THE EVOLUTION OF ISPRS ACTIVITIES IN THE SPATIAL INFORMATION SCIENCES: DEVELOPMENTS IN SDI IN AUSTRALIA

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ABSTRACT:

This paper discusses the development of the spatial information sciences in ISPRS from its early beginnings in 1910 when its activities were directed to research, development, documentation and education in all aspects of data acquisition by photogrammetry its presentation and display, to the present broad range of activities covering data acquisition, data modelling, data base management including SDI, knowledge representation, and quality assessment of geographic data. The paper then describes the development of the SDI in Australia, which had its beginnings in the 1980s, to the establishment of a strong private sector, which is primarily responsible for further developments in the spatial information industry. The 'notional architecture', developed as part of the Spatial Interoperability Demonstration Project driven by the private sector, is an indication of the recent approach taken in the continued development of SDI in Australia.

1. INTRODUCTION – DEVELOPMENTS OF SDI IN ISPRS

ISPRS was formed in Vienna, Austria in 1910, as the International Society of Photogrammetry. Its aims were to develop international cooperation in all aspects of data acquisition by photogrammetry, its presentation and display. In the early days after its formation, the fledging Society was comprised of a handful of members from Europe, but as the science of photogrammetry developed more countries became involved. In the 1950s and 1960s, many of the theories in photogrammetry had been developed in Europe and North America, while methods of presentation of primarily paper map products, as well as procedures and policies in map production were also being studied. In those days, map products were indeed the spatial data infrastructure (SDI) of a country, and hence even in the early days of ISPRS, the Society was having a significant influence on the development of what was then the foundation of SDIs around the world. Of course, such procedures as interoperability that are available today were only addressed in a rudimentary way by paper map products but the needs for such procedures were well recognised. New technologies have led to the availability of the many facilities of current SDIs.

At the same time, topics covered by the Society were expanding beyond the metric aspects and applications of photography. 'Photo-interpretation' was included in the activities of the Society as Commission VII in 1948. Following the launch of the first Earth observation satellite in 1972 (coincidentally during the ISP Congress in Ottawa), then named ERTS and subsequently named Landsat1, the term Remote Sensing became established as a field of activity in ISPRS and elsewhere in the 1970s. As a consequence of this growth in the Society's activities in remote sensing, the General Assembly of ISP changed the name of the Society at the Congress in Hamburg, Germany in 1980 to The International Society for Photogrammetry and Remote Sensing.

Developments in the spatial sciences have led to further increases in the breadth of ISPRS activities. In 1990 an ad hoc Statutes and Bylaws Committee of ISPRS, chaired by the author, recommended that the acquisition of spatial data by photogrammetry and remote sensing could not be divorced from the subsequent processing and management of that data. It stated that 'recent developments in ISPRS however have seen it [i.e. the range of ISPRS activities] expand rapidly into a much wider range of topics, such as data acquisition, data modelling, data base management, knowledge representation, quality assessment of geographic data, and dynamic modelling'. The Committee further stated that 'the inclusion of the broad range of GIS topics in ISPRS [activities] is appropriate'. While this would lead to overlap between other professional societies, it was felt that they could 'not be logically divided up amongst these bodies, so that each body could work within its own narrow area'. Rather, it was essential that these bodies were allowed to develop in these areas, but to ensure that they worked more closely through appropriate coordination groups. Such coordinating bodies have and currently do exist, although they have been through some difficulty times.

The recommendations of this committee were a forerunner to modifications that occurred in the terms of reference of the ISPRS Technical Commissions in 1992. These terms of reference included a broad range of activities encompassing the acquisition of spatial data, as well as data modelling, data base management, knowledge representation, quality assessment of geographic data, and dynamic modelling. Further modifications to the terms of reference of the Technical Commissions took place from 1992-2000, which involved the inclusion of such topics as SDI, in Technical Commission IV - Spatial Information Systems and Digital Mapping. In the period from 2000-2004, SDI was studied by Working Group IV/4 and at the ISPRS Congress in Istanbul in July 2004, 10 papers were presented in Commission IV on this topic.

In 2003 the terms of reference of the Technical Commissions (see www.isprs.org) were again revised and a new Commission VIII was established to ensure that the three areas of activity of ISPRS, photogrammetry (Commissions III and V), remote sensing (Commissions VII and VIII) and spatial information sciences (Commissions II and IV) are adequately identified in each of the two technical commissions shown in parentheses. These changes continue the move to broaden the range of activities of ISPRS and they represent the direction in which ISPRS will develop for the next decade or so. The justification for the changes in 2003 were as follows:

The fundamental photogrammetric research and development (R&D) for exploring and resolving the geometric issues of imagery and the spectral/temporal aspects of imaged features is now raised to understanding, identifying, and modelling the complexities of images created from all parts of the electromagnetic spectrum, as well as the processing, analysis and management of spatial data derived from images. Advanced research strives for automating the detection, identification, correlation and extraction of spatial, spectral and temporal characteristics of imagery; modelling for high quality digital geometric restitution; and investigation of optimal representations and fusions of imaged and ancillary data for generalization, aggregation and structuring of data bases. The integration of the processes associated with the extraction of information from the images, its compilation into 3D spatial databases, and the subsequent processing, management and archiving of the information are important elements of the tasks of ISPRS that need to be reflected in the terms of reference of the Technical Commissions.

Given the historical developments of topics covered by ISPRS, it should be clear that it is very appropriate for ISPRS to be covering the topic of SDI in its current activities. It could be argued that it has always covered aspects of SDI, although they were presented in a much simpler hardcopy form. Over the past decade or so, some participants in ISPRS have lamented the apparent absence of mapping authorities in ISPRS. Hopefully the more comprehensive coverage of the topic of SDI in ISPRS will lead to once again their greater involvement in ISPRS activities. This workshop, which is covering advanced technology for SDI, value-added services operational applications of SDI and regional development of SDI, provides significant advancement in the activities of ISPRS in SDI, and the Chairs should be congratulated for taking this initiative.

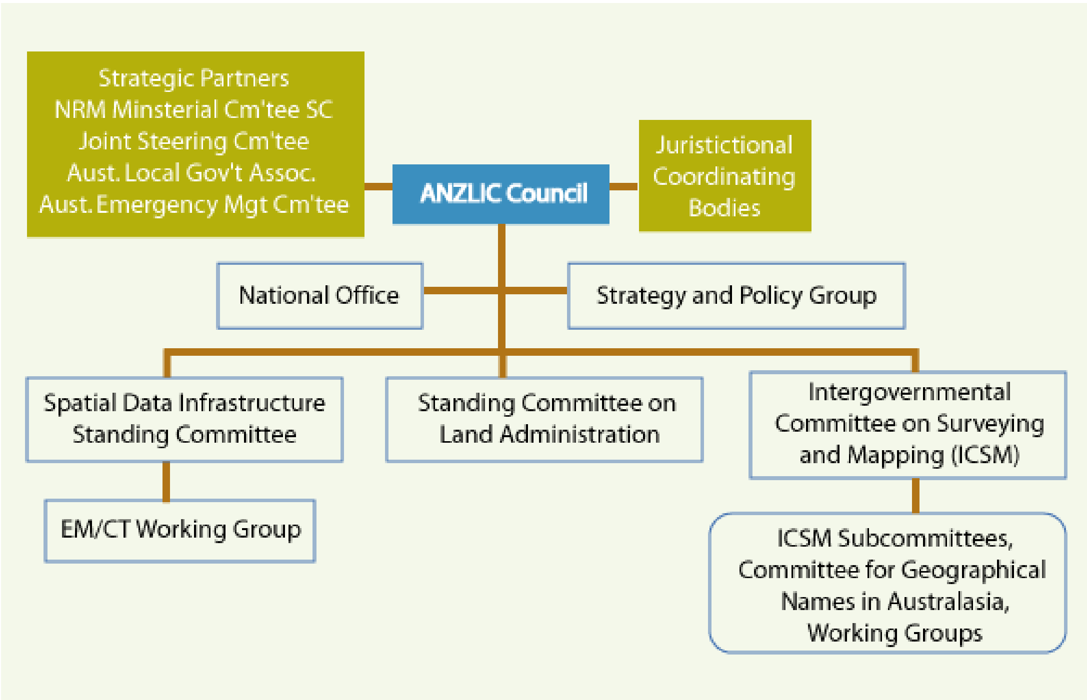

Figure 1.Structure of ANZLIC

2. SPATIAL DATA INFRASTRUCTURE IN AUSTRALIA

2.1 ANZLIC

Now turning to implementations of SDI, while there have been many examples of developments of SDI worldwide, the remainder of this paper will concentrate on SDI within Australia. ANZLIC (which derived its name from 'Australia and New Zealand Land Information Council'), and now know as the Spatial Information Council has oversight over The Australian Spatial Data Infrastructure (ASDI). It is the 'peak intergovernmental organization providing leadership in the collection, management and use of spatial information in Australia and New Zealand'. ANZLIC has existed in various forms since 1986, but it has become established as the major coordinating body for SDI in Australia and New Zealand. The ANZLIC web site (www.anzlic.org.au) states that it 'is developing nationally-agreed (in both Australia and New Zealand) policies and guidelines aimed at achieving "best practice" in spatial data management'. Within Australia, the major vehicle for improving access to data is the Australian Spatial Data Infrastructure (ASDI). The key role of ANZLIC is to promote accessibility to and usability of spatial information. It advises on standards, policies and land reform. Its structure is given in Figure 1, which demonstrates that it is a broadly represented coordinating body of all organisations associated with spatial data in Australia.

ANZLIC has prepared policies and guidelines aimed at assisting organisations to achieve 'best practice' in spatial data management, including:

- Guidelines for Custodianship of spatial data
- Policy Statement on Spatial Data Management
- Metadata protocol and standard metadata profile

- Guiding Principles for Spatial Data Access and Pricing Policy
- Privacy guidelines for spatial information
- Access to Sensitive Spatial Data

2.2 Current Areas of Importance of Spatial Information in Australia

The following examples taken from the ANZLIC web site demonstrate the increasing importance of spatial information and hence the ASDI.

2.2.1 Industry Growth: Growth of the spatial information industry is important to ensure that it can provide the diverse services to users of spatially related information. It was estimated in 2004 that in Australia, which has a population of about 20.1 million, the spatial information industry comprised over 4000 companies and generated AUD1.2 billion (about $US900,000). The growth is estimated to be over 10% per annum. Over recent years the spatial information industry in Australia has been rationalized. Five professional organizations in the areas of spatial information are in the process of forming the Spatial Sciences Institute (SSI). As well, the Spatial Information Action Agenda with the assistance of federal government funding led to the establishment of the Australian Spatial Information Business Association (ASIBA), the aims of which include:

- 'representing and promoting the interests of its members in political and industry arenas
- promoting the scope, applications and value of the spatial sciences to other industries, government and the community
- providing an avenue for cooperation between members and connectivity of the diverse disciplines which, together, constitute the Spatial Information Industry'

ASIBA is a major partner in the Spatial Interoperability Project, which will be referred to later.

2.2.2 Land Administration Reform: Land administration reform can encompass policy settings, information sources, transactional processes, regulatory regimes and administrative arrangements. Reform can have a number of outcomes, including improved customer services, more efficient operation of property markets and better decision-making. Reform can encompass the more traditional land interests or a broader range of property rights over other natural resources. Provision of comprehensive property rights information is seen by ANZLIC as a key deliverable.

There is evidence of an emerging demand for consistent information and transactional processes across jurisdictional boundaries. Potential users include financial institutions, property developers, bodies involved in social issues such as native title and (increasingly) national and regional natural resource conservation programs.

2.2.3 Natural Resource Management: The National Land and Water Resources Audit works with Australian Government, State and Territory agencies, regional natural resource management groups and community stakeholders through the Audit Advisory Council and the Land Water and Biodiversity Advisory Committee of the NRM Ministerial Council. ANZLIC and the National Land and Water Resources Audit have had a strategic relationship since the formation of the Audit in 1998. The result has been the application of ANZLIC policies and guidelines by the Audit and support for the ASDI concept in natural resources information management practices.

The Audit has published a report focusing on its findings related to availability, access and quality of natural resources information, called Australian Natural Resources Information 2002. The report discusses the development of Australia-wide natural resources information and demonstrates the benefits of a coordinated and integrated approach to the development of information products to support natural resources managers. It also highlights areas in which information must be better managed. The Audit's final report summarises the findings across all its activities. An important issue covered is the need for access to good data underpinned by nationally-agreed standards, guidelines and frameworks. There are a number of specific outcomes and actions identified for ANZLIC's review and reporting role, including:

1. Ensure that users can find out whether suitable natural resources data exist by reviewing the Australian Spatial Data Directory and improving the quality and availability of metadata.

2. Ensure that government, industry and the community can easily obtain natural resource data by removing inhibitions to use and improving availability of data.

3. Ensure that natural resource data are comparable and consistent by providing audits on the progress of fundamental Australia-wide data sets in meeting guidelines developed for the Australian Spatial Data Infrastructure and recommending improvements.

4. Identifying opportunities for cooperation to avoid duplication and maximise benefits of investment in collection of natural resource data.

2.2.4 Emergency Management and National Security: ANZLIC is contributing to Australia's emergency management and national security capability through coordinating spatial information across all jurisdictions to meet user needs. An 'all-hazards' approach means that the measures put in place will be used to minimise the risks of hazards to the public from natural disasters (e.g. earthquakes and bushfires) and terrorist acts. Spatial information can be used to prevent, prepare for, respond to and recover from emergency events. ANZLIC is working with the Australian Emergency Management Committee to identify common national issues. Recent world events have sparked an increased interest in national security issues which have raised the need for risk assessment and critical infrastructure protection. National security is emerging as the key driver for ANZLIC initiatives such as the Australian Spatial Data Infrastructure. The issue provides a compelling argument for cooperation between agencies to collate spatial data and GIS capacity in order to maintain a state of preparedness.

2.2.5 Local government: All levels of government recognise the need to share spatial data in order to save time and money on data collection and management. Flows of data between local governments, state and national government agencies are no longer a luxury, they are a necessity in areas such as planning, environmental management and community safety. Benefits include reduced duplication of effort within local governments and reduced time and transaction costs for the community. All levels of government and business enterprises have or are developing services and products using spatial information. Applications span the full range of local government functions. Sharing application development and experience is needed to increase timeliness of installation and decrease development costs for local governments, given their common needs in this area. It is necessary to break down barriers and build capacity to access and use spatial information resources needed by local governments: people, data and technology. This requires common policies, strategies and programs and involvement of local government in development of spatial data infrastructure elements at local level. The key resources needed include:

- Advice based on experience and best practice
- Sustainable expertise at local level
- Good quality and current data fit for local use
- Investment funds for building local capacity
- Increased cooperation and reduced duplication of effort, both between local governments and with State and national government agencies
- Cementing relationships between levels of government at both formal and informal levels.
- Providing local government input to national and State/Territory spatial information initiatives with local impacts.

3. THE SPATIAL INTEROPERABILITY PROJECT (SIDP)

The establishment of a firm foundation for the private sector in spatial information industry in Australia has provided the basis for new developments in SDI. The Spatial Interoperability Project (SIDP) is a collaborative initiative between the ASIBA, OGC-A with federal government funding from AusIndustry Innovation Access Program, and additional in-kind support provided by private sector companies and government agencies. By including these end-user communities, SIDP has demonstrated that spatial interoperability is real and can help solve real-world problems. An essential aspect of an efficient sharing of spatial information is clearly interoperability.

Aims and objectives of SIDP are to add real value to the end user community and work with end-user organisations in the sectors of:

- Emergency Management
- Insurance
- Utilities

Interoperability is defined as the ability to:

- Link business processes across organisational lines and cost-effectively share information resources
- Find data, information and processing tools no matter where they are physically located
- Understand and employ the discovered information and tools, no matter what type of computer system is being used, whether local or remote.

Specific outcomes of interoperability for the user, government and industry communities are:

- Demonstrator scenarios that meet real user needs
- The foundation of an on-demand spatial information infrastructure
- Training, documentation and skills development

Scenario Story Books have been developed for the topics of Incident Notification - Infrastructure planning, Bushfire Response and Insurance Risk Management and Recovery. A 'notional architecture' has been produced based on contributions from a number of spatial information experts, which 'provides the foundation and proof-of-concept of a spatial information solution for tracking, monitoring, identifying and responding to business opportunities and service delivery challenges for sustainable communication with, and planning and protection of, our communities'.

The SIDP Notional Architecture Volume 1 Vol.1-3 states that:

- It must accommodate transactions between users and services being conducted by web agents, mediated through the Internet
- Users and agents have rules dictating their authority to access specific content and services. Authentication rules have been established according to services' access policies, and there is an accounting of the amount and type of services that are used
- Applications should provide transactional interfaces to users' agents, whether via 'thin' (browsers) or 'thick' (remote processes such as desktop GIS) clients, to specify required actions and to receive results
- Descriptions of services and content (metadata) provide for interrogation so as to allow dynamic discovery and in the case of services, provide detailed interface specifications that allow agents to adhere to the described service
- Means should be available for accessing data stored in repositories
- It should perform a variety of geographic processes including reprojection, subsampling, analysis, comparison and amalgamation
- It should include operational data repositories which collectively provide storage, modification and access to spatial data, geo-linked data, metadata descriptions, policy and authority
- It should include specifications, and user accounts.

The full details of the notional architecture are available on the SIDP web site at http://www.sidp.com.au.

4. SUMMARY

In summary, while the ASDI has been developing for about 20 years, the recent developments of ASIBA and SIDP are being driven by the private sector. With the assistance of government funding the notional architecture is providing the foundation for the future of SDI in Australia.

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