# Geospatial Standards Working Down Under

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## SUMMARY

The growth of the spatial industry in Australia and New Zealand is underpinned by well developed policies, guidelines and standards that are continually being maintained to meet the emerging requirements of government, industry and the public. ANZLIC – the [Australian and New Zealand] Spatial Information Council, provides the all important national leadership and promotes accessibility to and usability of spatial information across the industry.

ANZLIC's aim is to promote best practice in spatial data management through a suite of inter-related policies and guidelines. This is achieved through its Standing Committees, including the Intergovernmental Committee on Surveying and Mapping (ICSM) whose role is to provide coordination and cooperation in surveying, mapping and charting. The major vehicle for improving access to data in the region is the Australian Spatial Data Infrastructure (ASDI). This national framework links users with providers of spatial information and has been in development since the mid 1990s.

This paper outlines the structure and activities of these policy and standards bodies, highlights some of their achievements and reviews the ASDI as a spatial data delivery mechanism.

# GEOSPATIAL STANDARDS WORKING DOWN UNDER

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## 1. INTRODUCTION

The primary message of this paper is that the spatial industry is alive and well *Down Under*.

*Down Under* a popular term for Australian and New Zealand, two countries covering an area roughly twice the size of the European Union, with the Australian landmass making up 7.7 million square kilometres. It is comprised of two independent nations; with Australia being a federation of 8 states & territories. Surveying and mapping functions in Australia are carried out by national, state and territory governments, each with differing legislative frameworks.

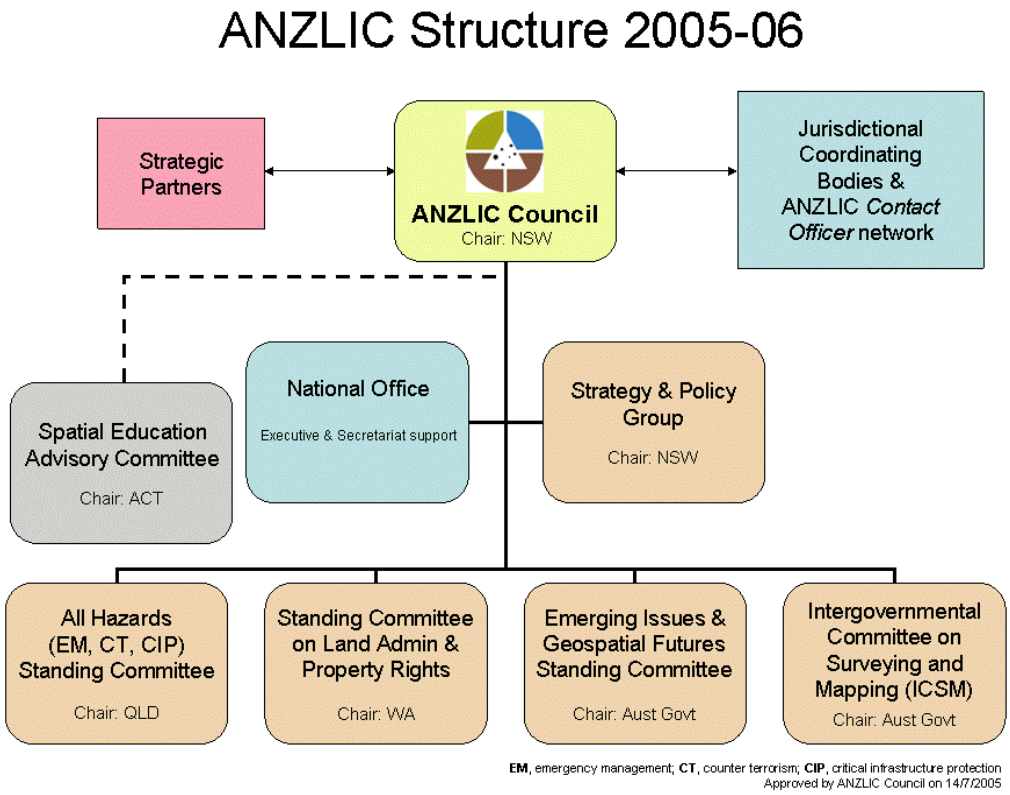
The geospatial industry has matured through the use of national and international standards for surveying, mapping and charting. With increasing awareness of spatial information and the value it makes to well-informed decision-making, there is now even greater importance on the consistent use of standards.

## 2. ANZLIC – THE SPATIAL INFORMATION COUNCIL

ANZLIC is the peak spatial information body in the Australia and New Zealand region. Its role is to facilitate easy and cost effective access to the wealth of spatial data and services provided by a wide range of organisations in the public and private sectors. It advocates the use of common standards, ensuring that data is more easily available to decision makers and increasing the range of spatial information products and services available to government, business and the community. Within government, ANZLIC is creating a strong linkage between policy decisions and the information needed to implement them.

ANZLIC consists of four Standing Committees whose role is to advise ANZLIC council on policy development and to implement policy when endorsed. These committees are:

- Land Administration and Property Rights
- Emerging Issues & Geospatial Futures
- All Hazards (Emergency Management, Counter Terrorism & Critical Infrastructure Protection)
- ICSM (Intergovernmental Committee on Surveying and Mapping) which has responsibility for the Australian Spatial Data Infrastructure (ASDI).



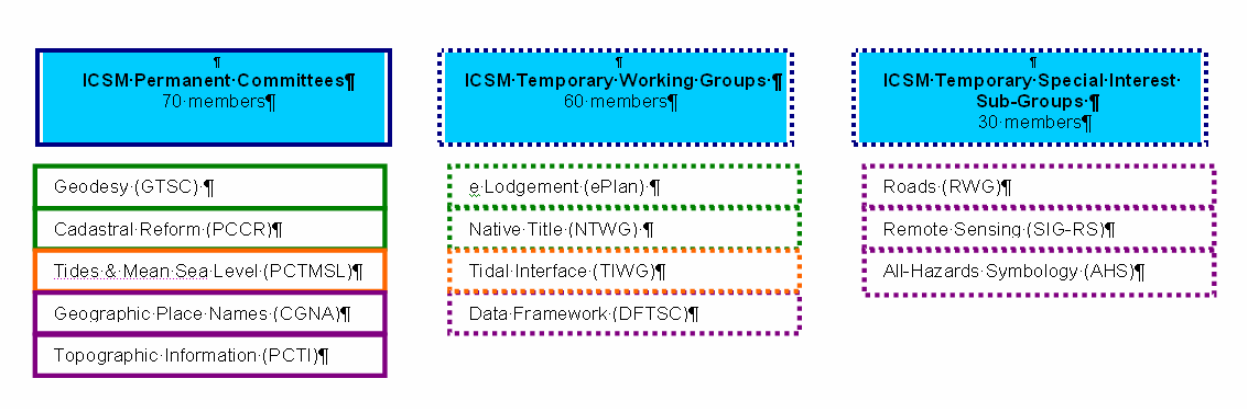

ASDI is the national framework for linking spatial data users with spatial data providers and one mechanism which drives this is the creation and application of standards. It comprises the people, policies and technologies necessary to enable the use of spatial data through all levels of government, the private sector, and academia. The ASDI is a continually evolving framework that is focused on maximising the economic, social and environmental benefits from investment in spatially referenced information. In a recent move ICSM has assumed the task of re-defining, promoting and implementing the ASDI.

## 3. ICSM – THE INTERGOVERNMENTAL COMMITTEE ON SURVEYING AND MAPPING

The ICSM's core function is to coordinate and promote the development and maintenance of key national spatial data including geodetic, topographic, cadastral, street addressing, tides & sea level, and geographical names. All of these fall under the broad umbrella of ASDI, the national framework for linking users with providers of spatial information.

ICSM is a committee comprising Surveyors General and their equivalent mapping counterparts from national (Australia and New Zealand), state governments and defence.

Within ICSM, a number of Working Groups are tackling a variety of issues ranging from geodesy & surveying to cartography & data/work practice standards. In June 2006 these Working Groups consisted of:




### 3.1 Permanent Committees

Effectively these are Working Groups that have been formed to undertake long term coordination, development, maintenance and communication of important spatially related issues such as:

- geodetic networks
- cadastral systems – including 3D cadastre
- tidal gauging networks and marine cadastres
- geographic place naming conventions and procedures
- topographic mapping

### 3.2 Temporary Working Groups

These are Working Groups which are formed to undertake nationally focused short term projects that can take several years to complete.

Current projects are the development of:

- a national data transfer standard for the electronic capture, visualization and validation of cadastral survey data traditionally presented on paper plans
- methodologies to accurately record and supply information relating to native title
- best practice guidelines for mapping and recording the tidal interface zone
- an ISO focused Harmonised Data Model which can be used to record and transfer spatial information of national significance

A recently completed project is the development of a national standard for street addressing (see Item 5.4).

### 3.3 Special Interest Groups

These Groups are usually short duration (less than 1-2 years), with a very precise terms of reference and time frames. They are usually formed under the auspices of another committee. In the case of the three current ICSM Special Interest Groups, the sponsoring committee is the Permanent Committee on Topographic Information.

Current activities are:

- the development and promotion of nationally consistent classification and attribution scheme for the representation of roads and associated infrastructure

- develop a framework for national cooperation for examination of the technical issues associated with the application of digital aerial photography information for mapping

- developing a nationally consistent set of symbols for emergency management mapping

The work of some of these Working Groups is outlined in Section 5 - ICSM – A Record of Achievement.

## 4. ASDD – THE AUSTRALIAN SPATIAL DATA DIRECTORY

The Australian Spatial Data Directory (ASDD) is a national initiative supported by all governments under the auspices of ANZLIC - the Spatial Information Council. The ASDD aims to improve access to Australian spatial data for industry, government, education and the general community through effective documentation, advertisement and distribution. The directory comprises government and commercial nodes in each State/Territory and spatial data agencies within the Australian Government.

The ASDD is an essential component of the ASDI and incorporates information about datasets (metadata) from all jurisdictions. The ASDD was launched in 1998 and has since steadily grown in content to become the key source of metadata regarding spatial information in Australia.

The technology being used for the ASDD is the Z39.50 search and retrieval protocol which when combined with the World Wide Web provides a simple method of searching, discovery and retrieval of spatial data.

## 5. ICSM – A RECORD OF ACHIEVEMENT

### 5.1 Harmonising Data

ICSM has traditionally been a sponsor for a number of ASDI fundamental data themes, these are:

- Topographic data
- Cadastral data
- Place Names
- Street Addressing
- Geodesy
- Hydrography

A number of ICSM Committees had been tasked with developing data models, feature catalogues and associated guidelines for the first four of these themes. In November 1999, ICSM recognised the need to harmonise these data models and, wherever possible, use consistent terminology and definitions between each theme.

In 2001 this resulted in the creation of a Harmonised Data Model (HDM) for the four themes and, together with the metadata specification, feature catalog and incremental update policy, they form a Harmonised Data Framework (HDF). The model adopts Unified Modelling Language (UML) for all data modelling and Extensible Markup Language (XML) as the transfer standard.

These models seek to be compliant with the ISO 191xx-series standards, in particular:

- ISO 19103 - Conceptual Schema Language
- ISO 19107 - Spatial Schema
- ISO 19108 - Temporal Schema
- ISO 19109 - Rules for Application Schema
- ISO 19111 - Spatial Reference by Coordinates
- ISO 19115 - Metadata
- ISO 19136 - Geography Markup Language
- ISO 19139 - Metadata – XML schema implementation
- ISO 19118 - Encoding

In 2004 it was further recognized that the existing model needed to be refined to link in a unified fashion. In addition, they are not fully compliant with current ISO standards. Work commenced in early 2005 to re-develop the HDF into a full UML model that can support the creation of a Geography Markup Language (GML) schema and therefore fully comply with ISO standards.

## 5.2 A Growing Spirit of Cooperation

Within a federated Australia, each agency involved with capture and maintenance of spatial information has traditionally approached the custodianship of its information with a focus on the needs of the custodial agency, without regard for the national need. So, when producing a national coverage it was necessary to contact each agency and expend considerable effort in getting each dataset into a consistent format.

Operating within the concepts of the ASDI and the HDF, ICSM took a leading role in the creation of a number of fundamental national datasets. The first of these was the Gazetteer of Australia which was first released in 1995. This is now up-dated annually and the 2006 version is scheduled to be released online http://www.ga.gov.au/map/names/ as a OGC complaint product at no cost. This represents an enormous step in the accessibility of national fundamental information.

Another is the National Topographic Map Index. This can be found on the ICSM web site and provides the only national index of the topographic mapping of Australia, as well as Land Information New Zealand and the Australian Hydrographic Office. Its importance as an index is demonstrated by the very high usage this site receives – since it was first released in 2003 it has averaged 5000 hits per month.

This increased spirit of cooperation is epitomised by National Topographic Information Coordination Initiative (NTICI) which was initiated in 2005. It involves Federal, State/Territory and local government agencies which carry out topographic mapping. The NTICI is founded on the mantra of "*CAPTURE ONCE, USE MANY*". Participating agencies come together through bi-lateral and multi-lateral projects that work to maximise the return to each other and thereby reducing duplication. A key element is the joint acquisition of high resolution imagery which allow cost sharing and more flexible licensing arrangements.

This spirit of cooperation has resulted in joint large-scale mapping projects being undertaken in five states with scoping of mapping projects in another two states and territories now underway.

## 5.3 Electronic Lodgement and Transfer of Cadastral Records

In 2003 ICSM formed a committee to review the creation of a national standard to capture, record and transfer survey records.

The standard is not about imaging hard copy survey plans, but rather about 'whole of life' digital data for the land subdivision process. It will allow seamless data use from capture in the field to dissemination and display through data bases, land titling systems and mapping products. The new framework makes it possible for the lodgement of cadastral survey plans with government authorities to be done electronically, via the WEB, without the inefficiencies of paper copies, incompatible unreadable data formats or introducing manual

transposition errors. This will substantially increase the efficiency of dealing with survey plan information.

By the beginning of 2006, a national UML model and modified Extensible Markup Language (XML) schema had been created and incorporated into the latest version of LandXML1.1. The model and XML schema was successfully trialled in a real world Land Title Office situation. This model and schema delivers significant time and effort savings (and therefore cost savings) to both private industry surveyors and Land Title offices. The model and schema is an excellent example of how a consistent application of standards can benefit all.

The model and schema has been installed in one State Land Title Office and is currently being implemented by another. There is considerable interest from remaining Australian State Land Title offices and private industry surveyors.

### 5.4 Street Addressing

In 2003 the final version of the Rural and Urban Addressing Standard (AS/NZS 4819:2003) was released by Standards Australia and Standards New Zealand. This was developed over a five year period by ICSM's Street Address Working Group. This standard has been incorporated in the ground breaking Geocoded National Address File database (G-NAF) created by Australia's Public Sector Mapping Agency (PSMA).

This standard has now been broadly implemented within both countries. It supports a consistent and unambiguous record of addresses and, among other virtues, allows for more efficient delivery of emergency services.

In brief the Standard covers six addressing issues:

1. *Rural Addressing*
Address numbers are based on a distance from a defined origin point (normally the commencement of the road) to the entrance of a rural property. This simplifies significantly the delivery of services, including emergency services.

2. *Urban Addressing*
Address numbers are based on defined rules.

3. *Complex Site Addressing*
Address numbers are based on a single address for a complex site such as a shopping centre, caravan park or apartment complex, while making additional provision for individual numbers internal to the site.

4. *Alias Address Management*
Address numbers are based on one of the standards listed above, with a secondary/alias address, primarily to accommodate the use of alternate names for places by the community.

5. *Geocoding*
This describes the coordinates that define the position of an address point/ (normally the postal service point). This is especially important for digital applications.

6. *Management and Transfer of Temporal Addresses*
This ensures that the dates and details of changes to addresses are recorded to allow users to determine the history of an address. It also allows for the identification of addresses which no longer physically exist, but which need to be retained for administrative and historical purposes.

### 5.5 GDA - Geocentric Datum of Australia

In 1988 ICSM resolved to progressively implement the GDA throughout Australia as the preferred datum for all spatial information. This was to replace the Australian Geodetic Datum (AGD) which had been in place since 1966, and a number of other horizontal datums which were in use prior to GDA. The new geocentric datum is compatible with international positioning frameworks and satellite positioning technologies.

A number of ICSM Working Groups were established to focus on various issues relating to implementing this decision. By 2004 the final Working Group (GDA Implementation) was disbanded following the very rapid up-take of GDA as the Australian standard.

A number of strategies were adopted including the development and implementation of:
- a migration plan
- a technical manual
- promotional & educational strategies
- an industry/user support strategy

A crucial tool in this very successful endeavour was the ICSM web site (http://www.icsm.gov.au). In particular this site was used to deliver technical information and connect users with service providers and supporting software. Indeed, the Technical Manual (version 2.2, February 2002) still receives 80,000 hit per year.

### 5.6 Agreed Understandings

A core component of the ICSM Working Groups is centred on supplying information to ensure that individuals have an agreed understanding of terms and concepts – this has been achieved by the creation of Data Dictionaries (Lexicons). The ICSM web site is a vital tool in achieving this. Examples of these are:

Tidal Interface Compendium of Terms – this identifies terms used in a legal context within separate agencies. While the Compendium is far from definitive, it does highlight that there are numerous terms used to describe the tidal interface; and that these terms frequently have varying definitions or are not defined at all. It should also be noted that the complexity and

significance of this issue varies between agencies, depending on the nature of the coastal area and tidal variations experienced and its impact on activity in the tidal interface area.

The ICSM Feature Catalogue contains a description of Classes, Attributes and Relationships presented in the Harmonised Data Model.

The ICSM Topographic Feature Catalogue documents and describes a national standard set of feature codes and feature definitions for topographic data. The document brings together a diverse group of data dictionaries and standards into a single amalgamated set of feature codes and feature definitions. Where possible, ICSM's Harmonised Data Model (HDM) feature definitions are used.

An Australasian All-Hazards Symbology Library is being developed to meet the needs of emergency managers and responders when mapping emergency events. This library will include symbol designs, definitions and usage guidelines for spatial data, mapping, signage and other forms of presentation medium.

## 6. AUSTRALIAN SPATIAL DATA INFRASTRUCTURE (ASDI)

The ASDI's core premise is the concept that a single, consistent, accessible government funded infrastructure is the basis for developing a healthy, competitive private sector producing value added services and products. The ASDI comprises four core components:

### 6.1 Institutional Framework

The Institutional Framework defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets. It includes:

- Leadership
- Sponsorship
- Custodianship
- Data Distribution
- Education and Training
- Applications eg Multi-agency projects

### 6.2 Technical Standards

Technical standards are required to define the technical characteristics of the fundamental datasets. This includes:

- Standardisation Processes
- Reference Systems
- Data Models
- Data Dictionaries / Feature Catalogues
- Data Quality
- Data Transfer
- Metadata.

### 6.3 Fundamental Datasets

In the Australia / New Zealand context a fundamental dataset is defined as one where a government agency requires a consistent national coverage. These datasets are viewed as being primary data sources which can be used to produce value added products. These fundamental dataset are produced within the institutional framework and fully comply with the technical standards. There is considerable overlap between fundamental spatial datasets and framework datasets as defined by the USA Federal Geographic Data Committee (FGDC).

### 6.4 Access and Delivery

In recognizing the broad significance of fundamental datasets, changes are being made to jurisdictional policy to make much of this data more accessible and more consistently priced, including more low-cost or free downloads. The Australian government has led the way with the 'Spatial Data Access and Pricing Policy' which makes fundamental data free of charge over the Internet and at no more than the marginal cost of transfer (generally A$99.00) for packaged products. Further, the datasets are provided without any copyright license restrictions on commercial value-adding.

### 6.5 Implementation

ANZLIC currently has identified the following priority areas for implementation:

- ASDI governance
- Access to data
- Data quality
- Interoperability
- Integratability

These priorities provide a solid base for further promulgation of the ASDI concepts as well as benchmarks for measurement of the uptake. They also provide an initial focus on interoperability issues using open system applications.

## 7. WHAT NEXT?

ICSM will continue to work on developing the future direction and standards to support the ADSI. The ASDI concept was developed in the 1990s and whilst it was best practice at the time, the concept and direction needs to be reviewed and revitalized. The environment has changed significantly over the past decade with the emergence of online players such as Google Earth, Microsoft, Yahoo and NASA. In addition OGC is now playing an increased role and the Australian Co-operative Research Centre in Spatial Information (CRC-SI) is now well established.

The CRC-SI has adopted a vision of a 'Virtual Australia'. The vision includes a virtual digital model containing and representing:

- All non-trivial objects and their contextual environment
- from blue sky to bedrock
- in Australia

That model should be:
- complete, current and correct
- available to anyone, anywhere at reasonable cost.

The 'Virtual Australia' vision is far-reaching and dynamic and provides a useful context for a renewed ASDI.

Implied in the Virtual Australia concept is:

- The final definition of 'non trivial objects' will be the view of the user. However it is clear that this will include many more objects than mapping agencies traditionally deal with.

- Location will be an important utility. Users will expect to be able easily determine their location and relate it to other non trivial objects of interest.

- Virtual Australia will almost certainly have to be 3D if non trivial objects are to be seen in their contextual environment.

- Visualisation will be an increasingly important way of viewing non trivial objects in their contextual environment.

- Improved institutional arrangements will be required. Wider implementation of Custodianship will be a key requirement.

- Virtual Australia will need to cater for variations in detail and show rich data where it is available. Former techniques such as reducing all data to the lowest common denominator will no longer be acceptable.

One area which is becoming more important is the review and development of three-dimensional (3D) cadastres. The work will encompass best practice, standardisation of surveying services and definition of boundaries. It will have implications in the terrestrial, marine and tidal interface zones. It is most likely that the first product that will come out of this review is a data dictionary of agreed terms and their definitions.

3D cadastre will provide for better representation of complex commodities and more sophisticated titling arrangements – such as indigenous rights and interests, high-rise buildings , urban transport corridors and marine cadastre.

## BIOGRAPHICAL NOTES

**Paul Harcombe**

Paul Harcombe is the Chief Surveyor, Land and Property Information NSW (LPINSW) within the Department of Lands. Paul is also Chairman of the NSW Survey and Mapping Managers Forum and a Member of the NSW Survey and Mapping Industry Council. His primary responsibilities include management of the State Survey System, and statutory functions involving approximately 70 staff across NSW. He holds a Bachelor in Surveying from the University of New South Wales and also a Master of Geomatics from the University of Melbourne. He has a broad background in surveying and land information.

Paul is also the Deputy President of the NSW Board of Surveying and Spatial Information which regulates land and mining surveying activities and advises Government on Spatial Information matters. He is also Deputy Chair of the Geographical Names Board of NSW.

Other positions held include Chairman of the Intergovernmental Committee for Surveying and Mapping (ICSM) and member of the University of NSW Dean of Engineering Advisory Committee as well as being on academic advisory boards for surveying and spatial information schools at Melbourne and New South Wales Universities.

Paul was recently appointed as an inaugural Director of auCD – a not for profit company established to manage the allocation of geographical names for use by Australian communities as Second level Internet Domain Names.

**Ian O'Donnell**

Ian O'Donnell is Group Leader of the National Mapping and Information Group, Geospatial and Earth Monitoring Division of Geoscience Australia. He has over 30 years association with the geosciences and has formal qualifications in cartography, geology and administration. In recent years he has been largely involved in shaping the strategic direction of topographic mapping and spatial information management on behalf of the Australian Government by Geoscience Australia.
He is the past Chair of the Intergovernmental Committee on Surveying and Mapping, a working group of the Australian New Zealand Land Information Council (ANZLIC), his two year appointment ceasing in June 2006.

**Garry West**
Garry West holds a Surveying Certificate (Hons), Sydney Technical College; Batchelor of Surveying (Hons 1), University New South Wales; Graduate Diploma Administration, Northern Territory University; Graduate Certificate Public Sector Management, Flinders University.

Current Position: Surveyor-General, Land Information, Department of Planning and Infrastructure, Northern Territory.

Activities in home and International Relations: Member Institution of Surveyors Australia; Regional NT Committee Member Spatial Sciences Institute Australia; Chairman Council of Reciprocating Surveyors Boards for Australia and New Zealand; Chairman Intergovernmental Committee on Surveying and Mapping for Australia and New Zealand.

**Russell Priebbenow**
Russell is Director, Land Policy with the Queensland Department of Natural Resources, Mines & Water. In this position he is responsible for the legislative and policy framework for surveying, and for the provision of strategic policy advice to business functions including management of state land and land valuations.

Russell is a registered cadastral surveyor. He has been involved with surveying and mapping policy and business direction in the Queensland government for 15 years. Proir to this, he carried out research into the mapping applications of imagery from the SPOT satellite, and attained a PhD from the University of Queensland for this research. Russell also holds a Bachelor of Surveying with honours from the University of Queensland.

Russell was recently appointed to the Surveyors Board of Queensland. He is also a member of the Faculty Advisory Committee for the Faculty of Engineering and Surveying at the University of Southern Queensland.

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