The Australian Spatial Data Infrastructure (ASDI) And The Geocentric Datum Of Australia (GDA)

A Nairn, S. Blake & K. Zammit
Spatial Data Infrastructure Program
AUSLIG, PO Box 2, Belconnen, ACT, 2616

INDEX

ABSTRACT

An Australian Spatial Data Infrastructure (ASDI) aims to ensure that current and accurate geospatial information will be readily available to contribute to both local and national economic and social development, and informed environmental management. The ASDI will provide the strategic directions for furthering the focussed implementation of freely available common on-line data management tools, the inter-agency agreements required to establish a distributed series of Nodes and the establishment of responsible agencies for clearly defined fundamental datasets. AUSLIG is the responsible agency for the management and implementation of the ASDI on behalf of the Commonwealth and has developed a draft ASDI implementation strategy. This draft was completed in late 1998 in preparation for further consultation with stakeholders from all jurisdictions and industry. The aim of these consultations are to further co-align the ASDI with the existing Commonwealth and State/Territory SDI implementation initiatives. Industry groups too are being involved as a priority, as one of the main aims of the ASDI is to further build an Australian spatial data industry. Many of the underlying principles of the ASDI have previously been defined by both the Australia New Zealand Land Information Council (ANZLIC) and the Commonwealth Spatial Data Committee (CSDC). The draft ASDI Implementation Strategy attempts to further crystallise these views in terms of a specific work program phased over the next few years. The underlying principles, projected milestones and suggested timings for the implementation of the ASDI over several clearly defined phases are outlined in the draft plan. The specific ASDI technical goal is to establish an ASDI Spatial Data Clearinghouse using common standards and software modules that are developed in an incremental way. The perceived essential precursors to further ASDI module implementation include: a distributed on-line metadata directory (the Australian Spatial Data Directory has already been released); a clear definition of fundamental datasets; an awareness of, and involvement in, the ISO TC211 and Open GIS activities; and the early adoption of the Geocentric Datum of Australia (GDA). GDA results from an international trend to adopt a geocentric datum. The move will make mapping and spatial data coordinates compatible with satellite based coordinates, providing a single reference framework for collecting,

storing and applying spatial data at local, national and international levels. The Intergovernmental Committee on Surveying and Mapping (ICSM) has adopted the GDA, which will be progressively implemented Australia wide.

INTRODUCTION

The ASDI will provide better access to essential geographic information of Australia to government, the private sector and the broader community. This increased accessibility is necessary to improve decision-making in such areas as environmental assessment, natural resources management, socio-economic studies and physical infrastructure development such as mobile communications networks, roads, railways, power grids and airports. Australia's national mapping agency, AUSLIG, is the focal point at federal level for the development and implementation of the ASDI. AUSLIG is the Commonwealth Government's primary source of advice on spatial information matters. Its role is to ensure that fundamental spatial information is available for the benefit of both Australian and international communities. It is recognised that no single organisation can build the ASDI and that a collaborative effort is essential to its success. The Commonwealth Spatial Data Committee, a forum of Commonwealth agencies with interests in land information issues, serves an important coordination role at Commonwealth level in this regard. Australia's peak forum on land information matters, the Australia New Zealand Land Information Council ensures effective collaboration between Commonwealth, State and Territory governments. AUSLIG has now developed a draft ASDI implementation strategy. This draft was completed in late 1998 in preparation for further consultation with data/information managers from all jurisdictions and industry. This paper will outline key elements of the draft ASDI implementation strategy and provide further information on a number of initiatives which have recently been announced.

ASDI RECURRENT THEMES

The ASDI has a number of recurrent themes that apply. These themes need to be considered when specific projects or initiatives are being developed. The recurrent themes include:

- Interoperability;
- Building partnerships;
- Identification and use of recognised standards;
- Leveraging technology;
- Utilizing public domain software where possible for the basic ASDI building blocks. Commercial software is also appropriate where it is compatible and uses open standards;
- Recognising the principle that databases will be maintained by a recognised custodian/ responsible agencies;
- The ASDI clearinghouse should adopt a distributed database model where custodians manage their own data;
- The ASDI should be compatible where possible with the emerging Global Spatial Data Infrastructure (GSDI).

CURRENT ASDI INITIATIVES

The ASDI Implementation Plan contains a number if discrete but inter-related elements. The key elements of the plan are described in more detail below. It is envisaged that the detailed implementation plan will be available after CSDC endorsement in the near future.

1. ALIGNMENT OF ASDI AND NLWRA ACTIVITIES

The NLWRA has been established by the Commonwealth as a program of the Natural Heritage Trust. The purpose of the NLWRA is to provide an independent, comprehensive nationwide appraisal of Australia's natural resources. It is due to complete its term in June 2001. According to an Industry Commission statement published in September 1997 much of the data collected in Australia relating to the physical condition of natural resources lacks comparability and uniformity. Lack of comparability means no meaningful comparison is possible between different land management practices and this significantly reduces the usefulness of the information collected. The Audit has indicated its strong support of the ASDI. An effective ASDI will greatly assist the Audit in developing a national information system for land, water and vegetation data that will continue after the Audit's operations

cease in June 2001. The Audit's Framework Database and Atlas projects closely parallel the Fundamental Datasets and Distribution Network components of the ASDI program and the ASDD. The Audit and AUSLIG have developed an MOU to harmonise work programs and provide efficiencies to each party and avoid unnecessary duplication of effort as well as providing a coordinated approach to the State and Territory governments. Stage 1 of the Audit's Atlas project involves establishing Commonwealth nodes of the Atlas and is due for completion in June 1999. Stage 2 is being developed to extend the on-line mapping nodes to the State and Territory Jurisdictions. Other data access, on-line mapping software (node) development and data management agreements have already been put into place by the Audit. The Audit process (combined with the Australian Coastal Atlas Project, being led by Environment Australia) should therefore assist with:

- definition of *fundamental* datasets;
- provide the road map for implementing a series of distributed nodes;
- identify shortcomings of, and improvements in, the ASDI Implementation Plan.

2. A CONCEPT ARCHITECTURE FOR THE ASDI CLEARINGHOUSE

Many agencies and jurisdictions are in the initial stages of developing on line services. An objective of the ASDI is to ensure that there is a high degree of standardisation so that user's have access to comparable data held by various custodians. In order to promote consistency of the various Clearinghouse implementations being developed in various jurisdictions and to be provide a blueprint for a Commonwealth implementation over the short and medium terms, AUSLIG has commissioned the CSIRO Centre for Mathematical and Information Sciences to develop a concept architecture for the ASDI clearinghouse. The consultancy will:

- Identify best practice for SDI Clearinghouses based on a review of online data access services being developed by Commonwealth, State and Territory governments and by the Federal Geographic Data Committee (FGDC) and the Open GIS Consortium in the United States;
- Specify a modular approach that can be progressively implemented for the Clearinghouse including identifying the standards, technologies and protocols recommended for each module;

It is envisaged that modules will incorporate the following functionality: Exploring - Discovery

- Metadata distributed via linked Z39.50 Jurisdictional & Thematic directories/ servers i.e. The Australian Spatial Data Directory;
- Stand alone image and browse graphics embedded into the metadata records;

Data Download & E-Commerce

- Customised data retrieval and download facilities, incorporating on-line licensing;
- Data transfer on-line via the options of several formats and several permission levels (including on-line data licensing) from the directories (e.g. The QLD Data Exchange Web (DEW) System);
- E-commerce tool for agencies who have to undertake cost-recovery;

Online Mapping

- Interactive mapping serving images and vectors on the fly (online mapping e.g. Environment Australia Australian Coastal Atlas and National Pollutant Inventory solutions, NSW ICMISS, ACTMAP online, Victorian GIConnections);
- Automatic layer/scale selection and service thresholds;
- Map symbolisation and on-line cartographic standards for rendering;
- Linking the metadata directories to the on-line mapping tools;
- Links to documents and textual information from both the metadata and the on-line maps;
- Thesaurus and gazetteer function;
- Feature query and attribute retrieval;
- Customised front-ends pending user access level requirements/ profiles;
- Visualisation tools suites;
- Real - time incorporation of spatial data from the Clearinghouse directly into the client's GIS software/ project.

CSIRO will conduct meetings with key spatial data Clearinghouse developers and stakeholders as identified by AUSLIG. The following groups will be included in the consultation: ERIN; AGSO; BRS; ABS; Murray Darling River Commission, ICMIS (NSW), InfoShop (SA), OpenGIS Consortium. It is

anticipated that a report will be available in June 1999.

3. AUSTRALIAN SPATIAL DATA DIRECTORY

The Australian Spatial Data Directory (ASDD) will be supported as a major ASDI activity again in 1999. The ASDD is considered the cornerstone of the ASDI Spatial Data Clearinghouse. The ASDD was officially launched in November 1998 at the GSDI Conference in Canberra. 20,000 metadata entries now exist from approximately 14 nodes to the directory. An "incubator node" is still being maintained by the Bureau of Rural Sciences (BRS) on behalf of those agencies who as yet do not have the skills and/or resources to house their own node. A continuing feature will be the close integration of ANZLIC Metadata Working Group (AMWG) and ASDD National Coordination Group. The ASDD National Coordination Group (AUSLIG, ERIN & BRS) are operating a three part "ASDD Implementation" Consultancy in 1999 to assist State and Territory jurisdictions to develop their own ASDD node. The skills and knowledge to establish agency stand-alone node will be made available to all the CSDC member agencies. There will be efforts in 1999 to increase the amount and the quality of Commonwealth metadata held on the ASDD, both through the BRS incubator node and also through agency stand-alone nodes. Efforts will also be made to build the thematic Marine and Coastal Data Directory of Australia (Blue Pages) into the ASDD while retaining its unique identity. Moves towards the updating of the "ANZLIC Metadata Guidelines" by the AMWG will be supported, as will the overall push towards the adoption of the ISO TC211-15 Metadata Standard.

4. THE AUSTRALIAN OpenGIS WWW MAPPING CONSORTIUM

The definition of the term Clearinghouse has historically remained ambiguous, however the overall premise is that the user can enter the ASDI Spatial Data Clearinghouse for Enquiry, Search, Discovery, Viewing, Visualisation & Retrieval of spatial data. Web Mapping is included in the ASDI Clearinghouse definition to assist with data viewing and visualisation. It provides users with the ability to gain a better understanding of the data before needing to purchase it. AUSLIG has established a consortium, comprising 24 industry groups and Government agencies to work in partnership with the main international driver on web mapping, the US-based Open GIS Consortium (OGC). The partnership with OGC gives Australian Consortium members a range of benefits, including the opportunity to provide direct input on user requirements and the technical development of web mapping at an international level. Membership of the OGC will ensure Australia's involvement in the development and testing of a new international specification for web mapping. Although web mapping is already possible in Australia, the implementation of an international standard will allow the integration of existing web mapping systems and vastly improve access to distributed datasets by a wider range of users. As a test site for the specification, Australian industry groups will have early warning of emerging technologies required to meet the standard, giving them a competitive advantage in their strategic planning during a time of rapid technological change.

5. ASDI PARTNERSHIPS PROGRAM

One of the imperatives in the development of The Australian Spatial Data Infrastructure is opening up access to data that is currently not well publicised. It is also to develop some practical projects that can be undertaken to improve the knowledge of and benefits of the ASDI. The ASDI Partnerships Program has been instigated by AUSLIG this year. The main aim of the 1999 ASDI Partnerships Program is the outreach to agencies and agency groupings to assist their building accurate, accessible and timely spatial data information holdings utilising existing data and coordination mechanisms. Groups could include:

- Industry Groups;
- University consortia;
- CRC's;
- Industry R&D Programs;
- R&D Corporations;
- Local Government Groupings

A strong interface with a relevant government authority is also desirable. Main Goals of the 1999 ASDI Partnerships Program The goals of the ASDI Partnerships Program include:

- Increasing the overall awareness and understanding of the vision, concepts, and benefits of the ASDI;

- Developing common inter-operable solutions for discovery, access and use of geospatial data in response to industry, environmental and socio-cultural needs;
- Using consortia and partnership-based approaches to develop and maintain common collections of geospatial data for informed decision making;
- Building relationships between organisations from all spheres of government, non government authorities and industry sectors to support the continuing development of the ASDI;
- Assisting AUSLIG with developing both the business and guiding principles of the ASDI.

6. ASDI COMPLIANCE TESTING

During 1998, ANZLIC developed a draft Compliance model for use in the evaluation of datasets to determine if they can be deemed "ASDI Compliant". CSDC has since taken this model, enhanced it and used it to evaluate 6 Commonwealth Datasets as a pilot project. The compliance testing pilot has proved to be a valuable tool in the standardisation of fundamental data management. Compliance audit teams consist of a representative from the data custodian agency, a subject matter specialist and an audit consistency representative to ensure that audits are undertaken to a similar standard. The draft compliance model used in the evaluation to date is given below. In this case ACRES TM data has been evaluated.

ASDI Compliance Rating

To be ASDI compliant, the dataset must be rated as compliant against each of the 7 criteria. The ratings used are either:

Not yet compliant	The dataset does not yet comply with this criteria
Compliant	The dataset complies with criteria.

Data Description

Dataset	Title	LANDSAT Thematic Mapper data.
	Custodian	Australian Surveying and Land Information Group (AUSLIG)
	Jurisdiction	Australia
Description	Abstract	The LANDSAT satellites are polar orbiting remote sensing satellites that capture the synoptic views of earth surface from an altitude of 705 km, once in every 16 days. LANDSAT 5 launched in 1984, carries a high spatial resolution (30m) sensor called Thematic Mapper (TM) which records data in 7 spectral bands covering visible, near infrared, short wave infrared and thermal infrared regions of the electromagnetic spectrum. A full scene TM imagery covers an area of about 185 kilometers by 172 kilometers. ACRES has been archiving this data from September 1987 onwards.
	Geographic extent	Australia

Compliance Assessment

ACRES is quality accredited under AS/NZS ISO 9002.
Well defined QA system is in place and all the processed products go through a QA check before they are sent to the customer.
QA documentation and certification viewed at audit.

Element	Details	Rating
1. Format	Digital, raster data in archive format. (This is an industry standard for raw data	C
2. Metadata	Complete & meaningful metadata for all ANZLIC page 0 elements is available on ASDD. Metadata meets ANZLIC requirements and contains some additional Page 1 information. Resolution is included.	C

3. Standards	Processed TM data sets are provided in the industry standard formats (CCRS format, EOSAT fast format) and can be read by the majority of the IP software packages. Comprehensive technical documentation on data formats is available on ACRES web site. Processed data sets (level 10) are GDA compliant.	C
4. Content/Extent	Repetitive coverage of entire Australia is available.	C
5. Access arrangements	Well developed distribution arrangements in place for accessing data. Conditions of use and pricing, licensing policies are well documented (price lists and data characteristics brochures viewed at audit). Have standard data transfer formats which are accepted by most of the vendor software packages.	C
6. Custodian	Australian Surveying and Land Information Group (AUSLIG)	C
7. Quality Assurance	C	

Summary comments and recommendations

This data set fully complies against each criterion.

Compliance Result

The LANDSAT Thematic Mapper dataset is ASDI compliant.

GEOCENTRIC DATUM OF AUSTRALIA

The establishment of the GDA is another cornerstone of the Australian Spatial Data Infrastructure. The GDA will provide a single reference framework for collecting, storing and applying spatial data at local, national and international levels. This single framework facilitates interchange of data between various geographic information applications. GDA provides compatibility with GPS measurements allowing for the direct input of GPS field data into datasets from other GPS surveys and mapping datasets and geographic information systems produced on a geocentric datum. GDA also eliminates the need for GPS users to have an understanding of datum and transformations and results in more efficient utilisation of resources and reduces overheads. Before 1966 there were many different astronomically determined datum, mainly using the Clarke 1858 ellipsoid. In 1966 the first National datum was established (the Australian Geodetic Datum - AGD), using the Australian National Spheroid (ANS) and Johnston Geodetic station as the origin. This origin was still essentially astronomically determined. AGD was a best fit of the Australian region, with its centre offset from the earth's centre of mass. This was not only adequate for Australia; it was undoubtedly the best approach at the time. Geodetic coordinates on this system (latitude & longitude) are known as AGD66 coordinates and the Universal Transverse Mercator (UTM) grid coordinates are known as Australian Map Grid 1966 (AMG66) coordinates. In 1984 additional observations and improved computing techniques were used to upgrade the AGD & AMG coordinates. These are known as AGD84 and AMG84 coordinates, and are still based on the AGD. In 1984, when adopting the AGD84 coordinate set, ICSM recognised that a geocentric datum was always inevitable due to global forces. This was reinforced in 1988 when ICSM recommended that Australia adopt a geocentric datum by 2000. In 1994 a new datum was established - the GDA. The AGD and GDA are two different mathematical models of the shape of the Earth. Each has a different origin and subsequently a point on the Earth's surface will have different coordinates based on each datum. While features on the ground will not change, coordinates will shift approximately 200m in a north easterly direction, between AGD and GDA. The magnitude and the orientation of the shift can vary across Australia by 10-15 metres and a few degrees respectively.

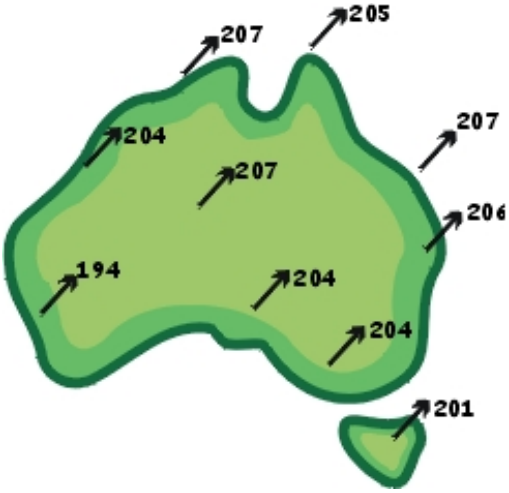

Figure 1 : The approximate differences between the AGD & the GDA across Australia.

COORDINATION OF GDA IMPLEMENTATION

ICSM ACTIVITIES

The Intergovernmental Committee on Surveying and Mapping (ICSM) recognises that changing the nations datum is a complex task and assistance will be required in a lot of areas. AUSLIG provides both an Executive Officer and GDA Promotion Officer to support ICSM. ICSM has focused its activities on the following areas:

Industry Briefings:
ICSM and other State and Territory representatives will provide briefings to industry at workshops and seminars up to 2000. On average there would be more than one workshop per week around Australia.

Educational Material:
ICSM will be publishing material on a regular basis in popular industry publications and will be encouraging the education industry in Australia to include GDA implementation as part of its education programs. ICSM has set up a GDA Promotions Working Group. The working group has a representative from each State & Territory of Australia and a representative from New Zealand. The initial task of the Working Group has been to develop an integrated promotion and education campaign between all jurisdictions. Contact Ms Kelley Zammit (email: icsmgda@auslig.gov.au, Ph: 02 6201 4357) if you wish to know more about the GDA Promotions Working Group.

Software Development:
ICSM is encouraging GIS and GPS software companies to incorporate the necessary transformation routines in their products. When purchasing GIS and GPS products, organisations are encouraged to specify that the product must be at least GDA compatible. Likewise we are encouraging vendors to provide users with technical information on how their product complies with GDA.

On-line support through the World Wide Web:
The GDA web site contains detailed technical information about GDA and implementation issues, links to other jurisdictional sites and a GDA news bulletin and more.

GDA Technical Manual
The GDA Technical Manual is a valuable reference available on the World Wide Web. The GDA Technical Manual contains computation explanations, transformation parameters and test data. The GDA Technical Manual can be viewed on screen or downloaded. However, revisions made to the documents on the web may be missed if you do not check the web pages regularly. In time, this manual will be produced as Adobe PDF format, for easy downloading and printing.

The national framework for GDA is already in place and processes to transform from the old AGD system to the new GDA are available. GDA products are already being produced.. ICSM is endeavouring to provide information to assist with the transition.

STATUS OF IMPLEMENTATION OF THE GDA

All the Australian States and Territories have GDA implementation strategies and are at various stages. The jurisdictions that have strategic plans on their World Wide Web sites are provided below for your information.

Commonwealth

ARMY and NAVY mapping agencies due to international obligations use WGS84, which is compatible with and can be considered (for most practical purposes) the same as GDA94. Airservices Australia have already reproduced all aeronautical charts on WGS84 to meet a January 1998 International obligation. Australian Surveying and Land Information Group (AUSLIG) has prepared and posted its GDA - Draft AUSLIG Implementation Statement on the Internet, Australian Geological Survey Organisation (AGSO) Environment Australia discussion paper for their wider portfolio responsibilities

Australian Capital Territory:
The ACT has posted GDA information

New South Wales:
The Surveyor-General's Department in NSW has posted GDA information at http://www.lic.gov.au/gda/

Northern Territory:
The GDA94 will be the primary geodetic datum in use from 1 January 2000. The spatial referencing system of the Northern Territory Land Information System was moved to GDA about a year ago. All base cadastral and large scale topographic mapping is already on GDA. Geographical information systems operated by utilities and land resource agencies are still on AGD66 and plan to GDA.

Queensland:
In Queensland, the Department of Natural Resources is committed to adopting GDA by 1 January 2000. It is expected that a large portion of spatial information users will adopt GDA within the following twelve months. The Department is optimistic that all its data sets and a large portion of State Government data sets will be converted to GDA around 1 January 2000.

South Australia:
Detailed documentation of the South Australia GDA implementation is on the World Wide Web

Victoria:
Detailed documentation of the Victorian GDA implementation and lots more is on the web

Western Australia:
Detailed documentation of the WA GDA implementation

GDA & THE MINING SECTOR

The mining sector has spent some time considering how the move to GDA will effect the mining and exploration leases across the country, both onshore and offshore. In the past most onshore leases have been described using even latitude and longitude divisions. With the move to GDA the descriptions will change, no longer being on even latitude and longitude. Each jurisdiction is looking at how to manage the shift with some help from the Australian and New Zealand Minerals and Energy Council (ANZMEC).

Petroleum Leases

Onshore: Overall, jurisdictions will have various transitional arrangements, as well as provisions to deal with the gaps and overlaps in leases/titles according to their respective circumstances. Offshore: Because of the number and duration of offshore petroleum titles (up to many decades), the Commonwealth will continue to use the existing grid relabelled with coordinates generated by GDA94. Most States and the Northern Territory will align their implementation of GDA94 in State and Territory offshore areas with the Commonwealth's position.

Minerals

Onshore: From year 2000, all new onshore minerals titles will conform with the GDA 94 (either by blocks or description of points). Current licences retain existing location, and with some exceptions, be redescribed according to GDA 94. All jurisdictions will have various legislative transitional arrangements, as well as provisions to deal with the gaps and overlaps according to their respective circumstances. Offshore: There are only a small number of offshore mineral leases in Australia. From year 2000, all new offshore mineral titles be allocated in accordance with the new GDA 94 one minute

block numbering system. Current licences retain existing location under legislative transitional provisions and be relabelled accordingly (because of their short life, these expected to disappear fairly quickly). In particular, in Northern Territory, there are the Mining Act and Petroleum Act which legislate licences, leases and claims for Mineral and Petroleum exploration and extraction. Exploration licences and three forms of petroleum tenure are defined under legislation in terms of blocks or graticular sections of latitude and longitude. Exploration licence blocks are 1 minute x 1 minute and petroleum blocks are 5 minute x 5 minute. The datum is not defined in the legislation. The datum in use at the time the Acts were proclaimed was AGD66 so by default this must be the legal datum. The Department of Mines and Energy (NT) proposes to adopt GDA for the definition of Exploration licences. Exploration licences are currently issued for five years. Legislation will be amended such that new Exploration licences will be defined in terms of GDA94. The change to GDA will have no major impact on other types of mining tenements. Mineral Leases and Extractive Mineral Leases are part of the cadastral survey system and are thus surveyed in accordance with the Licensed Surveyors Act. Boundaries are defined by marks on the ground and not coordinates. However, there are plans to compute survey accurate GDA coordinates as part of the cadastral coordination program. Mineral claims and Extractive Mineral Permits are pegged on the ground from a datum post which is referenced to a trig station (ideally) or a prominent topographic feature shown on a map sheet. These surveys are not required to be highly accurate. Boundary locations are recorded on AGD66 topographic map sheets. The shift to GDA will occur as GDA94 sheets replace AGD66 map sheets. In Western Australia, the Department of Minerals and Energy (DME) have recently adopted a GDA strategy to include the effect of GDA on Petroleum Leases and Mining Tenements, both offshore and onshore. The strategy deals with the two separately as:

1. Mining Tenements are covered by State legislation whereas Petroleum Leases are controlled by State(s) and Commonwealth legislation; and
2. Petroleum Leases are typically held for much longer periods than Mining Tenements

Petroleum Permits defined by 5'x5' graticules will continue to be defined in AGD coordinates after the year 2000. However all plans and graphics of Petroleum Permits will be referenced to GDA94. All Mining Exploration Leases currently based on 1'x1' graticule refer to AGD84. The DME have proposed that commencing 4th December 2000 all new Mining Licences will be based on a GDA. The Australian and New Zealand Minerals and Energy Council are investigating the implementation and legislative options within the various jurisdictions, and are preparing a discussion paper. For more information on the GDA

CONCLUSION

The ASDI clearly offers the potential of making better quality geographic information available. Many current Commonwealth and State Government initiatives are contributing towards the ASDI and a coordinated approach is required to ensure consistency. AUSLIG's support for coordination bodies, development of fundamental data and contribution to the creation of the Australian Spatial Data Directory is providing an impetus for the ASDI development. The GDA will provide a consistent framework for collecting, storing and applying spatial data at local, national and international levels. While posing some immediate challenges it will have a longer term benefit to Australia.

ACKNOWLEDGEMENTS

Some of the documents referred to in this paper were not publicly available at the time of writing. The author. acknowledges the work done by ANZLIC, ICSM and CSDC members in contributing to the ASDI development.

REFERENCES

Industry Commission, (1997), Ecologically Sustainable Land Management, draft report.
URL: http://www.indcom.gov.au/inquiry/eslm/draft/index.html Nairn A. and Irwin B 1997, The Australian Spatial Data Infrastructure: Its current Status and Future Directions, Cartography (Journal of the Mapping Sciences Institute, Australia)
June 1997, Volume 26, Number 1 Commonwealth Spatial Data Committee, Draft Commonwealth Position Paper on the ASDI.
URL http://www.auslig.gov.au/pipc/csdc/sdi4.htm Australia New Zealand Land Information Council, (1995), Australian Land and Geographic Data Infrastructure Benefit Study, Australian Government Publishing Service, Canberra.

URL http://www.anzlic.org.au/ The Information Industries Taskforce, (July 1997), The Global Information Economy, The Way Ahead. Commonwealth of Australia. Environment Australia, Australian Spatial Data Directory home page (accessed March 1999)
http://www.environment.gov.au/database/metadata/asdd/ AUSLIG, ASDI home page (accessed March 1999)
URL http://www.auslig.gov.au/pipc/asdi/asdihome.htm Intergovernmental Committee on Surveying and Mapping, 1997, Know Where You Stand With GDA.ICSM Publication. Steed, J., 1995, The Geocentric Datum Of Australia
Surveying World (Journal for Land, Engineering and Hydrographic Survey)
November 1995, Volume 4, Issue1, pages 14-17. Malays S., Slater J., Smith R.W., Kunz L.E., Kenyon S.C. (1997)
Refinements to the World Geodetic System 1984, Proceedings of the 10th International Technical meeting of the Satellite Division of the Institute of Navigation, September 16-19, 1997, Kansas City, Missouri, USA. Menzies, R., 1998. The Geocentric Datum of Australia - What it means for you, Proceedings of the Mapping Sciences Institute Australia, Adding a Spatial Dimension to Business Conference, May 24-28, 1998, Fremantle, Western Australia. Menzies, T., 1998. Notes on GDA and the Mining Industry in the Northern Territory- communication. Holloway, R., 1998. Legal Implications of GDA and the Mining Industry

http://www.auslig.gov.au/techpap/geoasdi.htm

TOP ▲

AUSTRALIAN SURVEYING & LAND INFORMATION GROUP Department of Industry, Science and Resources
Scrivener Building, Dunlop Court, Fern Hill Park, Bruce ACT 2617
PO Box 2 Belconnen ACT 2616 Freecall (Within Australia): 1800 800 173
International Phone: +61 2 6201 4201 Fax: +61 2 6201 4266