

University of Southern Queensland  
Faculty of Engineering and Surveying

# **The NOW Map: Consistent, Dynamic and Contemporary Geospatial Information**

A dissertation submitted by  
Mr Anthony John Baker  
AssocDip(Cart) *TAFENSW*, BAppSc(EnvTech) *CSturt*

In fulfilment of the requirements of  
Master of GEOMATICS

June 2005



*Some see things that are and ask "why?";  
Others dream things that never were and ask "why not?"*

George Bernard Shaw



## **Candidates Certification**

I certify that the ideas, designs and experimental work, results, analysis, software and conclusions set out in this dissertation are entirely my own efforts, except where otherwise indicated and acknowledged.

I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

Anthony John Baker

Student Number: 0031111263

\_\_\_\_\_

Signature of Candidate

\_\_\_\_\_

Date

## **Endorsement**

Supervisor: Associate Professor Frank Young

\_\_\_\_\_

Signature of Supervisor

\_\_\_\_\_

Date

## **Abstract**

Mapping agencies, national and regional, are finding it increasingly difficult to maintain the currency of their suite of map related products and services. These products include topographic maps and the provision of up to date topographic data. The maintenance of this socially important spatial information is at issue through the duplication of effort that presently exists within government agencies at all levels. A dedicated data sharing and topographic maintenance program has the potential to solve all of these issues.

The "NOW Map" gives the "map hungry" public the ability to obtain spatially located data and products in time frames and formats of their choosing. This system is capable of delivering consistent, dynamic and contemporary geospatial information. It will be flexible, in response to a modern ever-changing society, and capable of providing up to date topographic maps and data that not only meets current standards, but also continually exceeds them.

After the development of initial procedures, a pilot study was conducted to expand and further refine data collection and analysis procedures. This was followed by a final data-gathering research phase. The research used relevant local, interstate and international examples in all areas of the study.

The outcomes of the pilot study and analysis of the second research segment demonstrated that maps can be maintained more efficiently through the utilisation of accurate up to date information. These topographically significant updates can be provided incrementally by organisations that maintain data as part of their own core business.

## **Acknowledgements**

This research was carried out under the principal supervision of Associate Professor Frank Young.

Appreciation is also due to those who have assisted firstly with the supply of spatial data and / or industry information.

- Peri Cooper, Gunnedah Council; Francis Dorman, NSW Fisheries; Ron Maher, Forests NSW; Campbell Peterson, Kempsey Council; Ron Graham, Coffs Harbour Council; Terry Slattery, DNR Qld; Owen Moss and Martin Rutherford, Defence Imagery and Geospatial Organisation; Rick McRae, ACT Emergency Services Bureau; and Alan Swift, Geoscience Australia.

Secondly, to the NSW Department of Lands for allowing the occasional use of geospatial data sets, facilities and infrastructure, as well as those from NSW Lands who provided technical assistance and the occasional words of encouragement:

- David Abernethy, Mick Dare, Peter Drinkall, Stuart Ellis, Brenda Fahey, Paul Field, Hugh Gould, Doug Herrick, Jeff Larsen, Joanna MacLachlan, Ralph Mallard, Col Mitford, Brian Rattray, Alan Small, David Taylor and Graeme Thompson.

It would be amiss not to thank those friends and work colleagues who also contributed with proof reading.

Lastly, a huge hug to my family for allowing me to disrupt our lives yet again.

## Table of Contents

<b>Chapter / Section</b>	<b>Page</b>
CANDIDATES CERTIFICATION .....	i
ABSTRACT .....	ii
ACKNOWLEDGEMENTS .....	iii
LIST OF FIGURES .....	vi
LIST OF TABLES .....	ix
LIST OF APPENDICES .....	xi
NOMENCLATURE, ACRONYMS AND ABBREVIATIONS .....	xii
GLOSSARY .....	xv
<b>CHAPTER 1 – INTRODUCTION</b>	
1.1 Outline of the Study .....	1
1.2 Background .....	3
1.3 The Problem .....	5
1.4 Research Objectives .....	7
1.5 Conclusions: Chapter 1 .....	8
<b>CHAPTER 2 – LITERATURE REVIEW</b>	11
2.1 Introduction: What is a map .....	12
2.2 Maps, Maintenance and Production .....	14
2.3 Map Related Data: Uses and Benefits .....	40
2.4 Maintaining Spatial Relationships .....	47

<b>Chapter / Section</b>	<b>Page</b>
2.5 Production System Shortcomings .....	68
2.6 Summary: Chapter 2 .....	81
<b>CHAPTER 3 – RESEARCH DESIGN AND METHODOLOGY</b>	<b>85</b>
3.1 Design Outcomes .....	86
3.2 Pilot Study – NSW Government Gazette.....	87
3.3 Major Study Data Collection .....	101
3.4 Summary: Chapter 3 .....	121
<b>CHAPTER 4 –RESULTS AND DATA ANALYSIS</b>	
4.1 NSW Government Gazette .....	123
4.2 Data Sharing Results.....	138
4.3 Data Accuracy.....	152
4.4 Data Summary.....	159
4.5 Summary: Chapter 4 .....	162
<b>CHAPTER 5 – DISCUSSIONS, CONCLUSIONS, AND IMPLICATIONS</b>	
5.1 Introduction .....	165
5.2 Discussion .....	167
5.3 Summary: Chapter 5 .....	185
5.4 Future Research Opportunities .....	187
<b>REFERENCES</b> .....	<b>191</b>
<b>APPENDICES</b> .....	<b>213</b>

## LIST OF FIGURES

<b>Number</b>	<b>Title</b>	<b>Page</b>
2.1	Bargo 1:25000 Topographic Map	13
2.2	Scribe sheets and masks for map related feature themes	15
2.3	Photo Flight Path	17
2.4	Photo Coverage Without Navigation Support	18
2.5	Topographic Update Process	20
2.6	Bathurst 1:25000 Topographic Map	21
2.7	Hyperspectral Data Collection	28
2.8	GPS Controlled Photography	32
2.9	North Haven Comparison 1979 and 1997	36
2.10	Age of Current Topographic Map Stock	72
3.1	Breakdown of Organisations by Tier	90
3.2	Number of Amendments by Government Tier	90
3.3	Entries and Amendments by Date	92
3.4	Entries / Amendments by Organisation (Local Government)	93
3.5	Entries / Amendments by Organisation (State Government)	94
3.6	Referencing of Amendments	96
3.7	Amendment Actions	99
3.8	Geographic Names Notification	102
3.9	New Suburb Notification	104

<b>Number</b>	<b>Title</b>	<b>Page</b>
3.10	Road Names Notification	105
3.11	Aquaculture Lease Notification (Grant)	107
3.12	Aquaculture Lease Notification (Renewal)	107
3.13	Data Sharing Locations	109
3.14	Gunnedah Region	110
3.15	Geod Geodetic Transformations Program	111
3.16	TFW File Editing (before and after)	112
3.17	Macleay River Study Area	117
3.18	Forests NSW Study Area Locations	119
4.1	Aquaculture Lease Transactions	126
4.2	Map Sheet Locations - Aquaculture Leases	128
4.3	Geographic Names	131
4.4	Unspecified Amendments	132
4.5	Total Geographic Names	133
4.6	Road Name Transaction Summary	136
4.7	Aquaculture Lease Breakdown	139
4.8	Data Distribution within the Eastern Portion of Gunnedah Shire	141
4.9	Map Sheet Comparisons	142
4.10	Net Change by Map Sheet	144
4.11	Forests NSW Study Area Location - South	145
4.12	Forests NSW Study Area Location - North	146
4.13	Names Supplied and Printed	146

<b>Number</b>	<b>Title</b>	<b>Page</b>
4.14	Data Used	147
4.15	Net Gain	148
4.16	Net Gain Summary	149
4.17	NSW Forests Point Data Locations	150
4.18	Lease Overlaps	153
4.19	Gunnedah Road Names - Kelvin	155
4.20	Gunnedah Road Names - Gulligal	155
4.21	Road Name Continuity – 87241n	156
4.22	Road Name Continuity - 87242s	157
4.23	Total Study – Map Maintenance	161
5.1	Map Production Relationships	166
5.2	Topographic Data Integration Framework	183
5.3	Topographic Data Integration Framework – Cadastral component	184

## LIST OF TABLES

<b>Number</b>	<b>Title</b>	<b>Page</b>
2.1	Classification of Spatial Resolutions	24
2.2	Radar Capable Satellites	24
2.3	Selected Radiometric Instruments in Orbit	25
2.4	Launch schedule for high-resolution remote sensing satellites suitable for topographic mapping	27
2.5	A broad overview of the responsibilities of the various levels of government in Australia	48
2.6	Potential Data Sources within NSW	49
2.7	Level of Government Representation	50
2.8	NSW Map Production Statistics 1949 to October 2002 - Edition / Scale Combinations	69
2.9	NSW Map Production Statistics 1949 to October 2002 - Edition / Scale Combinations	70
2.10	NSW Map Production Statistics 1949 to October 2002 - Edition / Scale Combinations	71
3.1	Comparison of Tiers of Government	89
3.2	Gazette Amendments by Date	91
3.3	Spatial Referencing	96
3.4	Gazette Actions	98
4.1	NSW Fisheries Aquaculture Lease Transaction Summary	125
4.2	Topographic Map Sheet Identification	127
4.3	Map Sheet Maintenance	129

<b>Number</b>	<b>Title</b>	<b>Page</b>
4.4	Further Investigation Required	129
4.5	Scale Summary	130
4.6	Unspecified Amendments	132
4.7	Road Names Result Summary	135
4.8	Map Sheet Modifications (Road Names)	137
4.9	NSW Fisheries Data Result Summary	138
4.10	Unique Records	139
4.11	Gunnedah Shire Council Data Result Summary	140
4.12	Net Change by Map Name	143
4.13	Point Feature Summary	151
4.14	Homestead Name Variations	154
4.15	Map Maintenance Summary	159
4.16	Map Sheet Listing – Gazette and Data Sharing	160

## LIST OF APPENDICES

<b>Number</b>	<b>Title</b>	<b>Page</b>
A	Glossary	215
B	NSW Government Ministerial Portfolios	221
C	NSW Topographic Map Production Statistics: 1949 to October 2002	223
D	Gazette Amendments by Organisation	225
E	Geographical Names Summary	229
F	Road Name Summary	231
G	Aquaculture Lease Summary	233
H	Data Sharing Example 1: NSW Fisheries - Macleay Estuary Oyster Leases	239
I	Data Sharing Example 2: Gunnedah Shire Council - Property Access Information	245
J	NSW Forests Data Result Summary	255
K	Data Sharing Example 3: NSW Forests – Vehicular Roads and Tracks	261

## **NOMENCLATURE, ACRONYMS AND ABBREVIATIONS**

The following acronyms and abbreviations have been used throughout the text and references: -

<b>Acronym</b>	<b>Proper Name</b>
AGD	Australian Geodetic Datum (is shown as AGD66 to represent the 1966 definition of the datum)
AIRSAR	Airborne Synthetic Aperture Radar
ALS	Airborne Laser Scanning
ANZLIC	Australia New Zealand Land Information Council
ASDD	Australian Spatial Data Directory
ASDI	Australian Spatial Data Infrastructure
AURISA	Australasian Urban and Regional Information Systems Association
AUSLIG	Australian Land Information Group
AVHRR	Advanced Very High Resolution Radiometer
AVIRIS	Airborne Visible / Infrared Imaging Spectrometer
CASI	Compact Airborne Spectrographic Imager
CERCO	Comite Europeen des Responsables de la Cartographie Officelle
CTP	Computer To Plate
DAIS	Digital Airborne Imaging Spectrometer
DCDB	Digital Cadastral Data Base
DEM	Digital Elevation Model
DTDB	Digital Topographic Data Base
DTM	Digital Terrain Model
ENC	Electronic Navigation Chart
ERIS	Environmental Resources Information System
ESRI	Environmental Science Research Institute
FIG	Federation Internationale des Geometres

<b>Acronym</b>	<b>Proper Name</b>
FME	Feature Manipulation Engine
GDA	Geocentric Datum Australia (is shown as GDA2000 to represent the 2000 definition of the datum)
GIM	Geomatics International Magazine
GIS	Geographical Information System
GITA	Geospatial Information and Technology Association
GNB	NSW Geographical Names Board
GNR	Geographical Names Register
GPS	Global Positioning System
HRSC-A	High Resolution Stereo Camera – Airborne
ICA	International Cartographic Association
ICSM	Intergovernmental Committee on Surveying and Mapping
IMTA	International Map Traders Association
ISO	International Standards Organisation
ISPRS	International Society for Photogrammetry and Remote Sensing
JERS	Japanese Earth Resource Satellite
LGA	Local Government Authority
LIDAR	Light Detection and Ranging
LINZ	Land Information New Zealand
LIST	Land Information System Tasmania
LPI (NSW)	Land and Property Information (New South Wales)
MEGRIN	Commercial Arm of CERCO
MGA	Map Grid of Australia (is shown as MGA56 to represent the grid in zone 56)
NASA	National Aeronautical and Space Administration
NGDI	National Geospatial Data Infrastructure
NOAA	National Oceanic and Atmospheric Administration

<b>Acronym</b>	<b>Proper Name</b>
PCGIAP	Permanent Committee for GIS Infrastructure for Asia and the Pacific
PDF	Portable Document Format
PE&RS	Photogrammetric Engineering and Remote Sensing
RTA	NSW Roads and Traffic Authority
SABE	Seamless Administrative Boundaries of Europe
SAR	Synthetic Aperture Radar
SES	NSW State Emergency Service
SPOT	Systeme Probatoire d' Observation de la Terre (Satellite System operated by French National Space Agency)
SQL	Structured Query Language
SRTM	Shuttle Radar Topography Mission
TFW	Tiff World File
TIFF	Tag Image File Format
UAV	Un-manned Airborne Vehicle
URISA	Urban and Regional Information Systems Association
USGS	United States Geological Survey
WALIS	Western Australian Land Information System

## **GLOSSARY**

Definitions of lesser-known terms may be found in appendix A.

*The value and social utility of geographic information comes from its use. Sharing of geographic information is important because the more it is shared, the more it is used, and the greater becomes society's ability to evaluate and address the wide range of pressing problems to which such information may be applied. Failure to share geographic information is also economically inefficient and wasteful. The expertise and time it takes to collect and maintain information about the land creates a need to share that information*

(Masser 1997)