Paper 11

The Status of National Mapping: 400 Years On

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ABSTRACT

This paper looks primarily at the status of Australia's national topographic mapping. It reviews what we have achieved to date relative to a national mapping program that was initiated around 1956 to facilitate national development by the Division of National Mapping in conjunction with Department of Defence. Over time the original goals have changed, replaced by new objectives centred on a national framework of topographic and thematic map information. The drivers are different and this has placed a new perspective on what constitutes a national mapping program in 2006. In closing some observations are made on the challenges ahead and how well Australia is positioned to tackle these.

BIOGRAPHICAL NOTE

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 with formal qualifications in cartography, geology and management. In June 2006 he completed a two year term as Chairman of the Intergovernmental Committee on Surveying and Mapping (ICSM), a working group of the Australian New Zealand Land Information Council (ANZLIC).

INTRODUCTION

In preparing this paper I am wearing two 'hats', firstly as the outgoing Chair of the Intergovernmental Committee on Surveying and Mapping (ICSM). This Committee is responsible for the establishment of the Permanent Committee for Topographic Information, a working group whose terms of reference are primarily aimed at the Commonwealth and other jurisdictions taking a collaborative approach to topographic mapping of this country.
Secondly, and equally as pertinent to this subject, I am the Leader of the National Mapping and Information Group in Geoscience Australia and the person responsible for the national topographic mapping program.

NATIONAL MAPPING

Topographic mapping provides that all important locational context for other themes of information. So nationally it plays a critical supporting role for everything else that depends on positioning of some sort or another. Therefore, for this paper I have interpreted 'national mapping' as just that, nation wide coverages of topography at medium scales as opposed to the larger scale mapping at 1:25,000 and 1:50,000 which tends to be less nationally focused and more State/Territory or region specific.

A review of the status of national mapping 400 years after the first European contact is more than answering the question 'what does the situation look like now compared with then?' Our predecessors set goals that have in one way or another been achieved over the decades, but mapping is a continuum driven by changes in the landscape, the impact of technology and the demands of users. So, in reviewing the '2006 scorecard' we have to take into account not only the goals we have met, but how we are positioned to address the emerging needs of government and the community.

THE POST-WAR VISION

Around 1956 the Division of National Mapping was tasked with mapping the topography of the entire country to facilitate national development in the post-war period. The Royal Australian Army Survey Corps also had a part to play in this Herculean task by way of mapping selected areas of the continent.

The target for this new mapping was a map series covering the whole of Australia at a scale of 1:250 000 (1cm on a map represents 2.5 km on the ground) and comprising a total of 544 map sheet areas (later reduced to 513 maps by the use of Specials). Each standard map would cover an area of 1.5 degrees longitude by 1 degree latitude or about 150 kilometres from east to west and 110 kilometres from north to south. The compilation of the initial 1:250,000 series referred to as the R502 was completed in 1966 with the last map going to press in 1968.

In 1965 the Australian government initiated production of the National Topographic Mapping Series (NTMS) at 1:100,000 scale. This comprised some 3,062 map sheets which were completed around the 1988. Not all of the 3,062 were published as traditional topographic maps, about 1,460 (predominantly the remote central Australia region) were only produced to line-compilation stage. The NTMS also formed the basis for a new series of 1:250,000 topographic maps that was completed around 1991. These maps contain natural and constructed features including road and rail infrastructure, vegetation, hydrography, contours (interval 50m), localities and some administrative boundaries.

The NTMS as it was initially defined at medium scales of 1:250,000 and 1:100,000 and representing over 3,600 maps were completed at a cost of $600 million. For more than 40 years, these maps have provided the base information on which Australians have depicted other data themes, navigated and explored this vast continent. One only needs to look as far as the Australian Geological Map Series, the early 1:250,000 scale Gravity and Magnetic maps of Australia to see this.

Small scale mapping

Mapping at 1:1,000,000 of Australia could arguable be the forerunner of a national topographic mapping series for the country. Both World Wars had an impact on the production of the smaller scale 1:1,000,000 scale World Aeronautical Chart (WAC) and the International Map of the World (IMW). In fact, the first IMW map (Sydney) was produced in 1926. The original concept was that WAC map sheets were specifically produced for civilian aviation and the IMW for general and scientific purposes. Where it was possible common source materials were used for both series.

In 1953 the Division of National Mapping commenced production of a national series of WAC and IMW charts for the country and maintained both through to about 1987. In 1986 the custodial role for the WAC's transferred to the Civil Aviation Authority (as it was then) which also coincided with fading global interest in the IMW series. The WAC series of paper maps are still available today, although the data currency of these topographic map sheets varies considerably, some being up to 20 years old.

THE DIGITAL REVOLUTION

Since the adoption of digital technologies around the late 70's and early 80's mapping as it was traditionally practiced underwent a revolution of some proportions. Since then the technologies, processes and outputs associated with mapping have continued to broaden, as has the vocabulary associated with the activity. Mapping is now a sub-set of 'spatial information' and the business is now referred to as the spatial information industry.

During the period of traditional, or non-automated mapping, the most significant technological advances, such as changes in drawing medium (film replacing linen and the advent of 'scribing') seem quite benign compared with the introduction of digital technologies. It took about two decades for the transition from automated map production processes to the delivery of intelligent mapping to the spatial enablement of business processes. Clearly technology has been as much as influencer as it has been an enabler here, but along the way some quite important milestones were achieved which are discussed below.

Automation of topographic map production

In the late 70's computer aided mapping (CAM) systems were integrated into the map production processes in most of the larger agencies. The goal, albeit short-lived, was the automation of map processes associated with the production of lithographic printed maps such as the generation of grids/graticules, plotting of digitally captured data on devices such as drum and flat-bed plotters.

The development of Geographic Information Systems (GIS)

In the late 80's CAM was rapidly overtaken by developments in Geographic Information Systems (GIS) with its emphasis on intelligent data. This created a burgeoning demand for conversion of the information on paper maps to digital form. This presented new opportunities for the existing private sector players and lead to a host of new companies setting themselves up to digitise the hard copy products for a range of government, business and off-shore clients.

In the midst of this change the Australian Survey and Land Information Group (AUSLIG) responded to the growing demand for digital versions of its 1:250 000 scale series topographic maps. GEODATA TOPO 250K Series 1 was a vector representation of selected features from the original repromat used to produce the NATMAP paper maps. The data was thoroughly attributed and topologically structured

The commencement of the GEODATA TOPO 250K Series 2 program followed very soon after the completion of Series 1. It was primarily designed to provide high quality data for mapping and GIS professionals as well as hard-copy maps through the one process. The strategy at the time was unique. The product incorporates five main data themes - Hydrography, Infrastructure, Relief, Reserved Areas and Vegetation. These themes contain up to 138 feature classes, covering essentially all the features depicted on the paper map series. Series 2 is still available as free download for individual tiles, or can be purchased as state/territory based packages on CD-ROM.

GEODATA TOPO 250K Series 3 is the latest vector representation of the topographic themes appearing on the 1:250,000 scale NATMAP topographic maps. The difference between this and Series 2 is that the data is held as data themes and as a continuous coverage of the country in a spatial database environment. So users of the data are not constrained by map sheet boundaries and can pan through the data on the soon to be released MapConnect web site incorporating free downloads. Series 3 is primarily designed to provide high quality data for mapping and GIS purposes and is also available as a packaged product in Personal Geodatabase format as well as the typical GIS formats.

Digital Elevation Models

Representations of the height of the topographic surface are referred to as Digital Elevation Models (DEM's). They have a multiplicity of uses, for example analysis of climate, hydrology, agriculture, forestry and biodiversity and have proved to be essential for positioning of telecommunications or broadcasting transmitters to name but a few. In 1996 the growing demand for a national digital elevation model was addressed by the release of GEODATA 9 Second DEM Version 1. This was a cooperative effort involving AUSLIG, the Centre for Resource and Environmental

Studies (CRES) at the Australian National University, Australia Geological Survey Organisation and the Australian Heritage Commission.

Version 2, launched in May 2001 has a much greater accuracy than the previous edition. In essence, representation of the terrain more closely matches the real world through the preservation of the high points and absolute elevations of hills and mountains rather than being smoothed, as was the tendency in Version 1.

WWW and mapping

The growth of the Internet needs no further introduction other than it represents yet another medium by which topographic information can be discovered and disseminated. It provides the capacity to share data as well as integrate data from disparate sources to undertake analysis and conduct business etc. Through this technology the user experience continues to become richer and deeper as developments in web services are made publicly accessible by Geoscience Australia and the like.

Image topographic maps

As an adjunct to the vector data at 1:250,000 scale Geoscience Australia released NATMAP RASTER-250K, in 1996. Due to high demand and popularity of this product new versions were released in 2002 and more recently in March 2005. NATMAP Raster digital maps are exact digital copies of Australia's 1:250 000 scale topographic paper maps and each version incorporated updates as they had occurred. Perhaps the most popular use of the raster product is for real-time navigation when coupled with global positioning systems.

LARGER SCALE TOPOGRAPHIC MAPPING

Complementing (I use the term advisedly) the national topographic map and data produced by Geoscience Australia is a range of larger scale maps produced mainly by the state and territory mapping agencies as well as the Department of Defence. This hierarchy of mapping, or more aptly named, the ‘patchwork quilt’ of varying scales of maps and data products forms an important component of the Australian Spatial Data Infrastructure (ASDI). The ASDI is a national initiative that was launched by the Australian New Zealand Land Information Council (ANZLIC) in November 1996. It is about ensuring that Australians have better access to the fundamental spatial data that underpins sound sustainable development. When fully realised users will be able to acquire consistent datasets to meet their requirements, even though the data is collected and maintained by different authorities.

Underpinning the governance side of the ASDI are generally accepted divisions of responsibility for who maps what. That is, the Commonwealth’s mandated role (vested in Geoscience Australia) is national mapping at 1:100,000, predominantly 1:250,000 scale and successively smaller scales such as 1:1,000,000. The states/territories map at larger scales such as 1:25,000, 1:50,000 and in the case of the western region of NSW at 1:100,000. Inter-woven into this fabric is the Department of Defence who produce maps and datasets at a range of scales for predominantly homeland security purposes and generally, but not exclusively in northern Australia. A relatively small number of private sector mapping companies produce a suite of customised maps, such as tourist maps to complete the picture.

The Australian scene is not unique, take the United States, or Canada where a plethora of federal, state as well as private sector agencies produce topographic 'like' map products and datasets at varying scales. From a SDI perspective this fragmented approach can deliver if all of the players are working to the same vision. Sadly, until recently, this has not been the case in the US, Canada or Australia. Here in Australia a considerable amount of effort is now being directed towards a collegiate approach to mapping – one that delivers against the objectives of all participants. In this regard the ICSM has established the National Topographic Information Coordination Initiative (NTICI) which is developing a 'whole of government' approach to the collection, availability and maintenance of topographic information to meet the needs of governments and the public.

HOW DOES THE 2006 REPORT CARD LOOK?

400 years on from the first chart of the Australian coastline produced from the Duyfken voyage an obvious question would be 'have we completed the task'? In one sense the answer to this is no, because as I have previously alluded, mapping is a continuum. The completion of one grand objective leads to another, driven very much by the fact that the landscape is not static and that technological innovation and user demand will always set new boundaries for achievement.

We are a large continent, a land area of some 7.7 million square kilometres and therefore mapping it in a comprehensive way is a task of considerable dimension. We have achieved a great deal, especially post WW2, some of which I have outlined above. An assessment of how we rate nationally and internationally can be done in a number of ways. The 'yardsticks' I have applied are:

- country comparison;
- assessment against the ASDI priority areas; and
- user feedback

By country comparison:
The table below looks at the status of national mapping of Australia compared with that of Canada and the United States. These countries were chosen because of the similarities they have with Australia in terms of the landmass, levels of government and demographics. It is not intended to be a rigorous analysis but more of a comparative snapshot.

Country	Scale	Currency	Coverage	Form	Comment
Australia	1:100,000 (~3080 sheets)	Av 30 years old	National	Paper maps; some unpublished; limited vector; raster product developed from scanning the maps	A new approach to data and map revision commenced.
	1:250,000	Mostly	National	Paper maps;	Active

	(513 sheets)	based on yr 2000 imagery or better		vector & raster data - tile & theme based; data managed as themes in spatial DB	maintenance strategy now conducted in conjunction with 1:100K revision program
	1:1,000,000 (43 sheets)	82% are based on data better than yr 1997	National	Paper & vectors managed in spatial DB	Vector & raster will be completed early 2006/07; new edition paper maps
Canada	1:50,000 (~12,000 map sheets)	Some maps 40+ years old (oldest detected 1955 – 2003)	National – but some not printed in colour	Paper; raster data (scanned from paper maps); vectors captured from paper maps stored in spatial DB (NTDB)	No new litho maps printed - needs are now met through Print on Demand (POD); aiming to create a raster product where each pixel is geo-located
	1:250,000 (~1000 map sheets)	Some maps 20-40 yrs old , appear generally better than 1:50,000	National	Paper; vector data stored in spatial DB (NTDB)	No new litho maps printed – needs now met by PoD; aiming to create a raster product where each pixel is geo-located
	1:1,000,000 (18 map sheets)	1993-1998	National	Paper; vectors (VMap0)	Appear to be updated at regular intervals
USA	1:24,000 (~55,000 map sheets)	In 2002 av currency was 23 yrs	National	Paper, raster (DRGs), vectors (DLGs), some work on seamless coverage &	Maintenance of such a large number of maps at this national scale is a challenge –

				Spatial DB	hence the less than optimum currency
	1:1,000,000 (State Map Series ~46 map sheets) WAC: 19 charts	State Maps range from 1962 – 1985; WAC appear to be updated annually	State Maps – National coverage of individual/ grouped states WAC: National	State Maps: paper; WAC: paper	State Maps – appears to be no revision program in place

Summary of the comparison -The currency of Australia's national topographic mapping, specifically 1:250,000 scale is considerably better than that of the USA and Canada. Of the 513 maps now covering Australia, none have a currency date worse that 1997. In fact 79% are based on source imagery that is no older than year 2000 and those areas subject to greatest cultural change now have a reliability date of not more than five years.

All three countries have some form of revision program in place and all are creating spatial database environments such as Geoscience Australia's National Topographic Database (NTDB) to manage the data. What sets Australia apart from the others is the extent to which these strategies are keeping pace with change in the landscape. On balance Australia is performing far better with a new articulated maintenance program that is designed to sequentially update 1:100,000, 1:250,000 and 1:1,000,000 scale maps and data products from one revision activity.

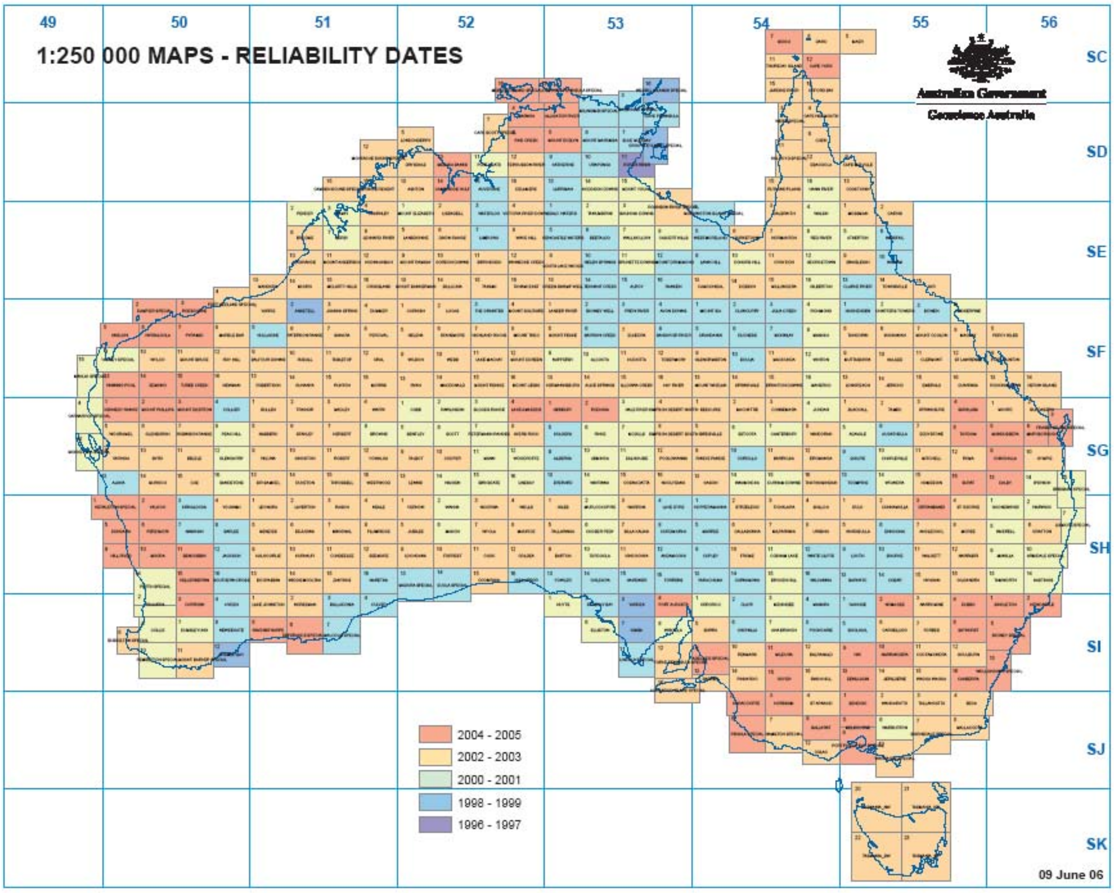

Figure 1 – Reliability dates of the 1:250,000 scale mapping of Australia

Compared with the ASDI vision:
The stimulus for the ASDI is the delivery of benefits to government, industry and the public from the collection, management and use of spatially referenced information. Because national topographic mapping is a core framework dataset of ASDI it has been rated against the five priority elements that have been identified for implementation of ASDI.

ASDI Priority Areas	Assessment	Rating 1-5
1. Governance: Holders of spatial data, service providers and users in government agencies, business enterprises, academic institutions and community groups are involved in implementation and use of the ASDI.	• Geoscience Australia, the Federal agency responsible for national topographic mapping and associated information has lead by example, by removal of barriers to access and use of spatially related data ie data is now 'a free good'. • Both ICSM and Geoscience Australia have strengthened coordination arrangements with the jurisdictions to provide a whole of government approach	**4**

	to the maintenance and improvement to national topographic mapping. • Industry has been engaged in building the national topographic data infrastructure.	

2. Data access:
Spatial data users are able to find and access existing data sources and services with minimum impediments.
	• Facilities for finding and accessing national topographic maps and data have never been better – eg discovery tools such as the ASDD
	• The range of topographic products available at 1:250,000 scale especially is diverse:
	  o Paper maps
	  o Digital data – vector, raster, personal Geodatabase in tile and continuous coverage.
	  o Available on DVD and as down-loads
	• There are no restrictions on the commercial use or value-added activities related to the national mapping data.
		4

3. Data quality: Users are able to easily ascertain the quality of existing spatial data and its fitness to meet their needs.	• Data is characterised by national consistency, assured quality and comprehensive documentation ensuring maximum fitness for use. • Quality of metadata is good and improving with an emphasis on feature level metadata.	**4**
4. Interoperability: Access to and combination of spatial data sources and services is made time and cost efficient for users through use of world's best practice interoperable technologies.	• While the importance of open systems specifications is recognised the development of reference implementations of topographic data has generally been slow. • Topographic data via *MapConnect* will be available in GML format. • Interoperability pilots are being developed for Gazetteer of Australia using OGC specifications	**3**
5. Integratability: Spatial data sources conform to common standards that enable integration with other data, where such integration enables efficient and	• National topographic data at 1:250,000 and associated scales has been assembled to exacting standards and specifications, to stated	

effective solutions for users.	accuracy, and based on Geocentric Datum of Australia to facilitate interoperability and integratability. • Data models applied to geographic data management have been developed in consideration of existing and emerging jurisdictional models so as to facilitate data development, sharing and use. • Mechanisms are available to facilitate integration of national data sets.	**4**

Summary of the assessment - In general our national topographic maps and datasets rate very well against the five ASDI priority elements, characterised by:

- Maps and data that are discoverable and readily accessible;
- Conformity to standards;
- Consistency in quality;
- Whole of government approach; and
- Liberal data licensing and use and conditions

Whilst interoperability is rated lower than the other priority elements, user feedback suggests that data provided in the major vendor GIS formats via download or on a transfer medium is not so much of an issue as the importance of access, licensing and quality.

User feedback:

Geoscience Australia undertakes customer surveys on a biannual basis to gauge the performance of the organisation and customer satisfaction with the products and services it provides. Surveys conducted in 2004 and a more recent analysis undertaken toward the end of 2005 as part of a map printing, storage and distribution review have been drawn on to provide another perspective of the status on national topographic mapping.

The following product attributes rated well or met expectations of the users:

- Accuracy of features in our products;
- Level of confidence that users have in our products;
- Positional accuracy;
- Up to date information in products (currency);
- Reasonable price for digital information;
- Products are easy to use (user guides accompany digital products);
- Product availability on different delivery media; and
- Look, feel and usability of the map products

Concerns were in the nature of:

- 1:250,000 scale products are good but 1:100,000 scale mapping is a more versatile scale – the mapping needs to be updated; and
- The need for a better resolution national DEM

Summary of the user perspective – While this assessment is far from a qualitative analysis it suggests that what is available in the way of national topographic maps and data satisfies the expectations of the majority of users. There is however, an acknowledgement that 1:250,000 scale has its limitations for some applications and there is a sustained demand for more current larger scale data and products.

Conclusion:
Overall, Australia has an enviable national coverage of maps and spatial data especially when compared with the USA and Canada. Our spatial data policies eg data access and pricing, are very liberal and valued by users. However, we are a long way short of the spatial data infrastructure that will help underpin a sustainable future.

THE EVOLVING WHOLE OF GOVERNMENT APPROACH

Every significant milestone achieved over the last 60 years has been a 'springboard' for the next generation of mapping. For example, the completion of the NTMS 1:250,000 scale map series in 1991 formed the basis for the generation of the GEODATA Series 1. This in turn formed the basis for the GEODATA Series 2 map and data products which has now been further developed into GEODATA Series 3, the first nation wide continuous coverage of topographic available as data themes. So, while the milestones we set ourselves today will always be targets in a timeline of changing requirements, the challenge for the spatial industry as a whole is being able to adapt to these in a timely and effective manner.

Australia's 1:100,000 scale mapping is mostly out of date and worsening – many of the maps are up to 30 years old. This parlous state received some press in *'A Nation Charred: Report on the inquiry into bushfires'* by the House of Representatives Select Committee into the bushfires of 2003. It made special reference to age of the 1:100,000 scale topographic mapping in supporting natural disasters. In response to this Geoscience Australia implemented a 1:100K pilot program to undertake new mapping and revision in key areas identified by emergency management agencies and responders.

Project areas totalling 55,000 square kilometres were completed in ACT, NSW, QLD, VIC and WA using the latest technology and approaches. The pilot also proved to be the litmus test for the NTICI concept, an Intergovernmental Committee on Surveying and Mapping initiative under which state and federal bodies partner to procure imagery and jointly undertake map revision. This 'whole of government' approach to the collection, maintenance and availability of topographic information is underpinned by a *'map once, use many times'* philosophy. Whilst not a unique concept internationally, eg the USGS National Map, it has required some effort to gain 'traction' here in Australia. In practice map revision and/or new mapping is carried out at the largest scale possible under bilateral and multi-lateral agreements between federal and state agencies in priority areas. The updated information folds back to the jurisdictions and is also generalised to meet the federal mapping mandate.

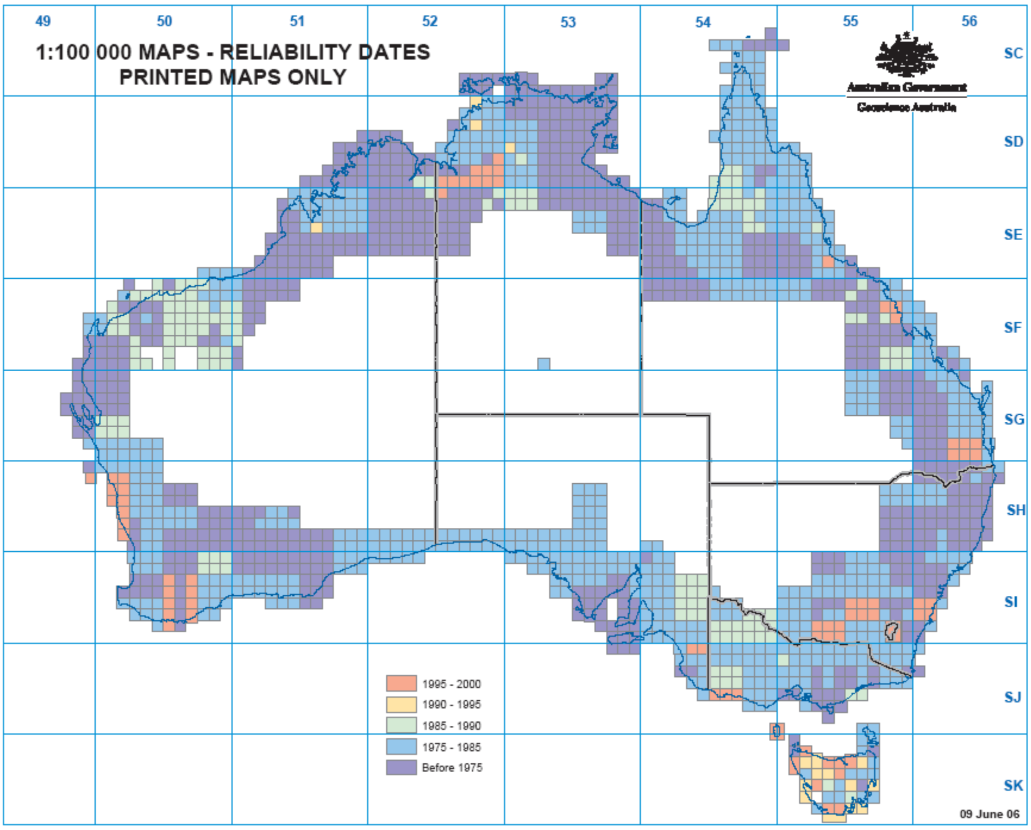

Figure 2 – Reliability diagram of the 1:100,000 National Topographic Mapping Series

The benefits of *'map once, use many'* are considerable; a few are listed below:

- Improved availability of up-to-date, reliable and accessible topographic information to meet government, value-adders, distributors and public users;
- Reduces the cost of mapping to the participating parties; and
- Outputs in the form of a 'single point of truth datasets' that are aligned to the emerging requirements of spatial enablers.

CURRENT MAPPING PROGRAMS

At the time of writing there are NTICI mapping projects either operating or being scoped in all States and the Northern Territory (Refer to Figure 3). These joint mapping projects are not specifically aimed at revising 1:100,000 scale mapping on a map sheet by map sheet basis. Rather, NTICI projects are aimed at priority regions that need map revision for one or a number of reasons such as emergency management, natural resource management, regional development and so forth. The outputs of which add to the national spatial information framework.

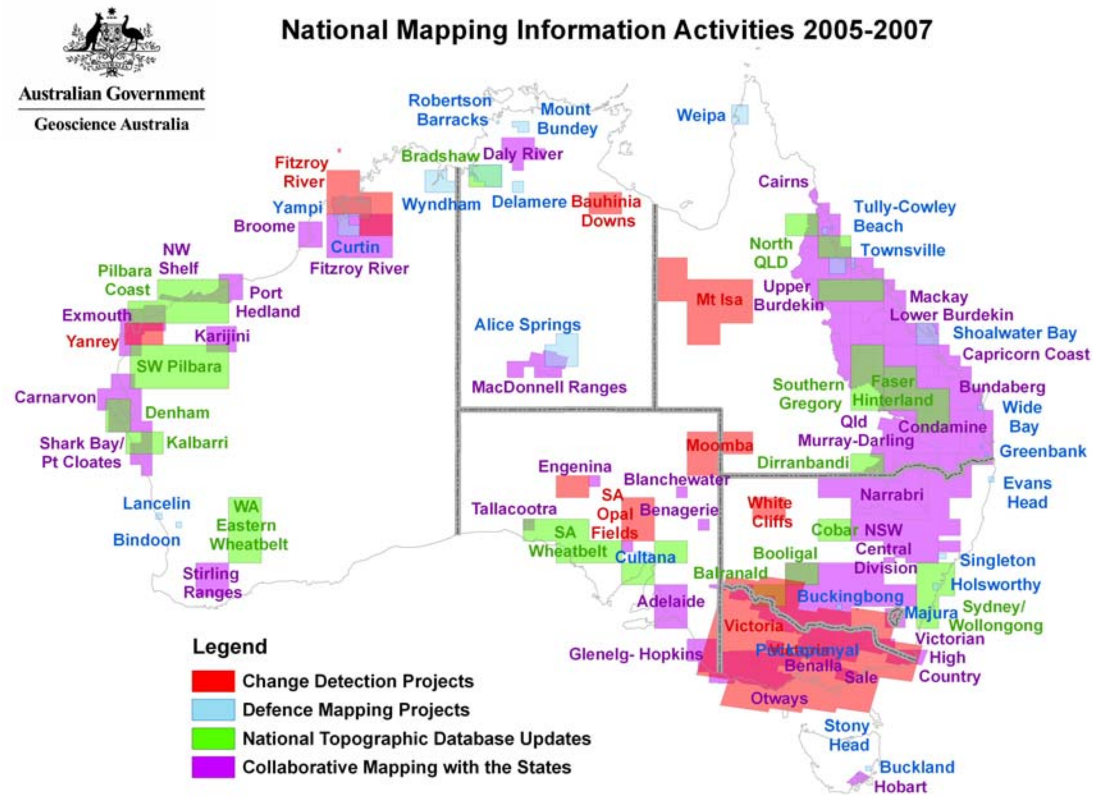

Figure 3 – The forward National Topographic Mapping Program emphasising the extent of the collaborative mapping in purple

With respect to 1:1,000,000 scale mapping, Geoscience Australia and Airservices Australia are partnering to produce new editions of the WAC's. They are being produced from the latest 1:250,000 scale data and when completed this WAC series will be the first covering Australia in digital form. Twelve of the forty two maps are with Airservices Australia now for printing with the revision planned for completion in early 2007.

THE SHORTCOMINGS

In general I believe Australia is reasonably well served from a national mapping perspective and things look good in this regard for the foreseeable future. What is missing are up-to-date topographic maps and data at larger scales ie 1:25,000 and 1:50,000 scales. Without being prescriptive many of these maps were produced 20 to 30 years ago, yet they represent a large component of the map and datasets that are necessary to decision-making for a sustainable future for this country.

Furthermore, what is available can be hard to discover because of a paucity of metadata, plus there are impediments to data access created by divergent pricing policies among the jurisdictions. Conybeare, in his report to ANZLIC on spatial information for counter terrorism also found these to be common obstacles in responding to the increasing pressures created by national security and community safety. The good news is these issues are not insurmountable and are being addressed either directly or indirectly.

THE CHALLENGES AHEAD

Governance and policy:

As technology improves and life on earth is impacted by human activity and natural phenomenon there will be even greater reliance on spatial information for support and decision making. Some form of ASDI will be an essential mechanism for provisioning all sectors of the community with efficient access to appropriate information. The original ASDI concept had its shortcomings and certainly it did not galvanise the support it deserved from elements of the spatial industry. In the last 12 months the ICSM has assumed the responsibility for it. Recognising the need for a reinvigorated ASDI the ICSM have established a task force to review the original goals and achievements to date. This will also have to involve key spatial industry bodies such as CRC- SI, ASIBA, PSMA and ANZLIC to collectively redefine the objectives and outcomes of an ASDI for 2006 and out to 2015. To this end the University of Melbourne have proposed the concept of a Virtual Australia as an enabling platform for an SDI, and maybe this is the right approach. Whatever way the ASDI ends up being packaged, the fact is that an overarching mechanism like it is critical to drawing the disparate spatial information initiatives and platforms together to facilitate access by the broadest cross-section of users.

Jurisdictional mapping agencies are now finding that alone they do not have the capacity to maintain their data custodial responsibilities. This has led to renewed interest for collaborative projects thereby allowing scarce resources (people and funding) to be spread further. So, initiatives such as NTICI will be the way of the future and the most effective mechanism for maintaining and improving the investment that exists in our topographic mapping. As one thing leads to another, the greater the level of cooperation, the greater the potential for a coordinated approach to value-adding of the national spatial framework.

Simple, yet effective discovery and access to topographic data will be contingent on a robust national spatial information framework. As long as we persist with the ‘stovepipe’ approach to data management we deny users the opportunity to benefit from all the data available as well as smart enabling technologies. The objective should be the creation of a national topographic information portal that provides access to a virtual network of custodians data. One in which users will be able to explore pathways to successive datasets unaware that they are moving between custodians sites (government or for that matter the private sector organisations) to acquire what they need. We are not too far short of a prototype being developed given the increasing level of cooperation between jurisdictional mapping agencies.

Metadata, preferably at feature level, is a critical element to the establishment of any form of national spatial information framework and portal. The Australian Spatial Data Directory has continued to improve over the years but it is still contingent on data custodians demonstrating a commitment to metadata. Associated with this ANZLIC has established a project team to deliver a new metadata profile that is consistent with the new international metadata standard and an ISO compliant metadata entry tool. Once available the entry tool should go a long way to harmonising the collection of metadata by data custodians.

Pricing policies associated with spatial data, especially at the jurisdictional level, will inevitably be liberalised. The arguments for maintaining the status quo are being challenged from many quarters. Google Earth, for example, has done much to set new rules for the game in the SI community. The clear message is, make information cheaper and more readily available or you will not be playing. Another big sleeper will be an emerging 'spatially enabled' Australian government who will increasingly demand that data custodians provide quality data available at lower cost, or as a free good.

A complimentary national dataset

The growth of Radar interferometry (InSAR) and Airborne Laser Scanning coupled with conventional photogrammetric techniques are now addressing a wider range of applications in the form of flood modelling, subsidence monitoring and landslide detection. This is in part driving the demand for a higher resolution national Digital Elevation Model (DEM) to replace the current 'Nine Second Australian Digital Elevation Model'. 3D geometry is the way of the future and although there are now better resolution datasets than the Nine Second DEM available, such as the SRTM Shuttle data, they all seem to have shortcomings. As a result Geoscience Australia intends scoping the requirements for a higher-resolution national DEM in conjunction with the ICSM's Permanent Committee for Topographic Information with the objective of getting production underway in the 06/07 financial year.

CONCLUSION

Australia's 1:250,000 scale topographic map and data products are the best we have ever had available and represent the cornerstone of a comprehensive national topographic data infrastructure. Whilst this is well short of what is necessary there is now a renewed sense of purpose to contribute to the sort of framework that will underpin the needs of government, industry and the public going forward. The fact that the catalyst for much of this reinvigoration is due to the impact of natural hazards and counter terrorism does not matter, the beauty of it all is that it is happening.

The future however, will be conditional on the 'big players' in industry and government providing the leadership and proactively driving the improvements. Geoscience Australia in conjunction with ICSM has demonstrated this by moving beyond the talk and initiating a collegiate approach to mapping the topography of this country. It is this type of momentum that will perpetuate the vision of our mapping forefathers.

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