



KNOW WHERE YOU STAND WITH GDA

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ABSTRACT

The Geocentric Datum of Australia (GDA) results from an international trend to adopt a datum which makes mapping and spatial data coordinates compatible with satellite based coordinates. The GDA will provide a single reference framework for collecting, storing and applying spatial data at local, national and international levels.

The Intergovernmental Committee on Surveying and Mapping (ICSM) has adopted the GDA, which is being progressively implemented Australia wide. ICSM provides information in various forms to assist with GDA implementation. It is important for every person who deals with spatial data, in any form, to give considerable thought to the adoption of GDA and how the change will affect ourselves, the data users and providers we deal with. This thought process has been titled "Migration Planning". It is the migration planning process that takes you through the issues of implementing GDA.

INTRODUCTION

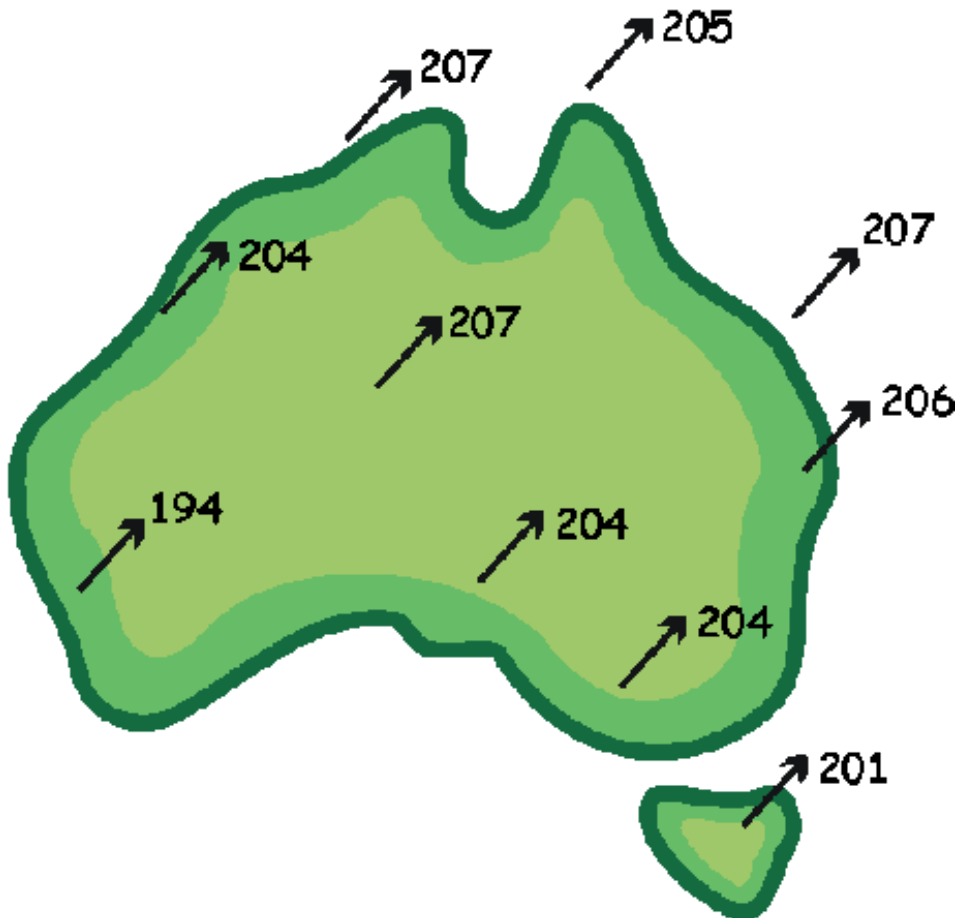
Satellites orbit around the earth's centre of mass (the geocentre) and are totally pervasive in all walks of life. In today's global society it is not only sensible, but also essential, to use a globally compatible datum - a geocentric datum. A geocentric datum is one that has its origin at the Earth's centre of mass. We are no longer talking about a change that will only affect standard mapping products, but a change

that will, to some degree, affect every piece of geographic information that is stored and maintained by any organisation. The change to GDA will affect the day to day operations of a much wider user community than any of the previous datum changes which some of you will have experienced.

Before 1966 there were many different astronomically determined datum, mainly using the Clarke 1858 ellipsoid. In 1966 the first National datum was established (the Australian Geodetic Datum - AGD), using the Australian National Spheroid (ANS) and Johnston Geodetic station as the origin. This origin was still essentially astronomically determined. Geodetic coordinates on this system (latitude & longitude) are known as AGD66 coordinates and the Universal Transverse Mercator (UTM) grid coordinates are known as Australian Map Grid 1966 (AMG66) coordinates. Up until now most maps were produced using AMG coordinates.

In 1984 additional observations and improved computing techniques were used to upgrade the AGD66 coordinates. The upgraded coordinates are known as AGD84. In 1984, when adopting the AGD84 coordinate set, ICSM recognised that a geocentric datum was always inevitable due to global influences. This was reinforced in 1988 when ICSM recommended that Australia adopt a geocentric datum by 2000. In 1994 the new datum, the Geocentric Datum of Australia (GDA) was established. Geodetic coordinates on this system (latitude & longitude) are known as GDA94 coordinates and the Universal Transverse Mercator (UTM) grid coordinates are known as Map Grid of Australia 1994 (MGA94)

THE CHANGE



The AGD and GDA are two different mathematical models of the shape of the Earth. Each has a different origin and subsequently a point on the Earth's surface will have different coordinates based on each datum. While features on the ground will not change, their coordinates will have an apparent

shift of approximately 200m in a north easterly direction. [1] The magnitude of this shift can vary by 10-15 metres and the orientation/direction of the change varies by a few degrees, across Australia.

Figure 1 : The approximate differences between the AGD & the GDA across Australia.

There are datums other than AGD66 & AGD84 still in use across Australia. The difference between these other datums and GDA94 are shown below.

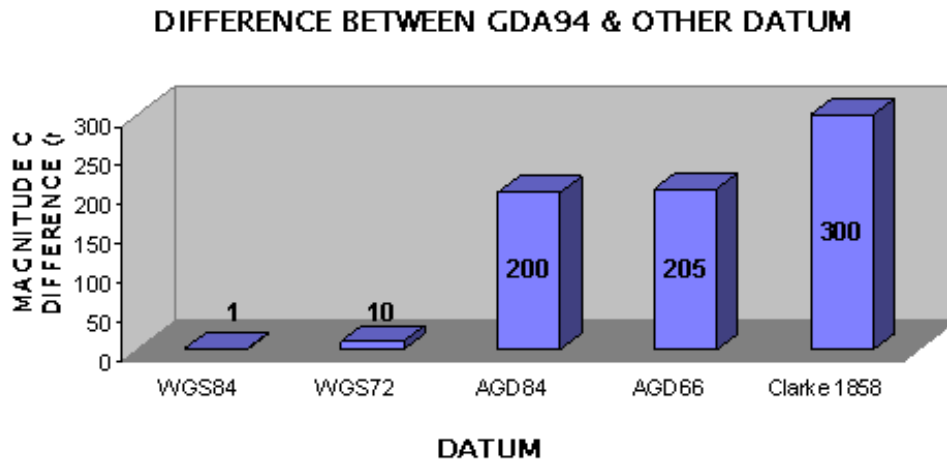


Figure 2 : Nominal differences between coordinates [2]

HOW THE CHANGE WILL EFFECT USERS

Maps

A considerable amount of geographical information is still held in paper maps. Much of this information may not require conversion, or it will not be economically feasible to convert. Shipping navigation charts and aeronautical charts are examples of maps that will or have been converted to GDA or a compatible datum. Some organisations will update their maps with their revision programs. Other organisations may not convert at all. All organisations will require individual strategies for paper-based products.

The technicalities of converting maps to GDA include deciding whether to move the graticule and keep even latitudes and longitudes, or maintain the existing graticules, resulting in non-integer latitudes and longitudes. If the map sheet area is changed, you may be faced with slivers and gaps where the converted data will either appear on two map sheets or be missing altogether. Bleed edges can be considered to overcome the gaps between map sheets.

Digital Data

Depending on how digital data is stored, the conversion method chosen and results achieved will differ. Digital data can be stored in both tiled and 'seamless' databases. The tiled data will suffer similar dilemmas to paper map sheets but in some cases may be more complicated to rectify. If the data is indexed using tile boundaries or using unique feature identifiers, which are referenced to a tile, then there may be some difficulties encountered if consistency is required through the migration process.

Global Positioning System (GPS)

The default datum in most Global Positioning System (GPS) receivers is WGS84. WGS84 and GDA94 coordinates differ by 10cm at the model level. This means that for most practical purposes GDA and WGS84 are the same. The impact this has on GPS users is quite significant. The new datum, GDA, is directly compatible with GPS measurements and mapping or Geographical Information Systems (GIS). This minimises the need for casual users to understand datum transformations.

While there is a 10cm difference between GDA94 and WGS84 at the model level, the absolute and relative accuracy of a GPS position will still depend on the GPS unit being used. Generally most handheld GPS will have an absolute accuracy between 10 metres and 100 metres for which relative accuracies may vary between 2 metres and 10 metres.

IT'S YOUR MOVE - MIGRATION PLANNING

GDA Migration Planning is simply a term used to describe the process of planning for the implementation of the GDA. Before we look at this process in detail, lets first examine why it is important to plan a migration when we have never had to do this where there has been a datum change in the past eg AGD66 & AGD 84.

Simplistically, in the past a change of datum really only directly affected a small number of users, primarily mappers, as there were very few computer systems containing geographic information. Users and uses of geographical data were generally restricted to tracing or plotting from existing map products at the time, so a small change in the coordinates did not matter to many users.

Today however things have changed, not only are GIS's widely used but so too are a number of other information systems (such as GPS) which are capturing and storing geographical information (eg stored in real world coordinates). Also, the relative and absolute accuracy required in some of these systems are much higher, to a point where centimetres can be critical.

Migration Planning is the process of considering the following phases:

- I. Determine if a Migration Strategy to GDA is required
- II. Develop a Migration Strategy and Plan
- III. Implementing the Strategy and Plans

There is no standard structure or content for a migration strategy, however there are some standard elements. The following sections cover the basic Migration Planning issues that need to be addressed.

I. DETERMINING IF A MIGRATION STRATEGY TO GDA IS REQUIRED

Essentially, anyone producing, providing or using spatial data will need to consider a GDA migration strategy. Only those people who do not receive, use or supply spatial data to external organisations can forget about GDA if they wish. However there must be very few organisations that fall into that category. Realistically, at some stage, whether sooner or later, most spatial data

producers, users and providers will have to consider a GDA migration strategy.

II. DEVELOPING A MIGRATION STRATEGY

Even if you do not plan to adopt the GDA internally, you will inevitably deal with data providers or clients that have already converted to GDA or plan to. In this capacity, it is still necessary to have a migration strategy that specifies how you fit into that dynamic framework. Here are some steps to assist you getting started.

Research & Understand the topic

Very few people understand about datums, and even less understand what datum they are using every time they use a data set or spatial product. In some cases it will not matter but in other cases it will. The question must be asked, does everyone using the product have a consistent understanding.

In terms of understanding GDA, it is important that a wide range of people in an organisation have an understanding of datums in general and more specifically about the migration path between datums. There is some material which is easy reading such as the "*Know Where You Stand With GDA*" brochure which is also available on the web at www.anzlic.org.au/icsm/gda/broch_f.htm. For those who are more technically oriented, there is a wide range of information under the ICSM GDA web page at www.anzlic.org.au/icsm/gda/index.htm. This page also has a wide range of links to other GDA sites, including the *GDA Technical Manual*.

Instigate Discussion about GDA

One person in an organisation can not implement GDA. There has to be a genuine commitment from all the staff as it may affect most staff in the organisation and others from outside the organisation as well. It is best to cast a wide net across all staff as well as providers and users of your information as they are probably the best and in some cases the only people who will be able to judge the magnitude of the migration task.

As with your clients, it is important for you to assist your providers with their migration plan.

Data Audit

A data audit is the only way an organisation can get a complete picture of what data exists and how it is used in the day to day business operations. This may also provide an opportunity to assess the corporate archive and remove unnecessary elements. The audit must include all forms of data including, digital, hardcopy and textual information.

The key questions here are:

What business operations utilise Geographic Information ?

What Corporate Geographic Information already exists ?

What information is required for the business operations ?

Assess the Legal Issues

There are two main areas here which need to be addressed. These are legislative changes required to accommodate GDA and making sure that individual work practices within an organisation are not exposing the organisation to potential litigation.

In terms of the first situation it is important to make sure that the datum change is being reflected in legislation. This may involve changing individual pieces of legislation, introducing umbrella legislation covering subordinate legislation, or maybe do nothing and resolve any issues through court. This may become a very complex legal issue in some cases. So the key question here are: What legislation will require changes and how are these changes implemented ?

In terms of individual work practices there are probably two main questions. Will my spatial information be used in Courts as evidence ? Can my data and data management practices survive legal cross-examination if it ends up in court ? Whatever the answer there is an implied requirement to review work practices and data management practices.

Software Requirements

Can the software you are using handle or manage GDA data ? This is really a problem for software vendors to solve but in the short term it is a problem for all the users. The best that can be done here is to make sure the vendors are aware of your requirements and where ever possible make sure any tender for upgrades, maintenance or enhancements include a clause stipulating GDA compliance.

Which migration approach will you use?

This is a key question for data producers and some users. Should everything be converted at once or should it be converted by product or geographic region. There is no easy answer except that the quicker a change, the shorter the transition period and hopefully the shorter any period of confusion. In the case of complex systems (such as in navigation or tracking systems) using a multitude of geographic information from different sources, it is likely that a "big bang" approach is required, where everything is changed at once. However, in some cases this may not be possible, such as with a Mapping program where there are substantial lead times required and where cyclic maintenance programs extend over many years.

In some cases an on demand approach may be the most efficient short-term solution. This approach relies on data being converted as required or as distributed. This approach is probably not a cost-effective long-term approach but may provide some short-term benefits.

III. IMPLEMENTING THE STRATEGY AND PLANS

Here, you will need to consider how to manage the change internally? Will you appoint an individual dedicated to GDA tasks (part or full time), or a small group or 'GDA Task Force'? What education is required for staff, clients and providers ? What promotion activities are required ? Migrating to GDA is not an overnight process and all of these questions raised need careful consideration throughout the GDA migration process.

ICSM ACTIVITIES

ICSM recognises that the migration to GDA is a complex task and organisations will require assistance in a lot of areas. ICSM has focused its activities on the following areas:

Industry Briefings

: ICSM and other State and Territory representatives will provide briefings to industry at workshops and seminars up to 2000.

Educational Material:

ICSM will be publishing material on a regular basis in popular industry publications and will be encouraging the education industry in Australia to include GDA implementation as part of its education programs.

Software Development:

ICSM is encouraging GIS and GPS software companies to incorporate the necessary transformation routines in their products. When purchasing GIS and GPS products, organisations are encouraged to specify that the product must capture and or convert data to GDA coordinates.

On-line support through the World Wide Web:

ICSM has a web site at <http://www.anzlic.org.au/icsm/gda/index.htm> which contains detailed technical information about GDA and links to other jurisdictional sites.

Receiving industry feedback is also very important to ICSM. Through the ICSM web page at: www.anzlic.org.au/icsm/icsmmain.htm, you will find the contact details for the ICSM member in your State/Territory as well as the Executive Officer and GDA Promotions Officer.

GDA Promotional Activities

ICSM has a GDA Promotions Working Group which is headed up by Ms Kelley Zammit (ICSM GDA Promotions Officer, email: icsmgda@auslig.gov.au, Phone: 02 6201 4357). The initial task of the Working Group is to develop an integrated promotions and educational campaign between all jurisdictions.

Some States and Territories have dedicated GDA staff who can help on specific jurisdictional issues. Their contact details are listed below:

NSW: Glenn Jones, email: Jonesg@lic.gov.au, phone: 02 6332 8220

QLD: Peter Todd, email: ToddP@dnr.qld.gov.au, phone: 07 3896 3723

WA: Robert Holloway, email: gda@walis.wa.gov.au, phone: 08 9273 7042

In other jurisdictions it is recommended you contact your local ICSM member.

CONCLUSION

Organisations need to plan for the transition to GDA. This involves understanding GDA, making an assessment of how it effects the organisation and determining the appropriate strategy. ICSM is endeavouring to provide organisations with appropriate information to assist with that migration.

REFERENCES

1. Intergovernmental Committee on Surveying and Mapping, 1997, *Know Where You Stand With GDA*. ICSM Publication.
2. Steed, J., 1995, *The Geocentric Datum Of Australia* Surveying World (Journal for Land, Engineering and Hydrographic Survey) November 1995, Volume 4, Issue1, pages 14-17.

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