100 Years of National Topographic Mapping

Topographic Mapping in Australia – From the Present to the Future

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INTRODUCTION

Since 1947, initially to aid post-war development, Geoscience Australia (GA) and its national mapping agency predecessors has been responsible for mapping the topography of the Australian continent at national scales, and producing and distributing paper maps. In recent times this has included the production of digital versions of these maps plus associated data products for emergency managers, defence, government departments, industry and the public.

The goals of the 'national map' have evolved and changed significantly over the past half century, commensurate with changing data capture, imagery acquisition, and mapping techniques and technologies. Similarly, government mapping agencies have also evolved. Recent change, the past 10 years in particular, has been driven in response to the contemporary needs of an expanding range of users of spatial information in a much more dynamic environment. As we are all aware, the days of agencies systematically mapping the topography of their jurisdictions have been relegated to the past, replaced with business driven organisations focussed on responding to the needs of clients, whilst doing their core business in a leaner and more demanding business and government environment.

GA is no exception as it strives to keep abreast of developments within the spatial community and present its topographic and other data to an increasingly spatially aware and enabled society. Mapping this large continent at various scales has been, and will continue to be, an enormous task, with the maintenance of this large and valuable data collection presenting unique challenges. However, technologies such as Google, Bing, Yahoo, and others have opened new innovative ways of looking at geography, introducing the use of imagery and maps to the masses in a manner that the traditional map has never been able to do. The availability of large scale locational information built from low cost, high quality data is now the rule rather than the exception. Regardless of these emerging content providers and capabilities, the authoritative collection of fundamental topographic data themes – that are at best available resolution, consistent and fully maintained – must come from somewhere. I would suggest that this will always be the role of government and the central mapping agencies – at least in the foreseeable future.

THE VERY RECENT PAST

Within the context of this conference and '100 Years of National Topographic Mapping' I have no doubt that the history of mapping will be faithfully recorded and presented at this forum, as will have the story of the evolution and challenges in developing Australia's various map series and data. Therefore it will not be duplicated here. Never the less, such challenges remain significant in the modern era and are never far from front of mind of the people entrusted with developing strategies for Australia's mapping program. This paper will concentrate on contemporary issues and the future of government mapping in Australia. To commence, we will fast forward from 1956 to 2005 and pick up the mapping thread when GA achieved a major milestone with the completion of GEODATA TOPO 250K Series 3 (1:250,000 scale national map).

The release of TOPO 250K Series 3 in 2005, the third GEODATA iteration, was significant in that it represented a seamless national digital topographic database of the Australian continent that was consistent, rigorous, and built to a uniform mapping specification. For the first time data was held as continuous 'themes' in a spatial database environment, not constrained by the well known map sheet boundaries (tiles) and also fully web enabled. This product represented the modern mapping era. Further, the 250K National Topographic Map Series (NTMS) printed maps were achieved as a direct hardcopy extract from the data. At the same time, a new raster format 250K digital product was launched and became the flagship product for GA, with revenue at its peak of around $300,000/year.

Today, the GEODATA 250K data and the associated NATMAP maps are GA's largest scale topographic products, and continue to be the flagship topographic product for Australia. Indeed they are the only products which offer complete national coverage of Australia and are a key fundamental resource for such activities as spatial analysis and government policy development. They are used across a broad range of government portfolios covering the environment, water, defence, infrastructure and transport, as well as across a broad spectrum of private industry players for analysis, reference, and planning and product development. In many remote areas of Australia GEODATA 250K and NATMAP's are the only detailed data/map products available and industry, government and the general public rely solely on them.

However, GEODATA Series 3 was just that, the third iteration GEODATA product that had first been delivered in 1995 from what was 40 years of hard copy mapping. This history means that it was also largely a cartographic derived database. Many features were represented as they would be on a map, and not necessarily in their true 'real world' position on the ground. Roads, railways and drainage are such examples, especially where they are closely aligned or coincident with each other. Users now increasingly demand that the data have positional accuracy that supports its use with GPS. Having data that is of lower positional accuracy encourages the development of alternative data sets and is in conflict with the modern 'point of truth' digital database concept.

Another major dilemma with GEODATA is the fact that it has not been comprehensively or systematically updated since the Series 3 2005 release. A GEODATA Series 4 regime was never initiated, as the resources required were too great, and the benefits too difficult to justify or quantify. Further, the 'series mapping' model had run its course and was no longer perceived as being relevant in a more dynamic digital data age. The net result is that parts of GEODATA are now up to ten years out of date. If we look at this pragmatically from a cost/benefit perspective, much of this is due to Australia's geography and population.

The vastness of our continent, combined with a relatively low population, both validate the past approaches described above, and also complicate the veracity of modern up-to-date database concepts. Change in the topography for many remote areas in Australia is infrequent, with updates to the data in these areas often on a 10 year cycle. This is acceptable. In other areas, for instance where there is population growth or infrastructure development, a shorter maintenance cycle is required, particularly with certain cultural themes. GA is not alone in facing this problem, as several of the larger State/Territory mapping agencies are facing the same challenges, as are other nations.

In absence of a comprehensive and systematic 'series' update of the national datasets, the solution for a sustainable and enduring topographic mapping program for Australia has

resulted in increased collaboration with the State and Territory mapping agencies – a commonsense and pragmatic approach. In 2004, just prior to the Series 3 release, a vital collaboration tool was established to offset the ongoing and increasing cost of data capture, revision and maintenance – the National Topographic Information Coordination Initiative (NTICI). Created with the mantra of '*capture once and use many'* and operating under the umbrella of the Intergovernmental Committee on Surveying and Mapping's (ICSM) Permanent Committee on Topographic Information (PCTI), NTICI is the enabling framework under which a collegiate approach to the topographic mapping of Australia is undertaken. This has the advantage of adding value to the topographic layers of Australia's spatial data infrastructure, whilst recognising the different but complementary roles and responsibilities of the mapping agencies in each of the States and Territories.

Now in place for 7 years, the NTICI model has focussed on collaboration with State and Territory mapping partners, mapping at large scales in priority areas, aligning with government priorities of the day, and minimising duplication. A cost/benefit analysis undertaken in 2008 concluded that many projects would not have been undertaken without NTICI. Participants believed that the benefits in having updated data far outweighed new costs in production and data integration. New priorities in areas of water management and climate change are now being aligned with the needs of traditional stakeholders such as emergency management.

Historically we have approached the task of mapping the Australian continent pragmatically and have been able to acknowledge that we will always be challenged by scale and our ability to keep data current. Many other nations do not have these challenges. However, I would argue that we have also been much more 'tuned in' to the needs of the Government of the day, and are somewhat flexible and adaptable in our approaches to delivering maps and products. This will be discussed further later in this paper.

Finally, and absolutely critical to acknowledge, the national topographic mapping program no longer resides within dedicated mapping agencies (AUSLIG and Royal Australian Survey Corps), but resides within a much larger agency in Geoscience Australia – responsible for delivering a very broad earth science program and providing first class geoscientific information and knowledge to enable government and the community make informed decisions. One can debate the merit of this decision, but the reality is that the digital data produced for and underpinning the national map is now more valuable, more integrated, and in more demand than it would have been otherwise.

THE PRESENT

Aware of the increasing pressure to provide richer, dynamic and authoritative data that is 'fit for many purposes', GA is now having to balance a number of factors within its business, including: the relevance of the traditional paper map in a quickly evolving digital world; the cost of capturing and maintaining more data at multiple levels of resolution; how we *capture once*, *use many*; and how we use the available technologies to enable consumers to easily discover, access, analyse, visualise and package spatial data. These are being driven by a number of priority incentives including the new and emerging policy directions of government requiring spatial enablement, agencies needing to 'partner' more to address limited funding and avoid duplication, and the reality that the face of mapping is changing quite dramatically (driven by the user community).

Complicating this and a common trend across the world, there still appears to be a poor appreciation for the resources required to build, maintain and deliver high quality, authoritative databases, despite the importance of fundamental spatial data and mapping being increasingly acknowledged. Recent discussions with many national mapping agency representatives around the world confirm this lack of appreciation and understanding, and Australia is no different with fundamental topographic information. Demonstrating the cost/benefit and value of a national resource is not only very difficult for us, but also the entire spatial industry. Unfortunately there is still an expectation that it is all being done, that the databases are accurate, consistent and up to date. However, this expectation is not often reflected in reality, particularly when budgets are tight and resources are diminishing.

Things have had to change, and they are changing. From a mapping perspective, this requires a cultural transition from a 'data/product owner/provider' philosophy to that of a 'geographic information content provider, enduring data custodian, integrator, and implementer' in order to present data to an increasingly spatially aware and enabled audience. Easier said than done!

Today, achieving a sustainable and modern national topographic mapping program relies heavily on three factors:

- Improvements in and leveraging of technology;
- Collaboration amongst mapping agencies; and
- Changes in the federal government's business ethos.

Technology

To state the obvious, technology has improved dramatically over the last 25 years. The technological revolution has totally changed our thinking and is now a capability that we not only rely on, but expect to help us provide solutions to problems. Consider such things as:

- we now produce authoritative spatial data and then derive by-products that include topographic maps and web services;
- we don't draw maps and then produce topographic data;
- we have in-car navigation systems which talk to us and map where we go;
- the web has totally changed how we deliver or look for information. It has been the game breaker;
- increasingly content and services are being provided over the web;
- users expect to be able to access accurate, up-to-date information instantly and are less tolerant of flawed or out-of-date information;
- users are increasingly technologically savvy; and
- these same users do not care where the data comes from. They just want to use it!

For topographic data producers technology change means that:

- **on the up side**
  - much more can be produced (quantity and quality), in less time and needing less staff resources;
  - data services and products can be derived at multiple resolutions;
  - 'representing' data at several scales is possible;
  - authoritative data is available 24/7 on the web for others to access; and
  - mapping agencies are able to be more flexible, adaptable, and customer focussed.

- **on the down side**

- users are demanding more complex products and services, and they want them now!
- staffing is an increasing challenge due to the highly skilled and geographically mobile nature of GIS trained personnel;
- agencies need to be constantly aware of technology and be prepared to change operations in line with developments. Getting locked in to one single approach is not always beneficial; and
- the role of traditional cartographic 'niceties' is no longer as important. Culturally, this reality is perceived as a threat when considering that software may make the decision rather than a person.

Recent technological change has resulted in a paradigm shift at GA. As described earlier in this paper, national topographic mapping is no longer systematically produced based on a regular map grid with a regular update regime and production is now totally digital-based. GA has recently created a 'multi-scale' national topographic database that will eventually supersede 250K GEODATA as GA's flagship product, and will relegate other derived smaller scale databases (1:1M, 1:2.5M, etc.) to the past. It is envisaged to be a mosaic of national and larger-scale topographic data, so that for any one locality only the largest scale data is stored, and which could be directly imported from State/Territory large scale topographic mapping systems.

Challenges remain in streamlining processes in data collection, management, editing, cartographic production, dissemination, and quality assurance, but we are getting there. The need to not only be able to produce the data and cartographic products much more easily from a single database, but to also have it available and accessible via the web, is widely recognised. Further, geography is now more mobile, with data and user-generated content at the fingertips of users and being harnessed as social networks are built in a growing consumer environment. Although simple, these services are extremely effective in delivering content to the broader community. We only have to observe how Google Maps and other like services have become regular and important resources, a 'must have' for consumers. Indeed, these services have made spatial information mainstream, even fashionable!

Collaboration

Continuing the earlier NTICI discussion, in this resource constrained time the jurisdictional mapping agencies are now finding that they do not have the capacity to meet their data custodial responsibilities working alone. This has led to renewed interest for collaborative projects, thereby allowing scarce resources (people and funding) to be spread further. The NTICI collaboration has successfully applied a resilient whole of government approach to topographic data collection, integration, dissemination and delivery. NTICI has realised significant regions of new and revised topographic data. In some cases new datasets in areas previously devoid of GIS data have been created and, in other instances 30 year old information has been significantly improved in currency. GA has funded a considerable amount of these data capture and revision programs under NTICI, but it is a partnership – the State/Territory jurisdictions would not have had the ability to capture such data themes alone, and nor would GA.

Therefore, initiatives such as NTICI continue to be the most effective mechanism for maintaining and improving the investment that exists in Australia's topographic mapping. The greater the level of cooperation, the greater the potential for a coordinated approach to value-adding in the national spatial framework. However, this cooperation and coordination needs

to be efficient and effective, rather than a data maintenance burden. There is now an increasing reliance by all government mapping agencies on data produced out of this collaboration. With the expected continuation of this successful initiative, it is envisaged that, in time, data maintenance rather than base data capture will become the focus for mapping authorities across all scales and in all jurisdictions – and will resemble a distributed data sharing arrangement. Such an arrangement would have multiple benefits including: leveraging smart enabling technologies; improving turnaround times; consistent specifications; a continuing focus on maintenance of priority themes and areas; and integration of NTICI data into jurisdictional and GA databases as *single point of truth*.

Government

As a Commonwealth Agency, GA acts in accordance with the policies and guidelines of the current government. With regard to mapping, GA is mandated to *provide fundamental geographic information at a national scale in a form that facilitates Australian Government and community decision-making and industry development*.

Today's Australian Government is increasingly demanding more efficient and effective service delivery, policy monitoring and evaluation, underpinned by a strong evidence base to enable better informed decisions. It also sees the spatial environment becoming increasingly more valuable and relevant to government and the community, especially in the key areas of service delivery and providing information to the public. However, many Government agencies do not yet effectively use spatial data, technologies and services to support their business or policy evidence base. GA is recognised as the Australian Government's 'spatial agency' and the realisation of the benefits of spatial technologies is growing, bringing with it greater expectation that GA will be able to readily support and/or deliver on such technologies.

The last 2-3 years in particular have seen an increasing trend in requests to GA for the development of 'value-added' spatial product and service delivery (as opposed to just maps) by a diverse portfolio of government departments. These include agencies responsible for driving policy in the areas of water resources, climate change (adaptation and coastal vulnerability), social inclusion, energy (including renewables such as wind and solar), defence, health, transport, information management, emergency response/recovery, and now regional Australia. The majority of these outcomes are underpinned by fundamental spatial information, including topography-related themes. So what we are now seeing is a requirement for what has been traditional data to be much more intelligent and specific. Further, these same requirements are realising and growing data that is more detailed, authoritative, temporal and scaleable – bringing more richness with it.

Let me use our activities in managing Australia's water resources as an example to demonstrate the real shift from static paper-based maps to dynamic and intelligent fundamental digital data supporting decision making and policy development.

Example – Geofabric

The Australian Hydrological Geospatial Fabric (the Geofabric) is being developed by GA for the Bureau of Meteorology in partnership with the CSIRO and ANU. The Geofabric is a major input into the Australian Water Resources Information System (AWRIS), a requirement of the Water Act (2007).

Representing the modern, intelligent 'blue line' drainage network of Australia, the Geofabric is a single, consistent, national geospatial framework for hydrological features including catchment boundaries, streams, aquifers, floodplains, storages and wetlands – all linked to a 1" (30m resolution) national Digital Elevation Model (DEM) – and all delivered across the web. The Geofabric is an evolution in spatial data management and will become the enduring geospatial information framework for Australia's water information activities.

Achieved through collaborative and inclusive partnerships, the next phase of the Geofabric will be to evolve the current national 1:250K scale water features by integrating the best available scaled hydrology datasets, with the realities of implementation and maintenance across national, state, regional and local jurisdictions. This will take the data from some 2 million features to approximately 10 million features. In the process watercourses will have flow directions, connectors and network topology issues resolved within each of the 3 scales of data supplied across the continent. The net result will be the integration and networking of all 1:25K, 1:50K and 1:100K existing mapped watercourses and water bodies (man-made and natural) into a truly unified national single point of truth.

This activity not only represents an important opportunity for GA to significantly augment one of its fundamental topographic data themes, but to also strategically influence current and developing spatial strategies and maximise the Government's investment in spatial information. It also reinforces GA's evolution from a provider of spatial products to a provider of value-added and authoritative information and services for the Australian Government.

To summarise today (2011), we are entering a brave new world where there are an enormous number of unknowns which will continue to impact on us in the short to medium term. We frequently ask ourselves:

- What is the future of 'traditional' topographic mapping (if any)?
- What does 'topographic mapping' mean today? It is certainly not what it used to be.
- How will the emergence and delivery of scaleless databases impact on our work?
- How do we ensure that we anticipate and manage change in an appropriate way?
- What technology changes are likely to impact on our production methodologies?
- How will government changes (both in policy and program delivery) impact on our work?
- How will societal changes and expectations impact on our work – for example the demand for real time and customised mapping?
- What is our relationship to other players 'in this space' – eg Google, Bing, Yahoo?
- How will the ongoing skills shortage impact on our ability to undertake work?
- How does the spatial industry see our role and relevance?
- How do we ensure that we remain relevant to the thinking of the current government and position ourselves for future governments?

In these times of change we must ensure that the things we do are relevant and deliver the information that stakeholders and the community need, including the ever-increasing needs of the Australian Government. GA needs to move its work into a new generation of business. However, the shape of this business is not necessarily clear. While demand for fundamental topographic information will remain, the shape and construct of how it is generated and presented will evolve, commensurate with technology and acquisition techniques.

The geography of topography will also change. Future topographic mapping will require new sets of information attributes and themes to record and detect how society interacts with the natural earth environment, and how we measure and monitor the impact of that change over time. Examples of these new information demands we are experiencing already include:

- high resolution national Digital Surface and Elevation Models, rather than contour maps and spot heights;
- connected hydrological drainage networks that can model water flow across the landscape both in drought and flood, instead of river course or outlines of water bodies;
- data on the state of the land, such as the dynamic health and moisture of vegetation and soils;
- data to support climate change adaptation and coastal vulnerability analysis; and
- pre-competitive solar resource prospectivity data that may play an important role in the decision process for locating solar energy power generation investments. Mapping layers include digital elevation, proximity to energy infrastructure, land tenure, water sources and solar radiation datasets.

This modern topographic data will have the capacity to provide the underpinning thematic framework for many spatial questions, especially when carried out on time series basis. Such data and information will provide a rigorous evidence base to aid Australia's future development.

THE FUTURE

So what does the future state of topographic mapping in Australia look like and what will GA be doing in the mapping arena in five or ten year's time? There is no doubt our role will be markedly different when compared to recent history. GA's National Geographic Information Group (NGIG) will not just be delivering topographic mapping, although the topographic data will continue to form the underpinning building blocks. It will have significantly broadened its role and the value of spatial information to government and society. NGIG will be providing more of a 'geography solution' rather than being a niche mapping and data provider as it is now. Several factors, some emerging rapidly, dictate why this will be the case. I will address these from a high level rather than in detail, and geographic information more generally rather than topographic information specifically. In so doing, my aim is to provide a flavour of the shift that is taking place in our sector – and the significance and high level engagement from the Australian Government in that shift.

Global Directions

Thinking globally, there is now a tangible realisation that geography and spatial information underpins everything we do. Many countries and agencies are thinking about, or have released, high level national strategies to address contemporary spatial information issues and challenges, not just from the perspective of the provider of the solution or products, but also from the perspective of the user and their requirements. Interestingly 'spatial' or 'GIS' are not key terms used, but rather 'location' or 'place'. This is deliberate, as they are terms that are easier to understand by policy makers and the community, and because we need to focus on the issues and solutions rather than the technology. Key messages in all of these strategies is that everything happens somewhere, that location is the common element in major issues confronted by all governments, that location will be a major driver for decision making, and that location information is completely mobile, pervasive and ubiquitous.

Australian Government Policy & Leadership

From a national perspective, there is a maturing appreciation and integration of spatial components into government agencies and policy agendas, not traditionally influenced by spatial information – and this is gaining momentum. There have recently been a number of Australian Government information initiatives to establish a policy framework that facilitates greater coordination in government information sharing and management. These initiatives include: Australia's Gov 2.0 policy; the new FOI laws; the establishment of a new Office of the Australian Information Commissioner; and the National Government Information Sharing Strategy. All of which contribute to and re-enforce the approach espoused in the One APS Reform Agenda.

Each of these initiatives recognise that information held by Government is a national resource; that technology now enables Government to better analyse, use, maintain and disseminate information; and that the policies and practices on how Government does this must be modernised. The emerging commitment to regional Australia (in which the role of geography and 'localism' is fundamental), and the desire to share information across location based portfolios to inform evidence-based policy, provides a further opportunity to unlock information held in all government portfolios.

While this has realised measurable benefits in a number of areas, Government's considerable information holdings are often stored in many forms across individual agencies according to service delivery or policy responsibilities. The majority of this information does not have a spatial or consistent geographic reference, inhibiting easy discovery, access, integration and reuse. It has also evolved in a fragmented and inconsistent manner, with duplication of effort, and with no clear whole-of-government direction, ownership or policy.

To bridge the gap, in December 2010 the Secretaries Board of the Australian Public Service established the APS 200 Location Project. The project proposes a whole-of-government review in the creation, management, sharing, and utilisation of location information across departments and agencies of the Australian Government. In July 2011 the project will present a framework of options to address three critical areas: location information policy, governance, and investment. In doing so, it will address the future geographic and location information needs of Government. The project sponsors are Ms Glenys Beauchamp, Secretary of the Department of Regional Australia, Regional Development and Local Government, and Mr Drew Clarke, Secretary of the Department of Resources, Energy and Tourism. GA and Regional Australia are the responsible agencies for ensuring the successful delivery of this project.

Topographic Mapping - PCTI

With regard to the future of mapping with the State and Territory jurisdictions, a national workshop will be conducted immediately after this conference (30-31 March) with the members of PCTI to develop an endorsed strategic national spatial information roadmap and work plan out to 2015. It is envisaged that this roadmap is to be proactive in nature and should be included in all future PCTI meetings. The outcome should provide the vision and roadmap to achieve a coordinated, whole of government approach to the future development, maintenance and investment in spatial information – topographic information in the first instance. This vision and roadmap would be then put to the next ICSM meeting for endorsement and become the framework for future development of the national topographic infrastructure.

Without pre-empting the outcome of the national workshop I would suggest that by 2015, and through our collaborative efforts, we have access to a single, seamless, authoritative collection of fundamental spatial data themes that are at best available resolution, consistent and fully maintained. This success would largely be due to the deployment of an integrated, end-to-end spatial data supply chain: a single, streamlined and automated process that ingests data contributions from multiple sources, integrates them into a common, consistent schema, and from which multiple data products at multiple scales are generated and delivered.

Data as a Service – Providing Access to Content & Information

Change will continue to come from new technology – and data services in particular. These will continue to revolutionise how consumers access and use data in the foreseeable future. Many participants in both the public and private sectors are now producing on-line mapping and spatial data products which compete with the traditional markets dominated in the past by the mapping agencies. Everyday consumers can make their own maps, download and import data, customise their maps with personal information such as photographs and activity based information (such as favourite locations), and even decide colour schemes, styles, etc. Comparisons of maps or images over time can be done, with most of these applications free! This information can be readily shared in communities of interest or just amongst friends, all on interoperable, everyday technology.

Driven by the incredibly inventive private sector and consumer market, online data access will become the norm and whilst paper maps will not be relegated to history, many of the traditional applications for mapping and paper products will be surpassed by digital data and web applications that can be manipulated on everyday consumer equipment, such as mobile phones, i-applications, etc. These are really the tip of the iceberg in terms of future functionality as consumers manipulate and use spatial information. However, all these public applications are prefaced by advances in technology and novelty at the provider end – mapping agencies, GIS professionals and web content providers are encountering exponential growth in technology which naturally feeds capability. The ability to manipulate data is almost unlimited. It is conceivable that one day imagination might be the limiting factor!

The future map is not only paper, nor is it just digital, but it is also online distributed ‘in the cloud’ allowing those who use the maps to do so in any way that they like – changing the very essence of what a map is. Data is now being collected and shared by anyone at any time via social networks, so the map is also able to be a dynamic representation of this data. Very soon using maps on an iPhone will be easier than using the traditional paper map. After all, it is intelligent and you can ask questions of it.

Questions are still being raised about the data being produced in these new ways, particularly with regard to accuracy and potential problems (particularly legal and privacy) when data are combined in ways that are not anticipated when the original datasets are developed. For example, the emerging role of social media in the recent flood and cyclone disasters was more prevalent than in the past, especially in providing a source for localised information and supplementing emergency warning information delivered through the normally accepted mediums of radio and television. Keeping up to date following feeds on twitter was accepted. However, this did highlight some problems, particularly with regard to ‘rumours’ being circulated on what may or may not have been happening in reality. What it did emphasise was that those traditional authoritative and trusted sources of information should still be the reference point so that rumours do not ‘spin out of control’.

Although the vast majority of geographic data still comes from the reliable and traditional sources, including national mapping agencies, how long will this be the case? Social networks and social networking have no time or respect for cartography and the concept of reliable and maintained authoritative information. They will use data as they see fit for any purpose, relevant or not. Our challenge will be in how we allow the new generations to participate in mapping in a way that we all benefit. Unfortunately, governments and mapping agencies are nowhere near as nimble as this evolving medium. We are getting better at responding to the challenges and agility of some of the private sector players, including Google and others, but less so to other challenges such as the growing fields of volunteered geographic information and social media. This cannot be ignored and may require the formation of new partnerships rather than attempting to manage competitors. A major challenge will be to come up with new strategies and business models in line with these rapidly changing circumstances.

CONCLUSION

All national mapping agencies are increasingly faced with the challenge of how to deal with the growing use of spatial information as an organising mechanism by both government agencies and the private sector. On one hand we must accept that we will never catch up and be in step with the cutting edge of the private sector and the community's appetite for information in new and novel ways. However, on the other hand it is acknowledged that we do have a very important and specific role to play – to ensure that we are able to continue to provide the nationally important authoritative collection of fundamental spatial data themes that are at best available resolution, consistent and fully maintained for our nation's prosperity. To what level we do that is a little unknown, but it is being recognised that we, and governments, must do so. Of critical importance is the growing motivation and recognition of the need to provide the appropriate policy and governance mechanisms at the highest levels of Government to ensure an enduring sustainability of these valuable data themes. I will conclude this paper with such an example.

To support the APS 200 Location Project process described earlier in this paper, a review of the Australian Government's Spatial Data Capability is being undertaken at the request of Drew Clarke by Dr Vanessa Lawrence CB, Director General and Chief Executive of the Ordnance Survey - Great Britain's national mapping agency. On 7 March 2011 a high level national workshop was convened to hear industry's views on how the Australian Government's National Spatial Capability can be improved to meet their business needs.

Five keynote presentations were made; including by the Hon Martin Ferguson AM MP, Minister for Resources, Energy and Tourism. In his speech, Minister Ferguson offered the following:

"*In my view this [spatial information] sector is not an "optional extra", rather it is the means by which we will grow Australia's prosperity in coming decades. Spatial information will increasingly grease the wheels of Australia's economy, drive innovation and increase productivity."*

"Spatial information has never had so many positive applications. The continued development of this sector is pivotal to Australia's prosperity, innovation and productivity. That is the challenge, as is finding the solutions."

Things are changing. There is a realisation of the value and promise of what location information can provide. We are not there yet, but the window of opportunity is open. The barriers are breaking down and it is now up to us to make the most of it.