Natural Resources and Water
Managing Queensland's natural resources
... for today and tomorrow

Geocentric Datum of Australia An Example Implementation of ITRF

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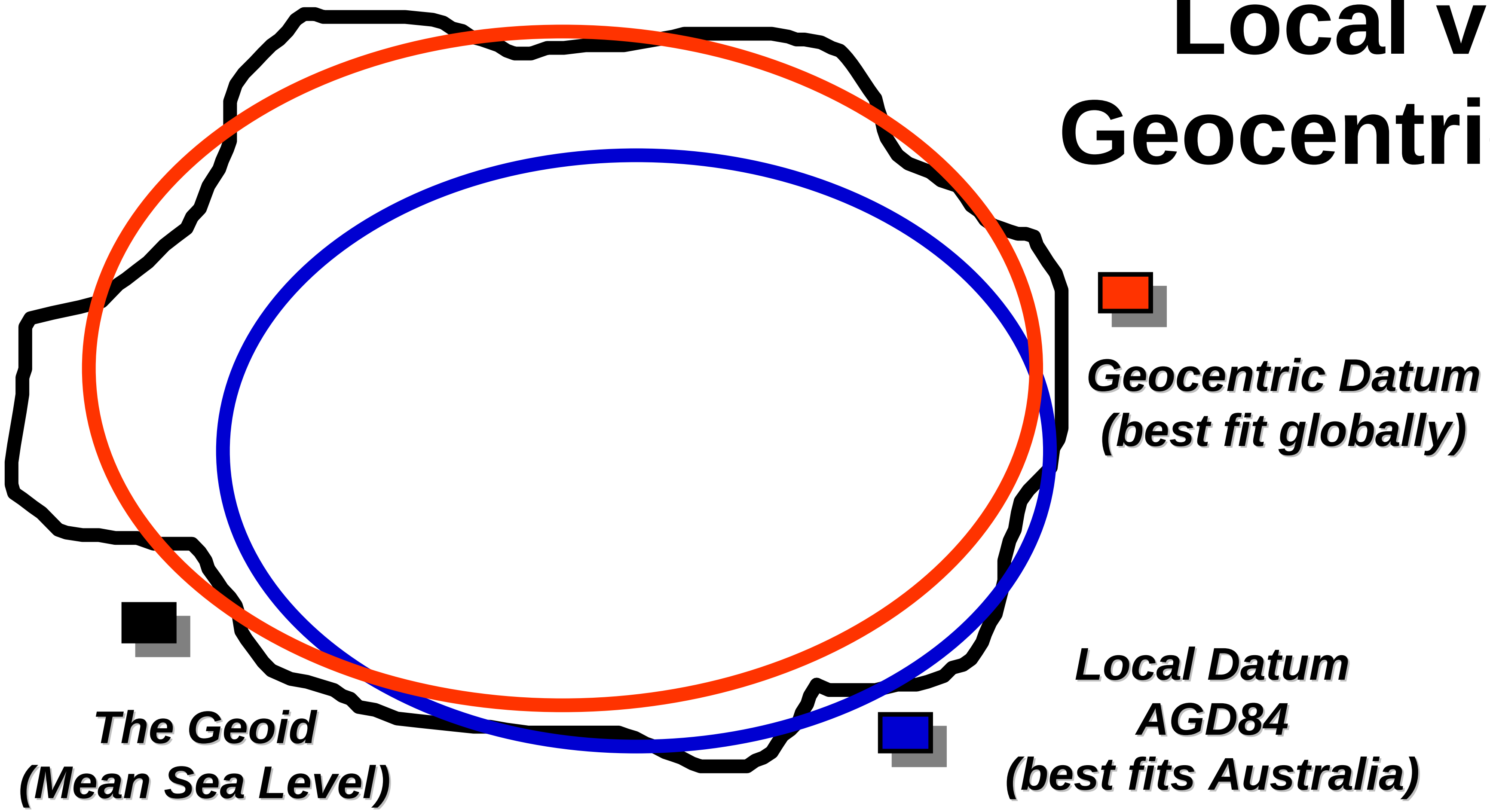
Outline of the Presentation

- Definition and Realisation of the Geocentric Datum of Australia (GDA) and its comparison to previous Australian Geodetic Datum (AGD);
- The importance of a "Reference Implementation" Approach to User Adoption;
- Changes to the operating environment since GDA was adopted;
- Conclusion – The role of the ICG.

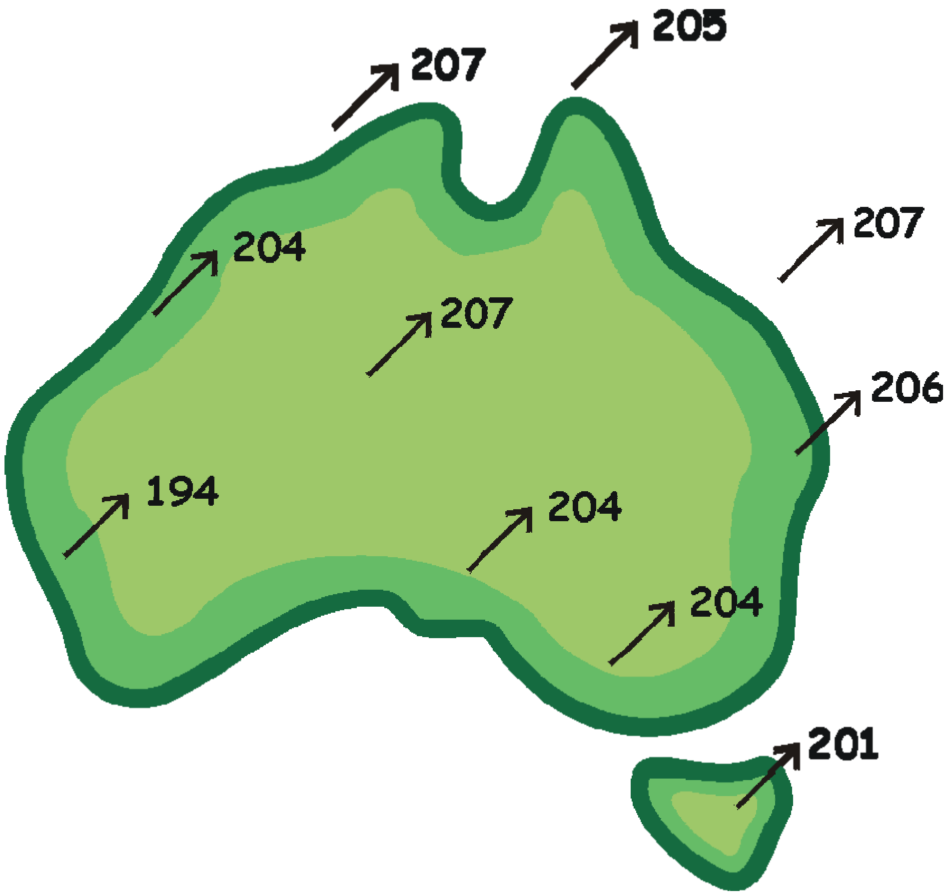
Definition and Realisation of the Geocentric Datum of Australia (GDA)

GDA
GEOCENTRIC DATUM OF AUSTRALIA

Local vs Geocentric



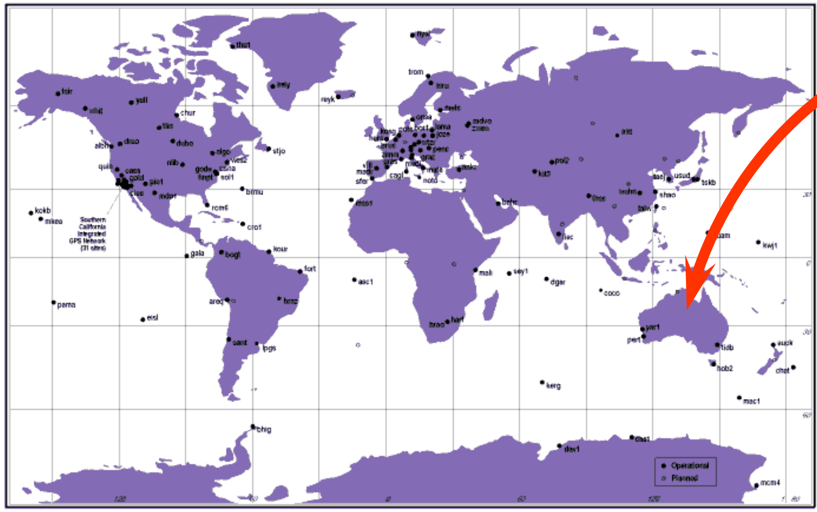
The Effect of GDA

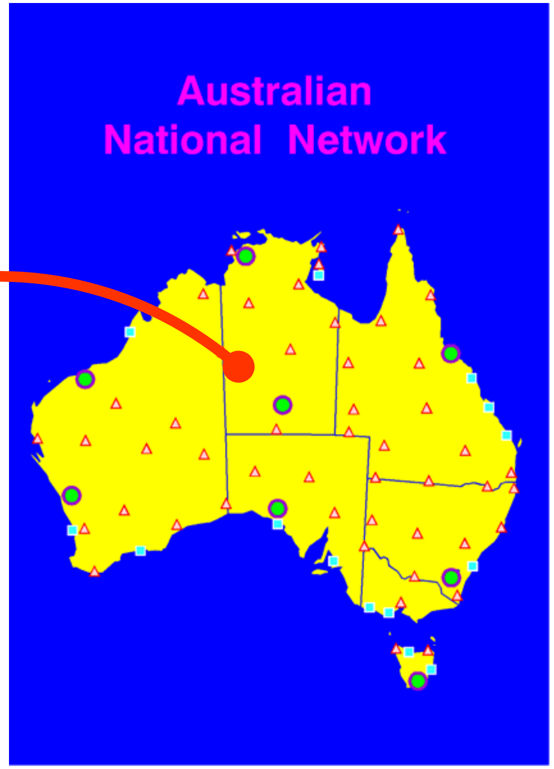


- ***Australia adopted GDA on 1 January 2000.***
- ***All coordinates appeared to shift in excess of 200m.***
- ***Australian Height Datum did NOT change.***

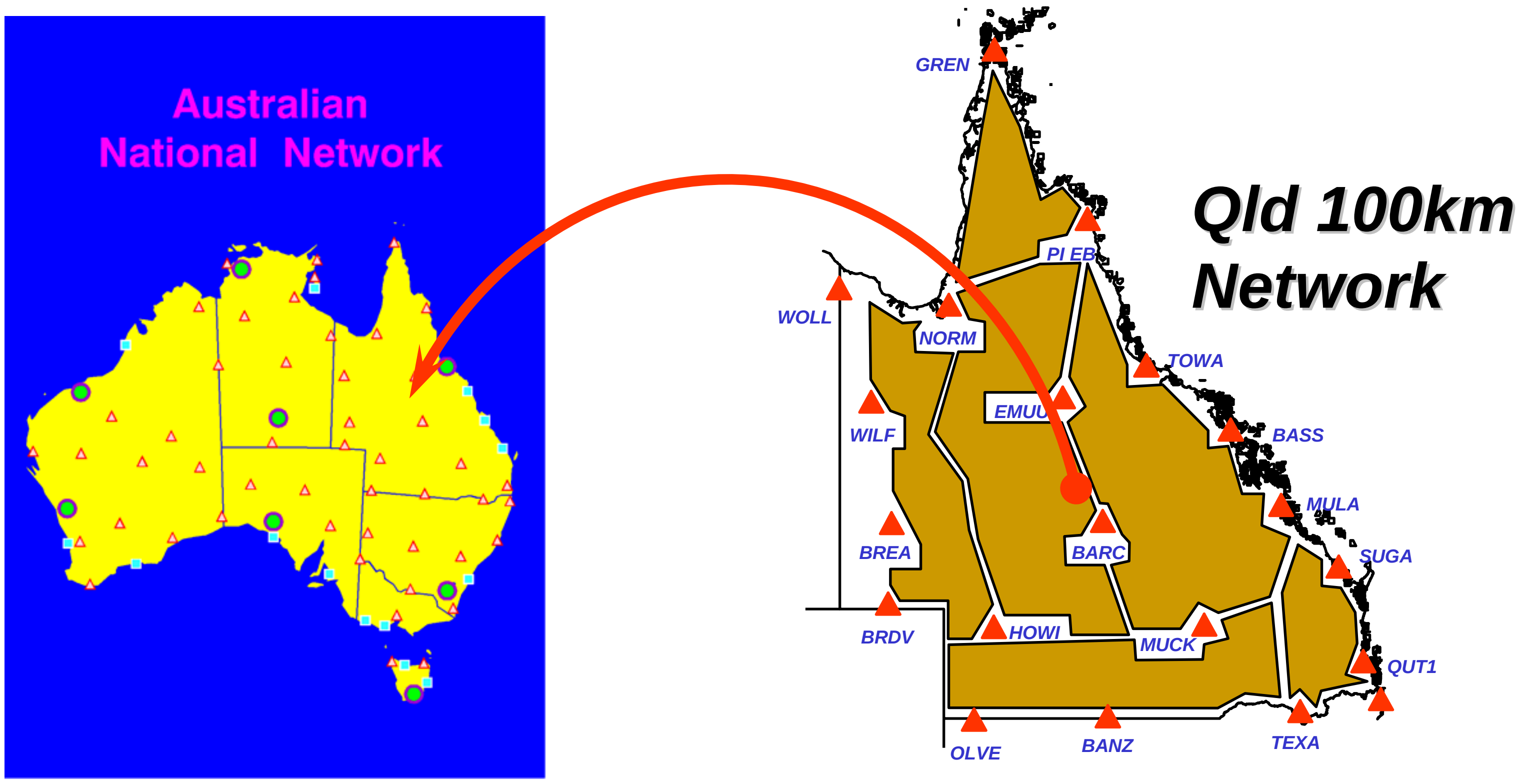
GDA94 ~ ITRF92 @ 1994.0

Link to ITRF by GPS observations at IGS sites and the Australian National Network (Campaigns stations at 500km density)



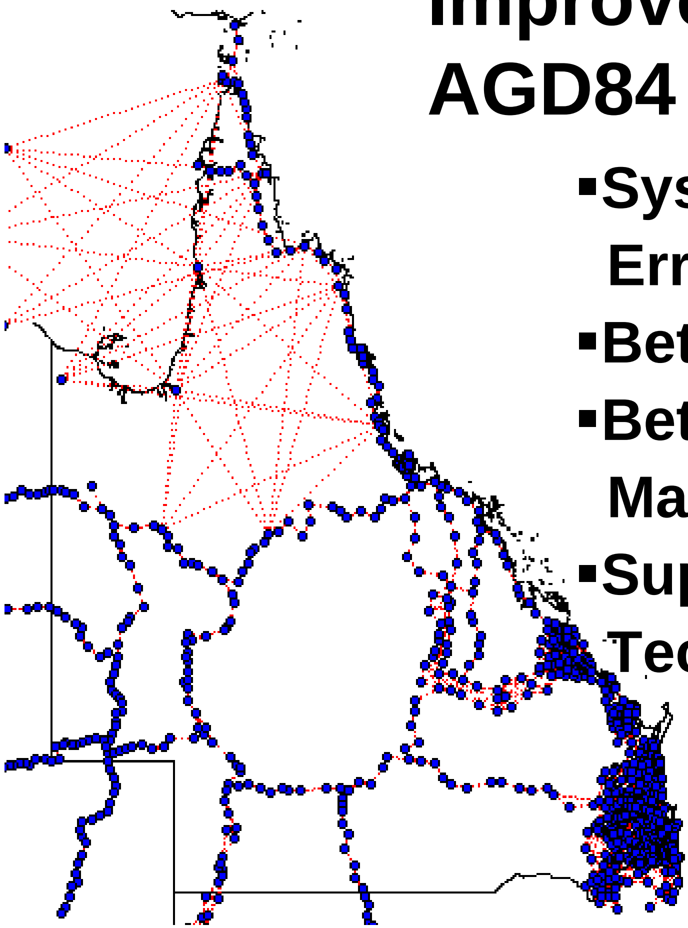


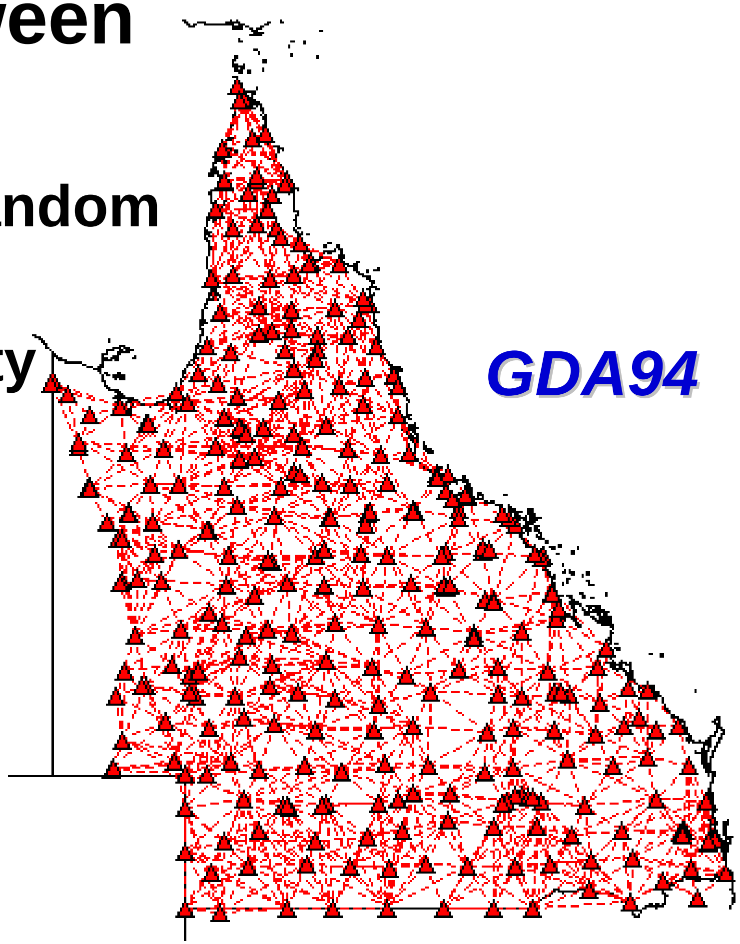
Densified by GPS Campaigns by States



Improvements between AGD84 and GDA94

- Systematic and Random Errors Reduced
- Better Homogeneity
- Better Access to Marks
- Support for new Technology



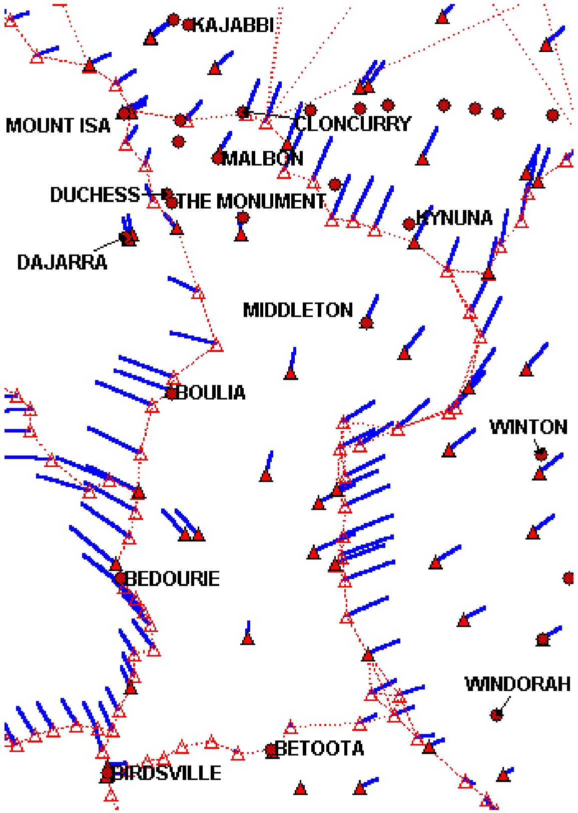


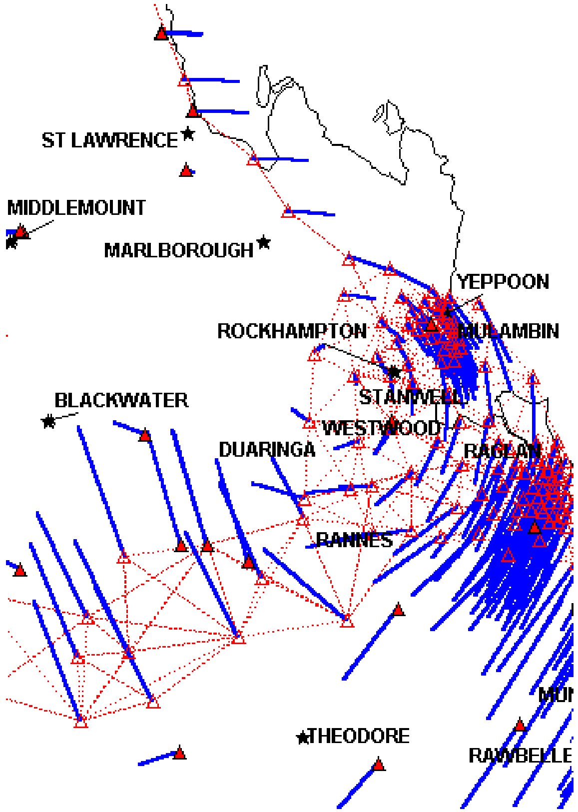
A "Reference Implementation" Approach to User Adoption of GDA

A "Reference Implementation" Approach

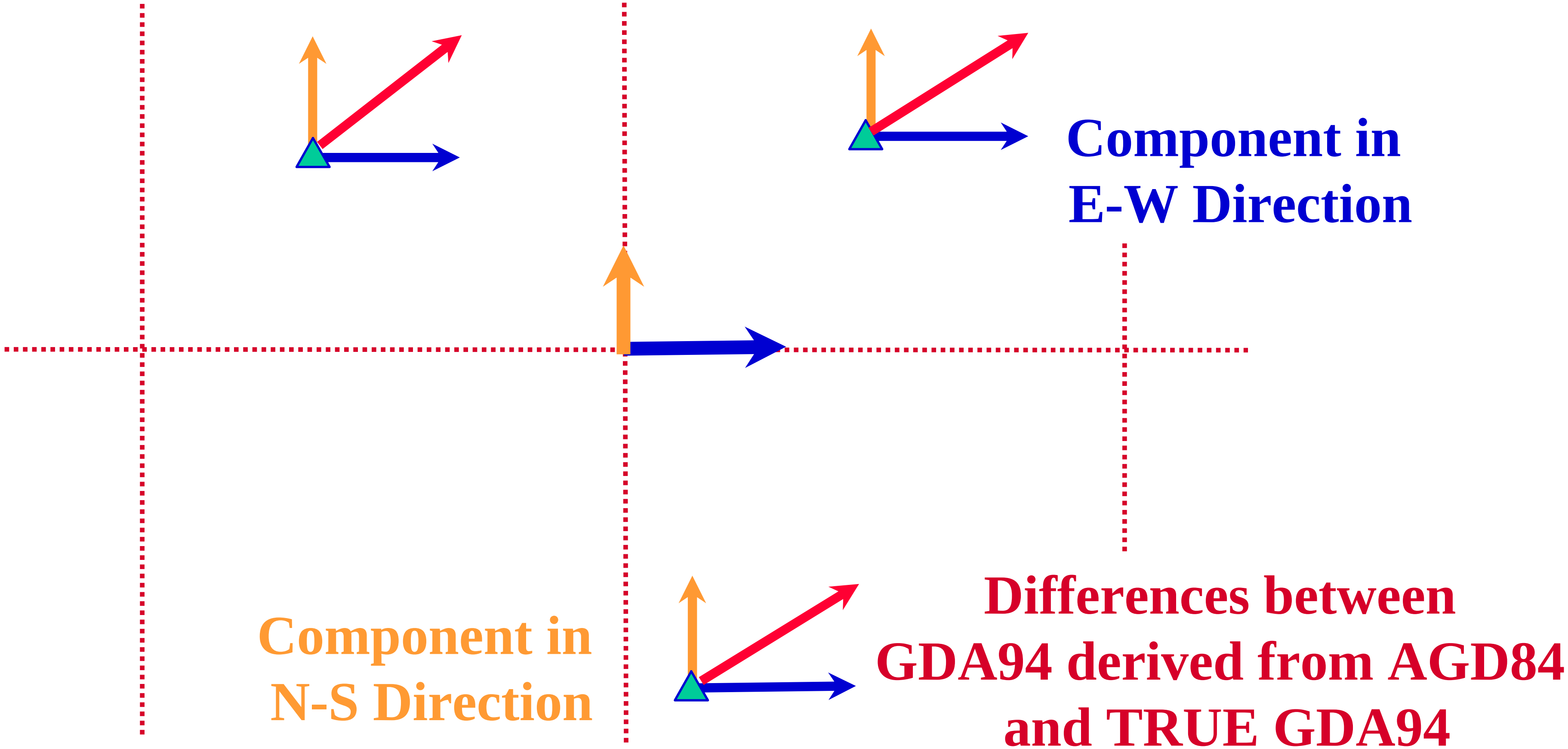
- We did not stop at the geodesy for the realisation of GDA94;
- We helped users understand the effect on their business, through brochures, workshops and tailored advice;
- Importantly, we made a conscious decision to produce a "Reference Implementation", which meant…
- We produced tools to help users implement the new datum;
- Distortion model grids and software (both free);
- Technical Manual on the web with worked examples in MS Excel Spreadsheets;
- Clear labels or metadata for products based on GDA;
- Encouraged software vendor support (GIS, Surveying etc).

Dealing with Distortions in the Old Datum

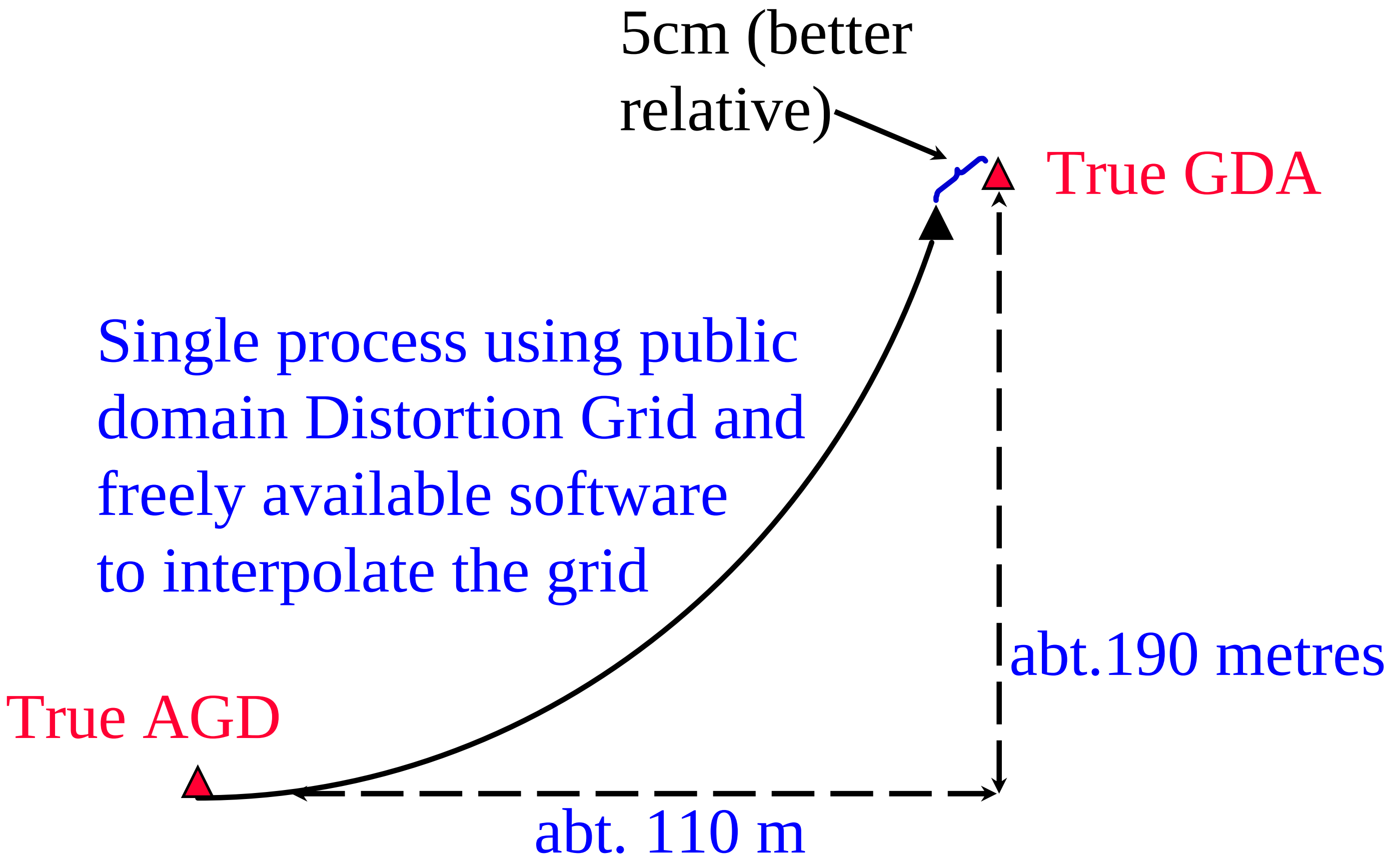




Distortion Grid



Using the Distortion Grid



Geocentric Datum of Australia

GDA

Topographic Image Map

9444-41

KENILWORTH

Queensland

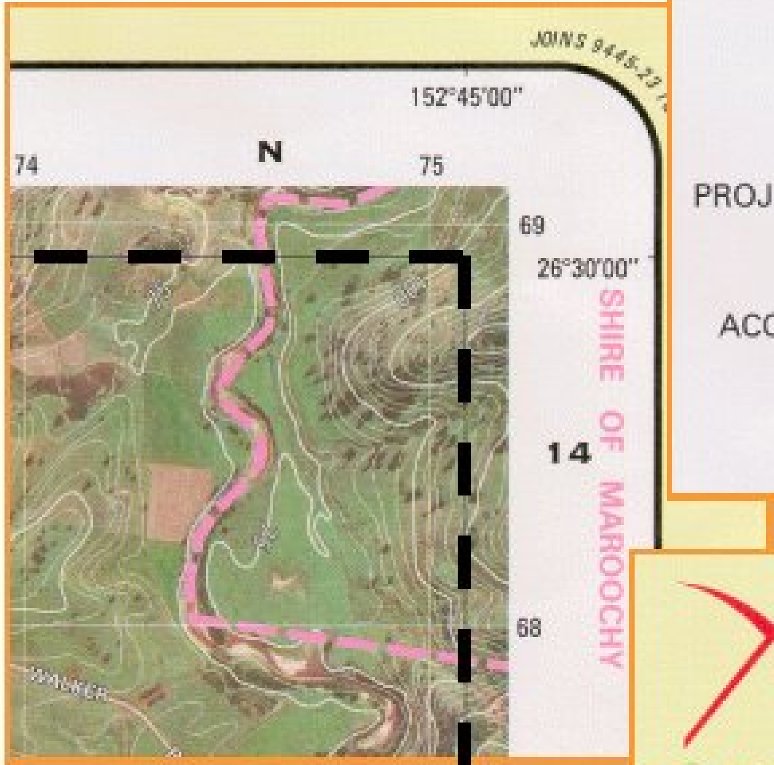
GDA

DATUM : Horizontal:- Geocentric Datum of Australia (GDA 94)
Vertical:- Australian Height Datum

GRID : Map Grid of Australia Zone 56, Central Meridian 153° E at 1000 metre intervals. Values are shown in full ONLY at the SW corner of the map.

PROJECTION : Map Grid of Australia 1994 (MGA94), which is a standard Universal Transverse Mercator Projection (UTM) in Zone 56 with Central Meridian 153°E.

ACCURACY : Horizontal : 90% of well defined detail is within ± 12.5 metres of true position.
Vertical : 90% of elevations are within ± 2.5 metres
These accuracies may not be achieved within areas of dense vegetation.



Map Edge

GDA

CAUTION
For all practical purposes GDA94 is the same as WGS84 as used in Global Positioning System (GPS).
For further information please contact your nearest Department of Natural Resources Customer Service Centre, or visit the ICSM Web Site at:
http://www.anzlic.org.au/icsm/gda/tech-f.htm

Changes to the operating environment since GDA was adopted

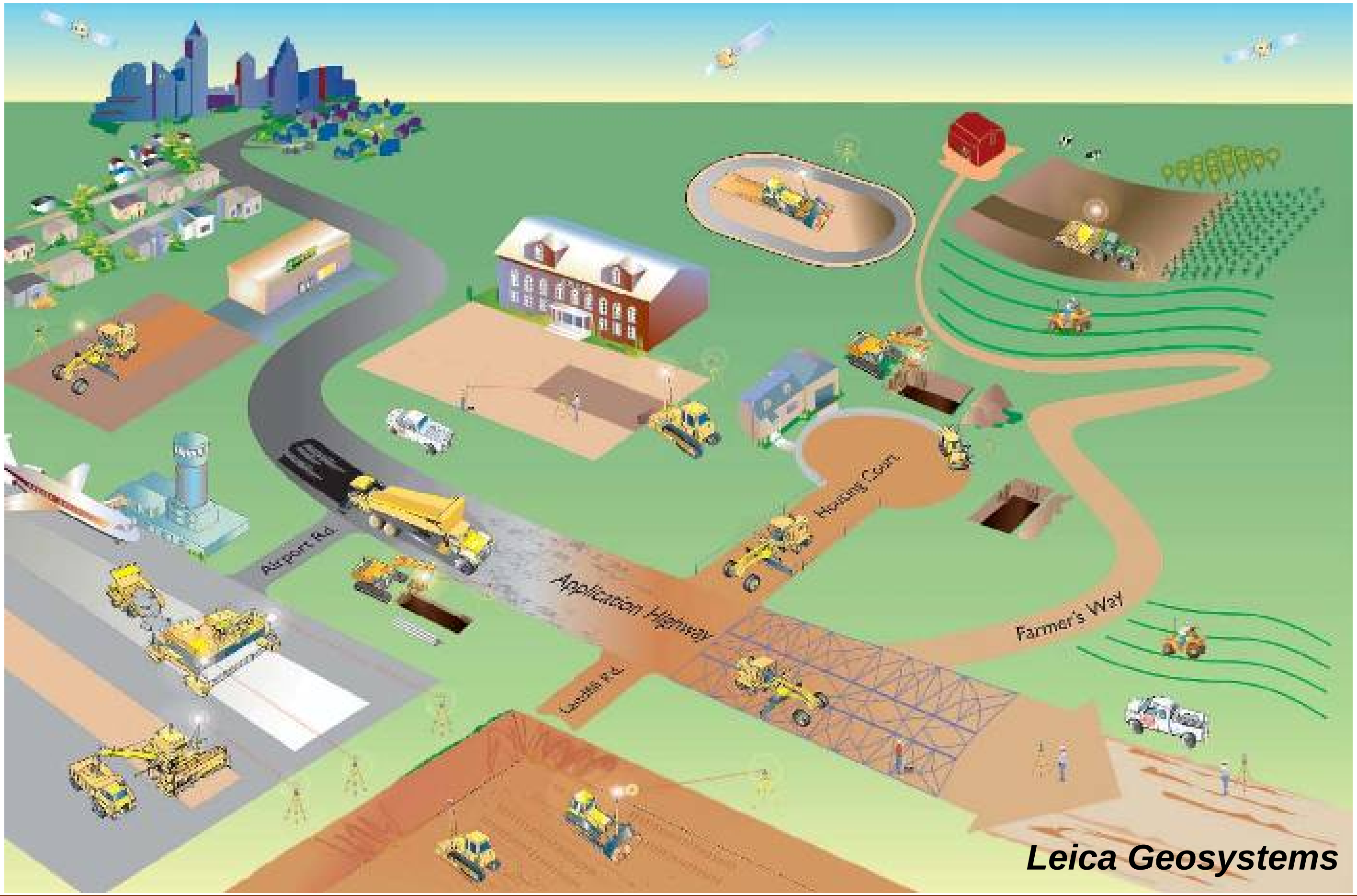
Fixing GDA at 1994.0 made sense for users...

- However, Australian Tectonic Plate moves at ~70mm per year;
- So coordinates of a point in GDA94 and in current ITRF (at today's epoch) appear to be separated by more than 85 centimetres;
- Also true for WGS84, remembering that it is now steered to be consistent with current ITRF;
- This is becoming an issue for some users and the gap is growing while users expectations are tightening;
- New Zealand has these problems in an even more pronounced way and is developing some pragmatic solutions to this problem;
- In Australia we are starting to ask how we should deal with this issue.

Expanding User Base for Centimetre Accuracy

- Traditional Surveying users embracing online processing and real-time surveying – but the user base is moving beyond surveyors;
- New applications for centimetre accuracy, especially in "*Machine Guidance*" for Agriculture, Construction and Mining;
- High value and high cost industries where marginal improvements to efficiency bring large $ savings;
- Also a growing number of users who only need 10cm but with very high reliability (eg they require 5*sigma so 1*sigma must be 2cm)
- Reliance on high accuracy GNSS services by these new users is leading to a new category of *"liability critical"* applications where suppliers need to deliver 2cm @ 24/7!

Machine Guidance with Centimetre Accuracy

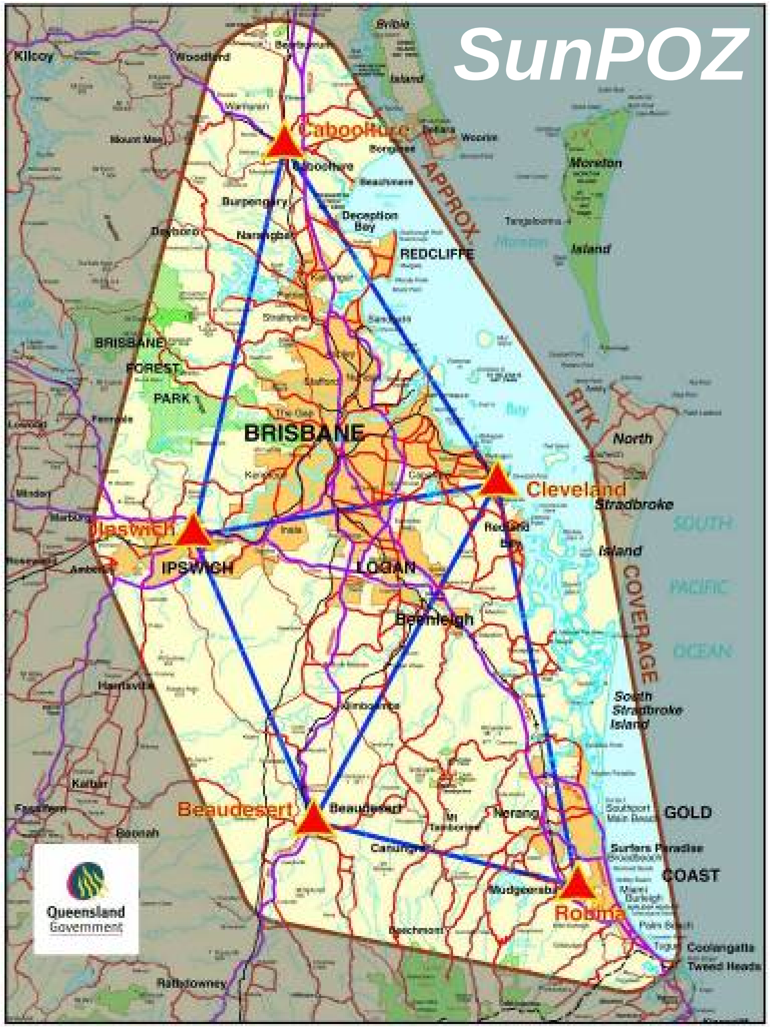


Machine Guidance with Centimetre Accuracy

- ***In Motorway Construction:***
  - ***30% reduction in time required;***
  - ***10% reduction in traffic management costs and***
  - ***40% reduction in lost time injuries.***
- ***In the Mining Industry:***
  - ***GNSS is used for a variety of tasks including surveying, grading, dozing, drilling and fleet management;***
  - ***Up to 30% productivity increases;***
- ***In Precision Agriculture***
  - ***GNSS machine control (auto-steer) widely used in grain, cotton, sugar and horticulture;***
  - ***Using auto-steer for control traffic farming can reduce input costs of fuel, seed, fertilizer, herbicide and time by 10-20%.***

RTK Networks

- Centimetre accuracy in real-time using survey quality GNSS receiver and mobile communications, many such networks springing up around the world;
- GDA good to 1ppm (eg 5cm between SunPOZ), which in the 1990s was an excellent achievement for a country the size of Australia but it is already not sufficiently accurate for network RTK.
- To deliver centimetre accuracy to the user, we can only tolerate errors in the reference station network at the few millimetre level;
- We now have GDA (SunPOZ) slightly different to GDA (Published).



AuScope GNSS Reference Station Network

- A major new initiative;
- Funded for Science to help better understand intra-plate deformations;
- Also forms a backbone for a new reference frame to better serve high precision users;
- Must all spatial data change or can we make this transparent to the users? (eg by reverse distortion grid).

Conclusion – The role of the ICG

1. Influence policy makers to commit to reference frame reform;
2. Assist countries with a methodology for adopting ITRF using lessons from GDA, EUREF etc, taking advantage of existing expertise, standards, services and tools;
3. Go beyond the geodesy through Reference Implementation approach to user adoption with standards, manuals, tools, education.