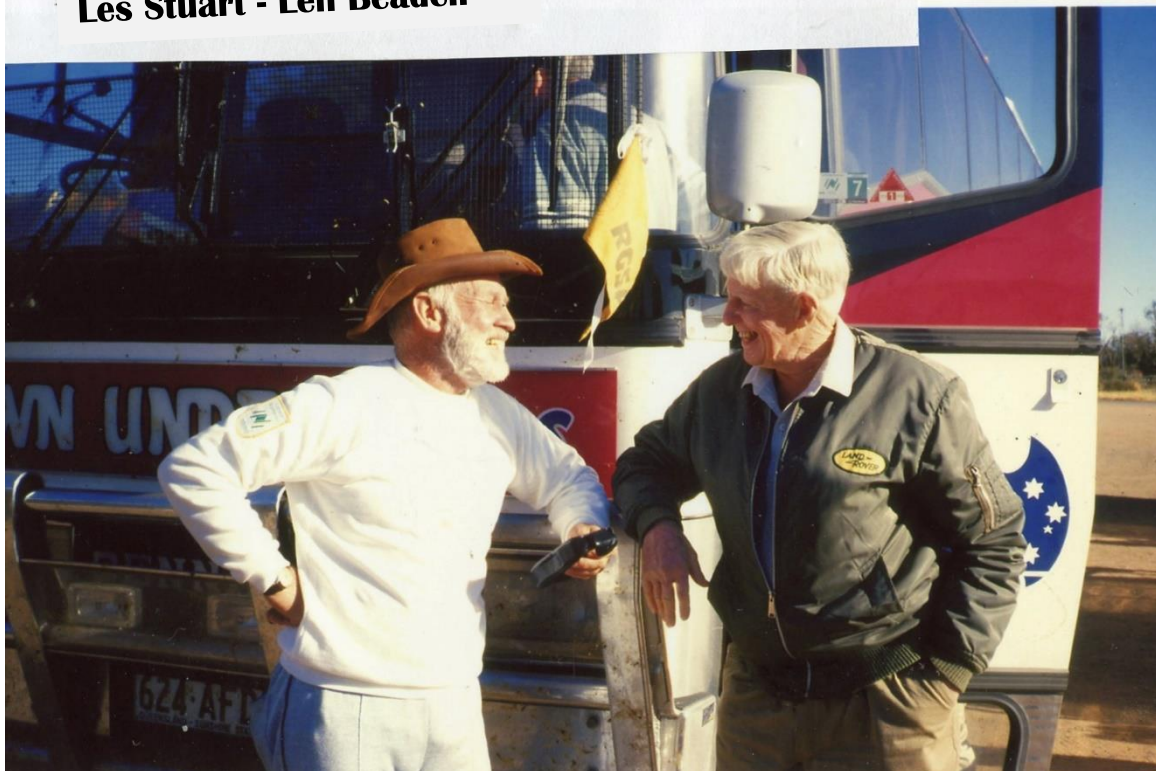
Queensland Surveyors Bulletin of August 1988.

Photographic Records



**S.A. Army Survey Team with their
Global Positioning System G.P.S.**

Les Stuart - Len Beadell





**Half day holiday for the town of
Finke 15.09.1998**

.....
**Elwin Stewart Army Officer, Les Stuart
at flag pole recovery station.**





**The Army with G.P.S over the flag pole
recovery station**

.....
**Les Stuart inspects the G.P.S
Lat.25 36' 27.52"S long134 21'38.31E**





**R.G.S.A. Members assembling
Flag pole**

.....
**Les Isdale and Bruce Lambert
at opening ceremony**





**Flag pole assembled ready to placed over
the recovery station**

.....
**Australian Flag on high with
R.G.S.A/ Flag**





AUSTRALIAN ARMY SURVEY TEAM
raises the AUSTRALIAN FLAG 11 AM
15TH SEPTEMBER 1988



Australian Flag change over to the
Bicentennial Flag

Les Stuart raises the BICENTENNIAL FLAG
2 Australian Army Survey 4 W D background.



Les Stuart under the Bicentennial Flag
Mrs Gwen Lambert walking away from the flag





**Les Isdale R.G.S.Q. Vice President
opening speech**

.....
**Mrs Lambert and Mr Lambert
under the R.G.S.A flag**

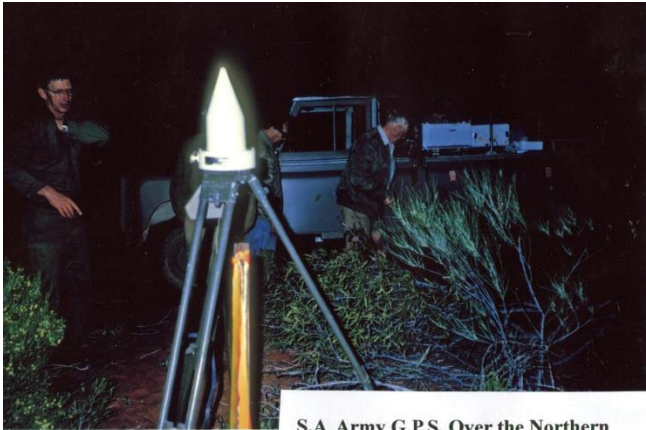


Les Stuart - Len Beadell

Under the flag pole

.....
Bruce Lambert - Len Beadell
R.G.S.A. Flag .





S.A Army G.P.S. Over the Northern Territory Permanent Survey Mark

Permanent Survey Mark
lat. 25 36'27.10"S long 134 21' 17.98"E

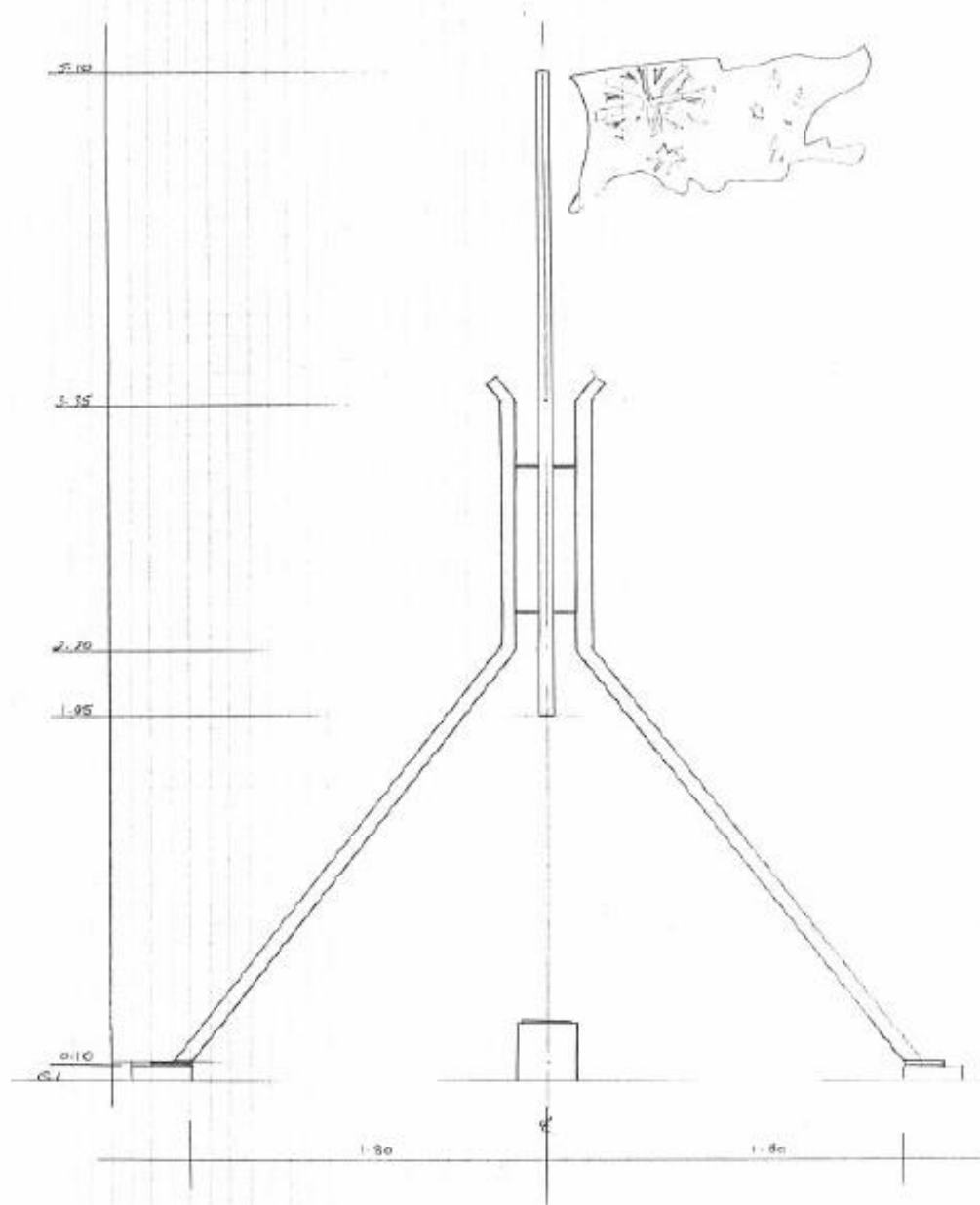


Jim Mitchell's Army Badge

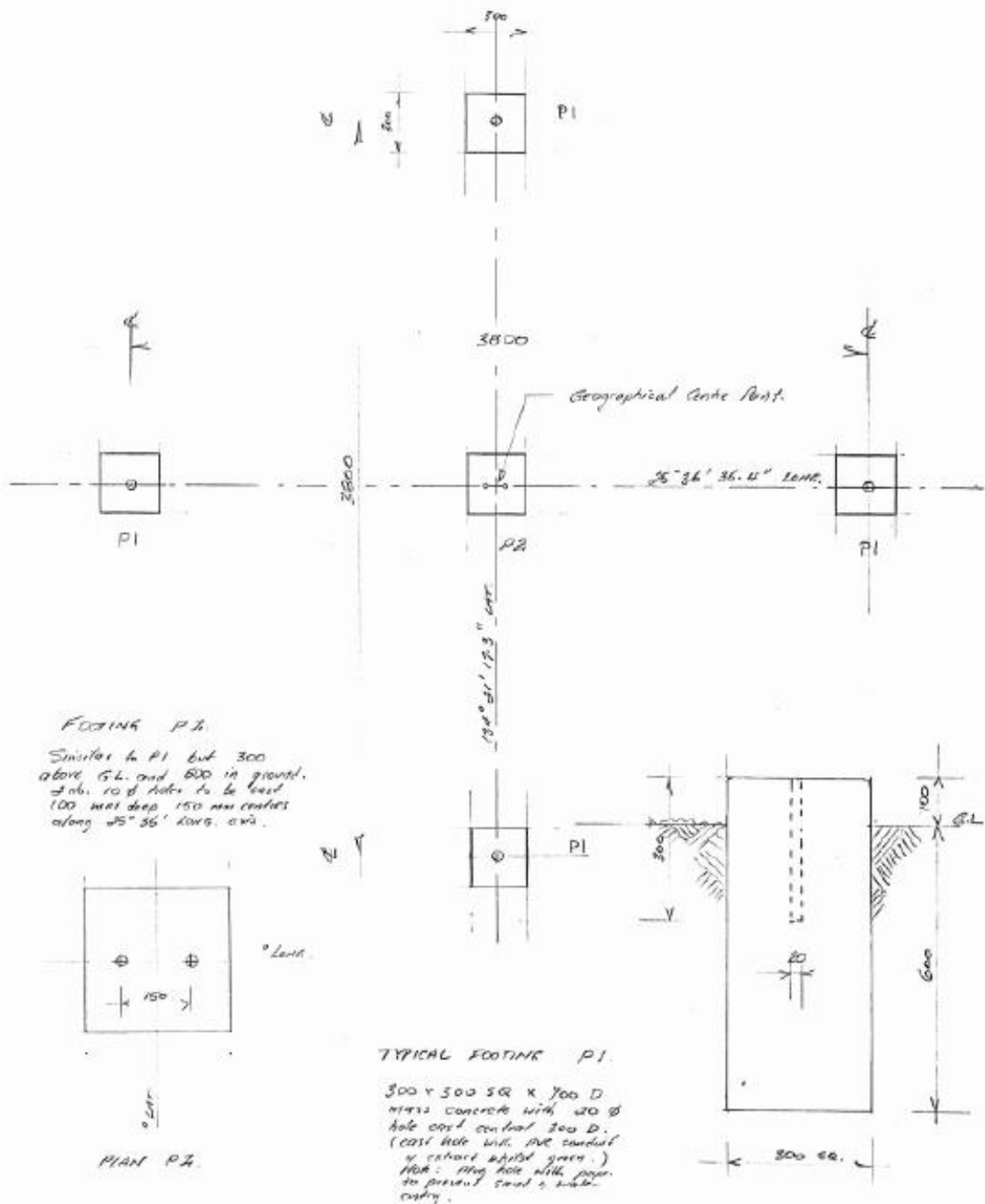
N.T Survey and mapping P.S.M. Marked "CENTRE" set by Les Stuart 8.30pm

P.S.M. marked CENTRE
to be covered over 15.09.1988





ELEVATION OF PROPOSED FLAG POLE & MONUMENT
for
R.G.S.A. Old.



FOOTING PLAN 1:25

Appendix 1

Extract from *Queensland Surveyors Bulletin* of August 1988

FROM THE DGI

THE CENTRE OF AUSTRALIA

The Department of Geographic Information has calculated the "centre of gravity" of Australia.

This new geographical concept was calculated at the request of Les Isdale, a member of the Royal Geographical Society. A Royal Geographical Society trip to the "center", is planned for September this year.

Before the calculations could begin, a definition was needed. This was provided by the Macquarie Dictionary, which defines a centre of gravity as, "that point of a body from which it could be suspended, or on which it could be supported and be in equilibrium in any position, in a uniform gravitational field."

Further parameters had to be set.

1. It was necessary to assume a curved surface with no distortions, as the distribution of weight, thickness of crust, distortions of gravity and so on, are not available.
2. Calculations were carried out on the sphere, while using "Robbins Reverse" to calculate distances. This was necessary because of the problems of gathering accurate coastline data. Coastline, rivers and lakes are constantly changing and it is difficult to assess tidal movements and arrive at a definition of mean high water mark.

Step one in the process of calculating the point was deciding which method/methods could be used. From the definition, the centre of gravity of a body is that point where two lines dividing the volume of the object into equal halves intersect. Another interpretation, notes that this point lies where the sum of all vectors in the object equals zero. After adopting the first interpretation (which seems more widely accepted), two methods were decided upon. The first method utilised a polygon routine to calculate the areas whilst the second uses spherical trigonometry. Both methods adjusted the data to ensure that it was in a suitable format for equal area calculations.

The second step was to get the data into a suitable format for calculation. The data used in the calculation was supplied by the Commonwealth Surveying and Land Information Group, which had digitised data in "stream mode" from the original reprostat used for the 1:5,000,000 Australian General Reference Map in unjoined segments. It was necessary to order these segments into one continuous loop to allow area calculations to be made. This was achieved using the Queensland Centre for Surveying and Mapping Studies' autocad system to manipulate the data. This task proved to be a time consuming one as locating the beginning and end of each segment and editing them was essentially a trial and error process. Our thanks go to the Centre for their time, skill and expertise.

Method 1

Method 1 utilises the formula:

$$A_{\phi} = 4b^2 \pi (B \sin \gamma' \cos \delta' - C \sin 3 \gamma' \cos 3 \delta' + D \sin 5 \gamma' \cos 5 \delta' - E \sin 7 \gamma' \cos 7 \delta' \dots)$$

D, E... are constants; $\phi'' - \phi' = 2 \gamma'$ and $\phi' + \phi'' = 2 \delta'$ to find the area of the quadrilateral formed by the two points on the spheroid.

The QCSMS utilised a high speed personal computer to calculate the point. This computer took around half an hour to arrive at a result after processing some 24,000 odd points. The programming for this task was relatively simple and utilised a centroid routine.

Method 2

The DGI's Computer Services Sub Program employed the Departments mainframe computer system. This method required considerable computing power as it calculated distances using the "Robbins Reverse method" and the formulae to calculate the area of spherical triangles:-

$$\tan \frac{1}{4}k = \sqrt{[\tan \frac{1}{2}s \tan \frac{1}{2}(s-a) \tan \frac{1}{2}(s-b) \tan \frac{1}{2}(s-c)]};$$
$$s = (a + b + c)/2; \text{ and } k = a/R^2 \sin 1''.$$

The procedure followed the following steps:

- a) Calculated all spheroidal distances in the triangle formed by the south pole and two adjacent points on the Australian Coastline;
- b) Calculated the area of the triangle and summed these areas (assigning a positive value when heading in an easterly direction). The total area of Australia, once found, was then halved.
- c) Two points on opposite sides of the coastline were arbitrarily selected and the area of the resultant figure calculated using the process outlined in (b).
- d) The process outlined in (c) is repeated iteratively until the area formed by the figure equals half the total area of Australia. The great circle formed by this calculation forms the first intersection line.
- e) Steps (c) and (d) are repeated to find a second great circle. Where these two great circles intersect is the centre of gravity by definition. The process is repeated several more times in order to check the original results.

The Royal Geographical Society will announce the latitude and longitude of this point in late August and then visit the site in September. The Northern Territory Lands Department and Royal Australian Survey Corps are jointly marking the point prior to the Royal Geographical Society's journey. Should anyone have any queries about this visit to the centre of gravity of Australia, contact Les Isdale on (07) 349 1888.

The Department takes this opportunity to wish the Society every success in its voyage to the Centre of Australia.

Appendix 2

Your Ref
Our Ref



DEPARTMENT OF LANDS

DIVISION OF INFORMATION

Office: Sunmap Centre
Cnr. Main & Vulture
Streets Woolloongabba
Brisbane

Postal: PO Box 40
Woolloongabba Qld
4102 Australia

2 April 1991

Secretary
Royal Geographical Society of Qld. Inc.,
112 Brookes Street
FORTITUDE VALLEY Q 4006

Dear Mr Smith

Thank you for your letter of 19 March 1991, regarding the "Lambert Centre".

The letter from the Division of National Mapping to Mr Young contains the explanation for their calculation. It also correctly mentioned the fact that "there will probably be as many 'centres' as there are attempts to compute it".

The "Natmap" calculation is based on the engineering concept of a "moment" which normally applies to the product of force and distance from its line of action to a point" (The Australian Concise Oxford Dictionary of Current English p. 696). This method is valid for the calculation of a centre; however, it does not mean this centre is also the centre of gravity or centroid of mainland Australia. A glance through any dictionary will reveal many and varied "centres" for objects, areas, shapes and so on.

I do not know the thinking behind the "Natmap" centre; but, depending on which centre is being calculated; the variance between centres can be in the order of thousands of kilometres.

Mr Young is correct in his belief that we should not blindly accept any calculation of the centre of Australia. Such calculations should be qualified with a statement explaining which "centre" is being calculated. At all times the calculation by my Department has carried a label describing it.

The Lambert Centre was computed by a simple polygon routine, verified by a second computation and rechecked by physically balancing a cutout of Australia at the Centre using a pin. No doubt improvements in technology, shifting coastlines and better digitised points will alter the present coordinates of the Lambert Centre; however this point was a physical representation of a new geographical concept.

The technology and information needed to calculate the true and exact Centre of Gravity of Australia is not likely to ever exist as the variables and components of such a calculation are immeasurable.

I trust this information helps to clarify this matter. Should you require further information, please contact me.

Yours faithfully

For **Dr NG Divett**
Assistant Director-General



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