CRC for Spatial Information
Annual Report
2003-04

"to enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation"

The Hon Peter McGauran

Established and supported under the Australian Government's Cooperative Research Centres Programme

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This Annual Report is issued in the format required by the Commonwealth Government.

Those who wish a deeper knowledge of CRCSI activities are referred to the publications listed in this report, to information available through the web page, and are welcome to contact the CRCSI office.

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Core Participants

Curtin University of Technology

Department of Land Information, WA

Dept Agriculture, WA

Dept of Lands, NSW

Dept Sustainability and Environment, Victoria

43 Pty Ltd

Geoscience Australia

University of Melbourne

University of New South Wales

Support Participants

ESRI Australia

Charles Sturt University

Defence Imagery and Geospatial Organisation

Dept Natural Resources Mines & Energy, Qld

Intergraph

Affiliate Participants

Bentley Systems Pty Ltd

43pl members

AAMHatch

Alexander & Symonds Pty Ltd

Apogee Imaging International

AST

Beveridge Williams & Co Pty Ltd

Brown & Pluthero Pty Ltd

C. R Hutchison & Co Pty Ltd

CSBP Limited

D.M. Gerloff & Associates Pty Ltd

Digital Mapping Solutions

Fractal Technologies

Fugro Spatial Solutions Pty Ltd

Geodata Information Systems

Geomatic Technologies

Glenndew Pty Ltd

Howell Spatial Industries Pty Ltd

Intergraph

Land Equity International Pty Ltd

Lester Franks Survey & Geographic Pty Ltd

Lisasoft Pty Ltd

LogicaCMG Pty Ltd

Mapinfo Australia Pty Ltd

Max Braid Surveyors Pty Ltd

McMullen Nolan & Partners Pty Ltd

Navigate Pty Ltd

NGIS Australia Pty Ltd

Omnilink Pty Ltd

Omnistar

Peter W Burns Pty Ltd

PSMA Australia Limited

QASCO Surveys Pty Limited

Reeds Consulting Pty Ltd

Sagem Australia Pty Ltd

Searle Consulting NQ

Sinclair Knight Merz Pty Ltd

Spatial Information Technology Enterprises Ltd

Todd Alexander Surveyors Pty Ltd

Webmap Pty Ltd

we-do-IT Pty Ltd

Wrenfeld Pty Ltd

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CRC for Spatial Information

Vision

To make the CRCSI a world leader in spatial information applications that are affordable, useful and readily available to all — at any time and in any place.

The application of the vision in Australia leads to the concept of *Virtual Australia,* ie the holistic representation of the vast array of information about our world in three dimensions and at any useful scale. In simple terms this means one can remotely access map-based information, combine it with information from other sources, conduct analyses, view the information in three dimensions, conduct forecasts (the fourth dimension), analyse historic trends, supply information and analyses to others, and know one's geographic position. Moreover it provides us with the ability to convey this position to others, at any time. Spatial information and its enabling technologies are therefore inextricably linked through the vision.

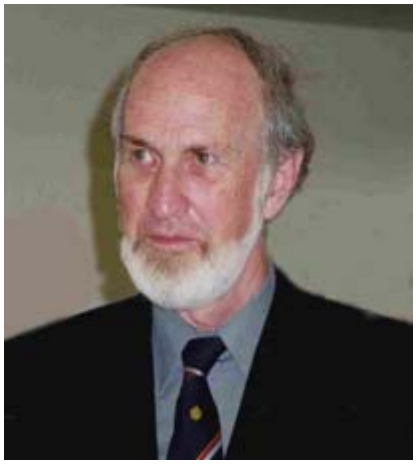
The same concept can be applied anywhere in the world and the CRCSI wishes to develop the application of the vision wherever there is a demand.

It is implicit in the vision that new or existing spatial information and other information will be seamlessly integrated for the benefit of the user at an affordable price, since it is recognised that for most applications spatial information is used with non-spatial information.

Statement of Purpose

To create new wealth for the participants of the CRCSI and for the nation: through research innovation and commercialisation, through educational activities, and through powerful collaboration to build institutional capacity.

Chairman's Foreword



The Governing Board of CRCSI was formed in the third quarter of 2003 and was fortunate to be able to draw on experience from the Interim Management Committee which operated as an unofficial Board from January to July that year. Formal thanks and acknowledgment are due to all the stakeholder members who assisted in this important formative stage.

A formal consultant report was commissioned from Mr Henry Bosch to ensure that a good Governance Protocol was put in place in the early stages of operation of the Governing Board. This important step was recognised by the 2004 CRCA Conference which devoted a session for Chairman based on this CRCSI initiative. I would like to convey my personal thanks to all CRC Board and SISL Board directors for their dedication, motivation and cooperation over the first year of existence.

Once established the Board moved quickly to realise ABN registration as well as the formation of the SME company 43 Pty Ltd and the unincorporated joint venture company Spatial Information Systems Ltd. It also formed its main committees: the Research & Education Advisory Committee, the Industry Advisory & Commercialisation Committee and the Board Audit and Compliance Committee. By January 2004 effective sign off had been achieved on the foundation contracts the Commonwealth Agreement, the Centre Agreement and the IP Management Trust deed.

In 2004 the Board was fortunate in obtaining the services of Professor John Lovering as a Centre Visitor and we look forward to his future guidance as the CRC for Spatial Information matures and consolidates its commercial and public benefit activities.

CEO's Report

Our newly formed CRC has before it an unprecedented opportunity to grow the spatial information industry. With 41 companies, seven government agencies, and four Universities collectively located in most states and territories we have excellent reach across all sectors throughout Australia. We are fortunate that we enjoy excellent relationships with our industry body the Australian Spatial Information Business Association, our peak government organisation the Australian and New Zealand Land Information Council and our lead professional body the Spatial Sciences Institute.

The first six months of our operation were dominated by the development and execution of our governing agreements. The second six months have seen significant effort to develop the overall strategic plan for the CRC through extensive consultation, the near finalisation of the first round of research projects that will see the release of $7 million of research investment funds and the commitment of $20 million of in-kind contributions.

Our CRC is strongly industry focussed. The key performance measures set us the task of generating significant new revenue, developing a world class research program and working hard to ensure significant collaboration on all projects with the overall objective of maintaining a high satisfaction level amongst all our partners. We have recruited an excellent team of managers and scientist. Their collective ability to innovate and adapt good science to emerging needs will ensure a new and significant impetus to spatial information research in Australia. On behalf of management I thank them for their excellent start to our new CRC.

Finally, we have been fortunate to have established a first class Board of Directors lead ably by Emeritus Professor Bill Charters and I would like to thank them and Bill for the support they have given to all members of the CRCSI in its first year.

Description of Structure and Management

Corporate Structure

The CRCSI operates as a small company. It has a board of directors with advisory committees and a CEO with executive staff. Spatial Information Systems Ltd is an IP holding company which also performs some basic administration functions. It provides a sufficiently flexible vehicle for parties agreeing to perform research and development jointly with a view to then, jointly or separately, commercialising the research under license or other such appropriate arrangements.

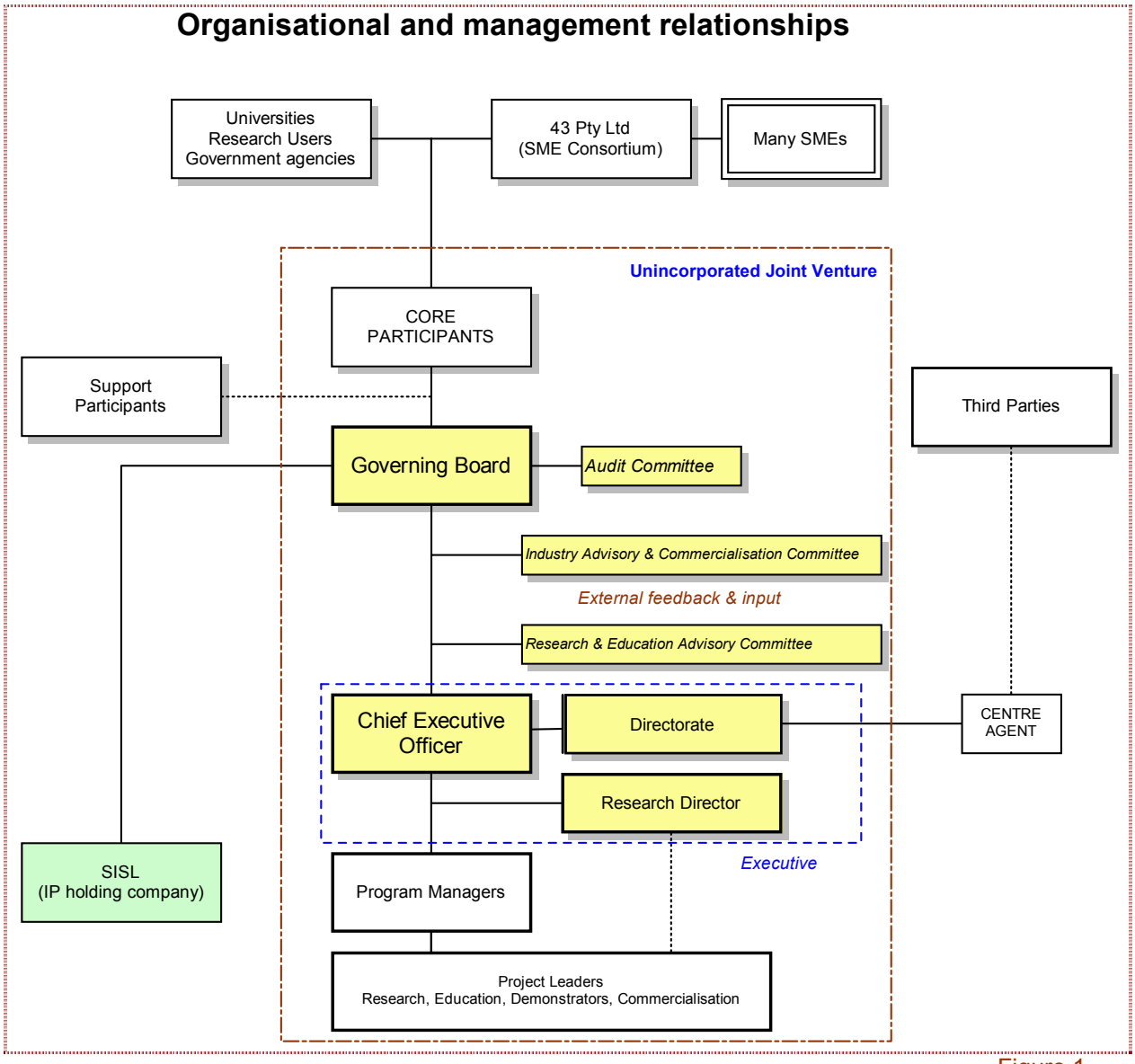


Figure 1

Roles and Accountabilities

Board	Executive	Program Managers	Project Leaders
Strategic direction Policy Budget Achievement of Strategic Plan CEO appointment	Strategic Planning Operational Management Business Development Commercialisation Ensuring programs interconnect and link to the market Member and client relations	Independent program management (project development; work quality; milestones monitoring) Internal links Market interface Research utilisation	Research leadership Project stakeholder communication and relations Project mgt (staff and budget), esp. meeting milestones & reporting Internal liaison

Figure 2

Governing Board

CRCSI is ultimately managed by the Governing Board of directors, which meets five times each year. There is a maximum of eleven directors, some of whom have alternates:
• an independent Chairman
• three independent directors including the CEO
• two representatives from each of the three 'colleges' of 43pl; state governments; and universities
• one representing the federal government
Figure 3 lists the directors as at 30 June 2004: their respective attendance is at Appendix 2.

Each college operates independently and confers amongst itself so that views of any participant can be brought to consideration in a Board forum. The CRCSI Business Manager is the Company Secretary. Not all Members have Board seats, but all have equivalent access through rotation of Directors that represent participants. Directors are made fully cognisant of the obligations of Corporations Law, which dictates that the interests of the CRCSI be placed above those of their own organisation while acting as a director. Comprehensive governance protocols have been designed for the CRC by Mr Henry Bosch AO.

Program Managers present overviews of their portfolio at successive board meetings. The Board oversees operations and provides the CEO general policy direction. As Figure 2 indicates, it is responsible for

- setting CRCSI's strategic direction and major policies
- allocating resources
- ensuring the program portfolio is in accordance with CRCSI objectives
- overall CRCSI performance, based on milestones, and including accountability to the CRC Programme and the legal requirements of the Australian Securities and Investment Commission.

Prior to the year the Interim Management Committee (IMC) ably prepared for the formation of the Governing Board, guiding the participants in their coming together for the formal commencement of the unincorporated joint venture effective 1 July 2003. Current participants and the Board extend their thanks to all contributors to the period of the IMC, particularly Bill Charters (Chair) and Prof Ian Williamson (defacto chief executive) and Mike Ridout (Business Manager). Major contributions were also received from Greg Beeston, Ian Bishop, Will Featherstone, Clive Fraser, Peter Holland, Ian Hyde, Bob Jemison, Mark Judd, Frank Leahy, Tony Milne, Des Mooney, Chris Rizos, Bruce Thompson, Jannie van Deventer, and Graeme Wright.

Director	Organisation	Alternate Director
Em Prof Bill Charters	Independent (Chair)	
Peter Woodgate	CRCSI Chief Executive Officer	
Mary O'Kane	Independent (Director, M O'Kane & Assoc)	
Roland Slee	Independent (Director, Business & Technology Solutions, Oracle Corporation Australia Pty Ltd)	
Bill Richards	43pl (Fugro Spatial Solutions Pty Ltd)	John Lazarus, Managing Director, Fugro
Tony Burns	43pl (Land Equity Pty Ltd)	Chris Grant, Land Equity
Neil Williams	Chief Executive Officer, Geoscience Australia	Peter Holland, GA
Grahame Searle	Chief Executive Officer, Dept of Lands Information, WA (Deputy Chair)	David Hartley, DAWA
Warwick Watkins	Director-General, Dept of Lands, NSW	Des Mooney, DoL
Colin Sutherland	Dean of Science & Technology, University of NSW	
Jannie van Deventer	Dean of Engineering, University of Melbourne	Prof Graham Hutchinson, UM

Figure 3

Audit & Compliance Committee

The Audit and Compliance Committee meets as required to support the audit process and CRCSI fiduciary and other protocols. Terms of reference include internal audit and compliance review. The ACC met three times during the year and membership was Mary O'Kane (Chair), Warwick Watkins and Neil Williams. Pitcher Partners are the appointed CRCSI auditors and they are conducting the financial year's audit in conjunction with the preparation of this annual report.

Research & Education Advisory Committee

The purpose of this committee is to provide independent advice and recommendations on, and review of, the research and education activities of the CRC within its areas of expertise. It met three times in the year, jointly with the Industry Advisory and Commercialisation Committee. The Chairman is an observer at Board meetings and delivers the REC considerations to Directors. Its membership was

Clive Fraser (Chair)	Research Director, CRCSI
Peter Woodgate	CEO, CRCSI
Roland Slee	Board Director, CRCSI
Colin Sutherland	Board Director, CRCSI
Peter Loughrey	Intergraph
Bruce Thompson	Dept Sustainability and Environment, Victoria (appointed June 04)

Industry Advisory & Commercialisation Committee

The purpose of this committee is to advise the CRC-SI Governing Board on issues concerning industry and commercialisation matters. It met three times in the year, jointly with the Research & Education Committee. Its membership was

Jack de Lange	43pl Director and Australian Spatial Information Business Association
Tony Burns	43pl representative CRCSI Board Director, and Land Equity Pty Ltd
Hun Gan	Starfish Ventures Pty Ltd (appointed June 04)
Grahame Searle	Board Director, CRCSI and Dept of Land Information WA
Peter Woodgate	CEO, CRCSI

Spatial Information Systems Limited (SISL)

The CRCSI established SISL to hold its intellectual property and oversee its exploitation. Currently the Governing Board is also the Board of SISL. This will be amended in the coming year to provide a smaller board. Spatial Information Systems Limited will maximise the commercial returns created by the activities of the CRC for Spatial Information. It will act as the commercial agent for the participants in the CRC for Spatial Information; hold in trust the intellectual property created by the CRC activities; and identify, protect, use and commercialise the Centre Intellectual Property

43pl – the SME consortium

43pl is a company established as a construct to help a large number of small to medium sized enterprises (SMEs) participate in the CRC in a manageable way. It has a board that oversees the trust, in which member companies hold units proportional to their annual cash subscription. Board directors come from each state involved in the CRC. There are two seats on the CRC Board reserved for 43pl representative directors.

43pl is one of the core partners in the CRC. 43pl is the proprietary limited company that binds the 43 small to medium enterprise (SMEs) companies through a unit trust deed. Each of the SMEs are unit trust holders in 4pl. There are five shareholders, one from each of Tasmania/Victoria, Western Australia, South Australia/Northern Territory, New South Wales/Australian Capital Territory and Queensland. The lead company from each state/territory provides the Director for the Board of 43pl. At 30 June 2004 the 43pl Directors were Mark Judd (Chair), Jack de Lange (Qld), Dean Howell (SA), Bill Richards (WA), Ian Batley (NSW & ACT). This Board has then nominated the two Directors to sit on the main Board of the Centre. All states and territories with the exception of the Northern Territory have headquarters of 43pl members.

CRC Visitor

CRCSI draws on the expertise and experience of Professor John Lovering AO, FAA, FTSE with regard to strategic direction and operations. John is an eminent Australian geologist and the former Vice Chancellor of Flinders University. He has been Chairman of a number of public and private company boards and formed Geotrack International Pty Ltd to market a new petroleum exploration technique. He has served on a number of national and international scientific and government committees. He has considerable experience in natural resources management having been Presiding Officer of the Natural Resources Council of South Australia from 1992 to 1994, President of the Murray-Darling Basin Commission from 1994 to 1999 and Chairman of the Environment Conservation Council (Victoria) from 1998 to 2002. He is currently Chairman of the Australian National Seismic Imaging Resource and the Gippsland Research Coordination Group and a member of the Board of Southern Rural Water. His role as CRC Visitor incorporates

- participation in reviews of CRCSI by the CRC Secretariat
- provision of general advice and guidance
- provision of independent advice to the CRC Secretariat on the potential impact of material changes being proposed or implemented by CRCSI.

Commercialisation, Technology Transfer, Utilisation

The CRC for Spatial Information has been established 'To create new wealth for the participants of the CRCSI and for the nation: through research innovation and commercialisation, through educational activities, and through powerful collaboration to build institutional capacity.'

This purpose is consistent with that of the CRC Programme, which has a single objective

'to enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation'.

Projects

The CRCSI strategy for technology transfer is inherent in the way it selects and funds its activities. The technology transfer and commercialisation strategy must be built into a proposal before the Governing Board will approve CRCSI funding and formalisation into a CRCSI project agreement contract.

Criteria for project funding approval include a requirement that prospective commercialisers and/or end users have significant involvement in the project; that there is a clear and credible route to market; that the work plan reflects market awareness; and that it is aimed at a demonstration of the project output.

Every project is governed by a Project Agreement which details intellectual property ownership, the proposed route to commercialisation / application, and the role to be played by the entities involved. All parties to the project sign the Agreement. Where appropriate, terms outlining the licensing and royalty structure are included. The Project Management Group pro forma agenda for quarterly meetings includes consideration of any commercial aspects pertinent to project progress and output.

Intellectual Property Management

The effective management and commercialisation of intellectual property (IP) is fundamental to achieving the CRCSI purpose and the CRC Programme objective.

The CRCSI IP Management Policy provides a framework to the CRC participants and researchers to permit the utilisation and commercialisation of research outcomes of the CRC. The policy sets out ownership rights and the responsibilities of researchers and participants. It provides guidance on the identification, protection and commercialisation of CRC IP. The policy is based upon the IP ownership and management principles outlined in the CRC Centre Agreement, Commonwealth Agreement, and Centre Intellectual Property Trust Deed.

Commercialisation of CRCSI Centre Intellectual Property (CIP)

Spatial Information Systems Limited (SISL) has been established as the holder of CIP. It is responsible for the commercialisation of CIP, including marketing, seeking potential licensees and seeking other commercial applications.

If SISL intends to commercialise any CIP, it must advise each CRC participant in writing and each participant has a period in which to express a desire to commercialise or participate in the commercialisation of the Centre Intellectual Property. By dint of the structure of 43pl, all of the SMEs involved can bid for commercialisation rights. If no participant desires to commercialise then SISL is free to commercialise the CIP. The details of the commercialisation plan for the CRC, including the patent and licencing strategies, will be documented within the CRCSI Commercialisation and Utilisation Plan in the coming financial year.

Involvement of End-Users In CRCSI

End users are involved in all aspects of the CRCSI. The following tables, responding to Commonwealth reporting requirements, list the end users with active engagement in the CRCSI during the year.

Core Participant	
Dept Agriculture WA	Department of Land Information, WA
Dept Sustainability and Environment Vic	Dept of Lands, NSW
Geoscience Australia	43 Pty Ltd – see below
Support Participant	
ESRI Australia	Dept Natural Resources Mines & Energy, Qld
Defence Imagery and Geospatial Organisation	Intergraph
Bentley Systems Pty Ltd	
43 Pty Ltd Member	
AAMHatch	*LogicaCMG Pty Ltd*
Alexander & Symonds Pty Ltd	*Mapinfo Australia Pty Ltd*
Apogee Imaging International	*Max Braid Surveyors Pty Ltd*
Advanced Spatial Technologies	*McMullen Nolan & Partners Pty Ltd*
Beveridge Williams & Co Pty Ltd	*Navigate Pty Ltd*
Brown & Pluthero Pty Ltd	*NGIS Australia Pty Ltd*
C. R Hutchison & Co Pty Ltd	*Omnilink Pty Ltd*
CSBP Limited	*Omnistar*
D.M. Gerloff & Associates Pty Ltd	*Peter W Burns Pty Ltd*
Digital Mapping Solutions	*PSMA Australia Ltd*
Fractal Technologies	*QASCO Surveys Pty Limited*
Fugro Spatial Solutions Pty Ltd	*Reeds Consulting Pty Ltd*
Geodata Information Systems	*Searle Consulting NQ*
Geomatic Technologies	*Sinclair Knight Merz Pty Ltd*
Glenndew Pty Ltd	*Spatial Information Technology Enterprises*
Howell Spatial Industries Pty Ltd	*Todd Alexander Surveyors Pty Ltd*
Intergraph- Mapping & Geospatial Solutions	*Webmap Pty Ltd*
Land Equity International Pty Ltd	*we-do-IT Pty Ltd*
Lester Franks Survey & Geographic Pty Ltd	*Wrenfeld Pty Ltd*
Lisasoft Pty Ltd	

Consultancy, Contract Research, etc	
Organisation	Brief description of the activities, and the principal researchers involved
Austroads (the national association of Australian and New Zealand road transport and traffic authorities**)**	**Austroads Intelligent Access Program** - Contract research (Professor C Fraser, Associate Professor G Hunter, Dr S Winter, Dr P Collier, P Woodgate)
Federal Ministers' for Environment and Agriculture under the auspices of the Coalition of Australian Governments	**Salinity Mapping Methods Project** (Peter Woodgate)
Department of Infrastructure, Planning and Natural Resources, New South Wales	**NSW Native Vegetation Monitoring Program (Peter Woodgate,** Dr Simon Jones, RMIT University)

Strategies for Developing SME Links

The CRCSI has a unique structure for its SME consortium: members join a company which has been established as a construct to afford CRC participation to the SME without the onerous aspects of the Commonwealth Agreement, and with appropriate flexibility, while maintaining an overall commitment to the CRC. A resourced set of strategies to engage with these companies has been devised and implemented in the year through the Communications Director position. New members of 43pl are encouraged.

The Australian SI industry is characterised by many SMEs. From the outset it was recognised that there was a need for SMEs to be integrated and ASIBA through one of its directors, Mark Judd, played a strong role in the formation of a unique CRC structure to achieve this. A representative company 43pl has been established as a trust manager: this company is a core participant; companies wishing to participate in the CRC buy units annually (as their cash contribution through to the CRC). A beneficial interest in the trust assets held by 43pl and hence of CRCSI joint venture is held by each in proportion to their contribution amount each year. The structure provides limited liability and ease of entrance and exit, two important factors to the SME.

The CRCSI provides finance, admin and communications functions to the company and its board of directors. The consortium is a major platform for the CRCSI to achieve industrial development which is a core outcome of the CRCSI and enunciated in the Strategic Plan.

The value proposition for the companies includes aspects of

- Access to specific R&D initiatives and IP (CRC was seen to be driven by commercial outcomes and projects of merit)
- Neutral ground to meet government agencies (which are both clients and suppliers)
- Growing the business (technical, professional development)
- Meaningful networking into government & academia
- Market development; kudos
- Growth in trust unit value

"43pl gives us an unprecedented opportunity to bring the small corporates and researchers together in a rapidly growing industry"

Peter Woodgate, CRCSI CEO

Research

This section describes the research activities conducted during the year in the CRC's programs and projects, as outlined in Schedule 1 of the Commonwealth Agreement.

…the amount of corporate data doubles every 12 to 18 months, but: only 15% is catalogued and retrievable resulting in an increasing effort required by organisations to get the balance right between codified information and mobile intellectual capital.

IBM - Knowledge Business

…there is around a 61% compound annual growth in digital information.

Dr William Lewis – JP Morgan.

…around 90% of government activity in the western world is based on SI.

based on Tomlinson 1993

Portfolio Overview

The CRCSI considers research to include the innovative use and application of emerging technologies as well as the development of new technologies. The CRCSI **will undertake world class research that will lead to new applications of spatial information and enabling technologies that can be used to generate new wealth for the partners of the CRCSI.**

The Vision of the CRC will be realised when spatial information is made useful and available to all – at any time and in any place. Implicit in this vision is that the needs of SI users will be met through the

development of the necessary supporting products and services. These will provide accessibility and knowledgeable use of SI within a favourable environment of regulatory policies and institutional frameworks. An enhancement of industry and user capabilities is essential if the broad spectrum of SI needs within society is to be satisfied. New developments in the acquisition, analysis, synthesis and delivery of SI are being continually called for. This in turn requires active research and development in the science and technologies of positioning, modelling and data processing, integration and archiving, and dissemination and visualisation of SI.

The CRCSI research portfolio focusses upon data collection technologies, including

- global navigation satellite systems and integrated multi-sensor positioning systems
- space and airborne imaging and ranging systems, and inertial measuring units
- spatial database technology and geographic information systems to support a national spatial data infrastructure
- earth observation technologies for environmental and resource monitoring and management
- visualisation techniques and tools for enhanced decision support capability.

In formulating its research projects the CRCSI will maintain a focus upon meeting the needs of the user of SI, and be responsive to the future needs of the Australian SI industry. This demands early stage planning for user adoption and utilisation of research outcomes, along with commercialisation of technological innovations for the benefit of CRCSI participants, the SI industry and Australia as a whole.

In the external environment relevant societal and technological trends include on-line government with greater access to and interchange of SI; the devolution of many non-policy functions within government to industry; the growing volume and value of technological innovations emerging from the SME sector; multi-disciplinary research collaboration to address complex national environmental issues; greater sectoral integration in these same issues and others; a shorter lifecycle for many SI technologies; and the 'consumerisation' of formally specialist products, systems and procedures afforded by miniaturisation in electronics, and advances in computing and in information and communications technology.

The path from adoption of project outcomes to realisation of the vision is by no means direct, yet all research projects will be designed to produce innovative solutions, through the generation of new intellectual property, to problems that currently impede progress towards "useful spatial information for all at any time and place." Project outputs will enhance capability within the SI industry and user community, which in turn will contribute to the usability of SI and to the knowledge base to support broader SI utilisation.

The activities of the CRCSI will be strongly user driven ….. it will invest between 60 and 80 percent of its research budget in projects that promise strong commercial outcomes for the shareholders of the CRCSI. The remaining 20 to 40 percent of the research budget will devoted to commercial research projects or projects in the national benefit whose outcomes will be put in the public domain for the industry as a whole to use. All projects will take into consideration the need to generate balanced environmental, social and economic outcomes.

Our emerging research program is based on 15 projects of roughly equal size (about $400,000 to $500,000 CRCSI cash each over three years) that more or less reflect the original proposal that led to the inception of the CRCSI. By conscious design to date the CRCSI does not have a single big project.

The CRC will consider funding projects that are at the 'fundamental' end of the research spectrum as well as the applied end where most of the research effort will be devoted in the first three years. The advantages of 'blue sky' projects are that they offer the potential for both radically new and lucrative commercialisation over a slightly longer time frame and substantial acceleration of the movement towards the realisation of the vision of the CRC. To achieve commercialisation or public good outcomes from blue sky research projects within the lifetime of the CRC there is a strategic advantage in seeding some projects at the outset to allow for applied R&D to follow on from the fundamental developments. The disadvantages of fundamental research are well recognised, principal amongst these being the inherent risk of failure.

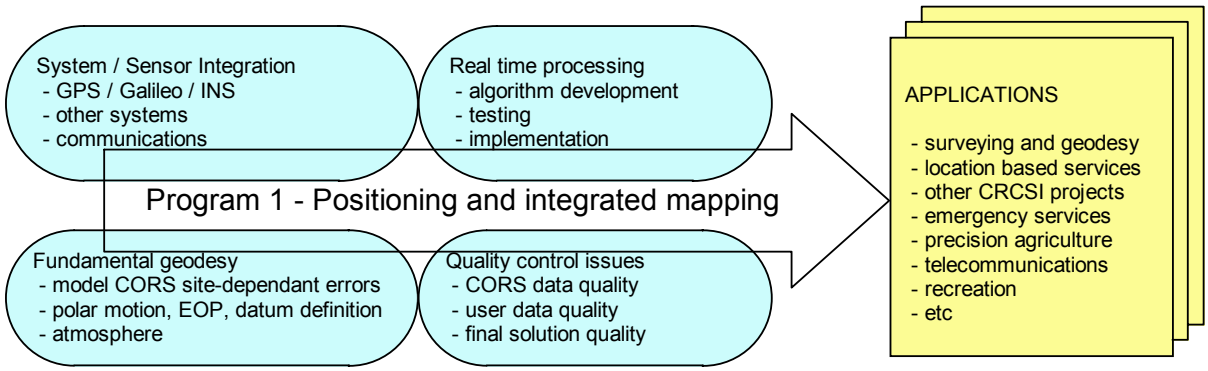
Given the rapidly changing nature of the technology that underpins the Spatial Information industry and the enormity of the ever shifting demands for new information products, the research program is committed to a high degree of flexibility to enable it to redeploy its resources to ensure it continues to meet the highest priority research needs, while acknowledging that higher degree students must be allowed to complete their theses.

The power of CRC research is its ability to integrate the developers (researchers) and the market. The CRCSI recognises that good research is not a linear process but is one of trial and error. Good research emanates from good ideas. Its nurturing involves astute judgement, good planning, risk taking and most importantly of all the involvement of the right people who are appropriately supported. Research is a process that breeds successes and failures and all those involved need to understand and accept these precepts in order to establish realistic expectations as an integral part of their involvement.

The CRCSI will have an Annual Conference, rotating amongst the geographical locations of its partners, that will bring together researchers, collaborators, shareholders, other sponsors and related stakeholders to critically evaluate progress and make plans for future investments. The inaugural conference will be in Melbourne in November 2004.

Program 1 - Integrated Positioning & Mapping Systems

The objective of Program 1 is to undertake research necessary to facilitate the development of a low-cost, real-time GPS-based positioning system capable of providing accurate location in any environment to support a range of surveying and mapping applications. The three projects contribute to this objective, the achievement of which poses a number of research challenges, as illustrated below (source: P. Collier).



Project 1.1 As GPS "base station" data is a crucial requirement for high accuracy systems, providers of Continuously Operating Reference Station (CORS) data must be able to assure the quality of their data. This project will develop techniques and algorithms that minimise the impact of multipath and interference on CORS data and identify local base station deformation. Long-term geodetic reference frame issues and the challenges of integrating local, national and global hierarchies of CORS networks will also be addressed.

Project 1.2 This project will develop rigorous real-time quality control procedures for both CORS GPS data and the user data. Because the user environment is uncontrolled, a number of potential sources of error need to be considered, making the task of assuring the quality of the user's data both critical and technically demanding.

Project 1.3 This project aims to develop a generic system for positioning and imaging sensor integration. The primary outcome will be a positioning and geo-referencing platform with the necessary microprocessor hardware, and appropriate data processing software, for integrating different navigation and imaging sensors. This project focuses on the user system, and therefore complements the two projects with significant CORS network emphasis.

Project 1.1 - Enhancing Australia's Core Geodetic Infrastructure

Project Leader Mike Stewart, Curtin University of Technology

Participants

Geoscience Australia, Dept Sustainability and Environment, Victoria, NSW Dept of Lands, Dept of Lands Information, WA

University of NSW, Curtin University of Technology

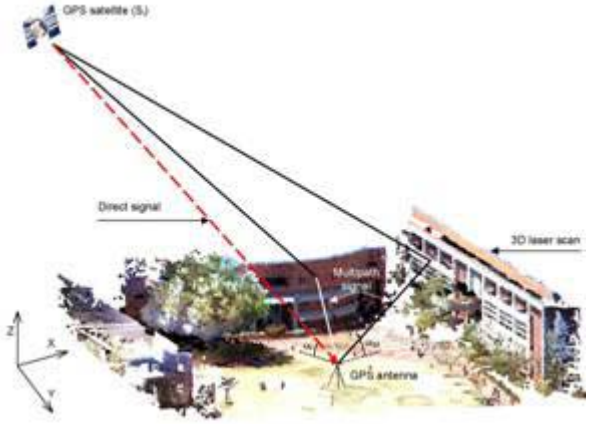
43pl (Fugro, McMullen Nolan)

Aims

- Develop devices and software to detect and evaluate GPS signal interference and identify interference sources
- Construct algorithms and models to identify and mitigate CORS site-dependent GPS multipath errors and hence allow site assessment before hardware installation
- Develop standard and protocols for a seamless integration of regional and local CORS GPS networks
- Create improved geodetic models to enhance the definition of the national reference frame

Work done, initiatives and breakthroughs and problems experienced

The project is still being established. A Research Associate, Ireneusz Baran, has been appointed at Curtin University, commencing in late June 2004. He has been performing a background review in the area of GPS multipath simulation. In addition, a fractional Research Fellow has been appointed at University of New South Wales, to commence 1 July 2004. He has been gathering background literature on GPS interference. Other project personnel have yet to be appointed.



The diagram shows how GPS multipath error can occur at a GPS receiver antenna from reflected GPS signals (multipath signal) off buildings. Using a 3D model from a laser scanner, Project 1.1 will try to predict the presence of multipath signals at particular antenna locations, and therefore find an optimal (minimum multipath location). (Ireneusz Baran)

Project 1.2 - Quality Control Issues for Real-Time Positioning

Project Leader Phil Collier, University of Melbourne

Participants

Dept Sustainability and Environment, Victoria, NSW Dept of Lands, Dept of Lands Information, WA ,

University of Melbourne, University of NSW

43pl (AAMHatch, Beveridge Williams, Geomatics Technologies, Glenndew, Reeds, Sagem)

Aims

This project will develop a real-time quality control module that will give mobile users a definitive statement regarding the integrity of a derived 3D position. In order to achieve this the following research tasks will be undertaken:

- Assess and report the quality of CORS data in real-time
- Assess and report the quality of mobile user positioning data from a variety of sensors in real-time

- Integrate the CORS quality control information with that of the mobile user's information in order to routinely, and reliably, determine and report the quality of the mobile user's position in real-time

The first task is linked to work being done in Project 1.1 while the latter two objectives will be pursued in collaboration with researchers working on Project 1.3.

Status

The project commenced on 1 March 2004, with the appointment of Simon Fuller as a full-time PhD student and Philip Collier as a Senior Research Fellow (30%).

Research is progressing according to schedule with initial work focussing on the identification and assessment of currently employed strategies and techniques for quality control of CORS data in a non-real-time environment. The intention is to use the results of this review as a platform for building a real-time quality control module for permanent base stations.

The Victorian Department of Sustainability and Environment (DSE) is a strong contributor and supporter, with a 0.9 full time equivalent commitment. In addition DSE has selected a staff member (Martin Hale) to undertake a part-time Masters degree in the Department of Geomatics. The intention is that Martin will carry out research relevant to the objectives of Project 1.2 while at the same time providing a direct collaborative link to DSE.

Changes in Research Direction

No significant changes in the research direction have been required at this stage and none are anticipated in the foreseeable future.

Project 1.3 - Integrated Positioning & Geo-referencing Platform

Project Leader Jinling Wang, University of New South Wales

Participants

NSW Dept of Lands
University of NSW
43pl (AAMHatch, Fugro, Qasco Surveys)

Aims

Integration of GPS with Inertial Navigation Systems (INS) can provide reliable and complete positioning and geo-referencing parameters including position, velocity and attitude for dynamic platforms for a variety of applications. This project aims to design, develop and test a generic hardware/software platform that can be used as the basis to build customisable integrated positioning/mapping systems. A low cost, integrated positioning sub-system based on GPS and INS sensors will be developed, being one of the components of a man-portable mobile mapping system that has been proposed as a future demonstrator project..

Work done, initiatives and breakthroughs and problems experienced

The project agreement is in the final stage of "signing-off", and therefore the project has not officially started. However, some project tasks are well under way since the beginning of May. From 26th of June 2004, a part time Research Associate has conducted background review of hardware and software aspects of GPS/INS integration. A full time Research Associate will be appointed in August 2004. Currently researchers are focussed on Task 2 (Evaluation of Current GPS/INS Integration) as well as investigating Field Programmable Gate Array technology platforms..

Progress against contract milestones, synopsis of outputs and outcomes

The project is on schedule and Task 1 (appointment of personnel) and its Milestones have been completed on time.

Program 2 - Metric Imagery as a Spatial Information Source

Program Manager Prof Clive Fraser

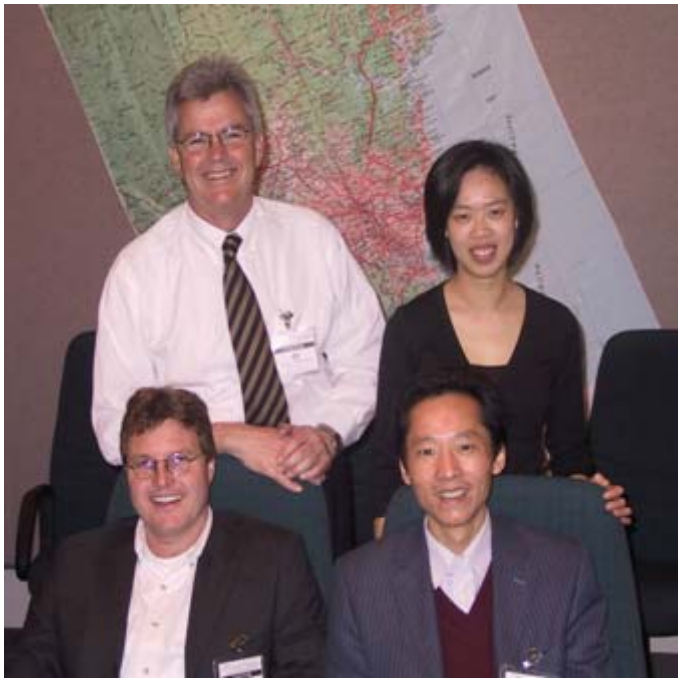
Project 2.1 - Automated Mapping & Feature Extraction from Space, Aerial & Terrestrial Imagery

Project Leader Dr Chunsun Zhang

Participants

Geoscience Australia, Dept Sustainability and Environment, Victoria, Dept of Land Information, WA, Defence Imagery and Geospatial Organisation
University of Melbourne , University of NSW, Curtin University of Technology
43pl (Fugro, Geomatic Technologies, Sinclair Knight Merz)

This project will research and develop geoinformation extraction from metric imagery. The focus will be new and improved techniques and tools for feature extraction from digital aerial and high-resolution satellite imagery. These developments, which will also require research into sensor calibration, sensor orientation modelling, 3D surface analysis and image matching, aim to improve change detection and automated updating of spatial databases.



Outcomes will be new techniques, software tools and procedures for technology transfer to industry. The project will develop models, algorithms, methodologies and robust computational systems for automated feature detection, extraction and modelling from metric imaging sensors for geodatabase updating and change detection.

Summary of work done to date

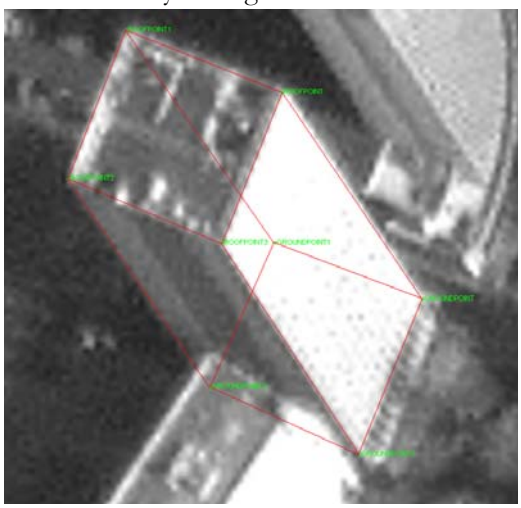
The project commenced with the appointment of the Project Leader, Dr Zhang. His immediate project team within the CRC is a research associate, Dr Jochen Willneff, and a PhD student, Joanne Poon. The first significant activity conducted was a project planning workshop, where participants provided valuable input to a refinement of project objectives and to the development of a detailed research plan.

Project work to date has concentrated in feature extraction, change detection and geodatabase updating. Firstly, building upon the development environment embodied in the BARISTA software system for data processing of satellite imagery, techniques for bias- and terrain-corrected geopositoning from high-resolution satellite imagery (so-called digital monoplotting) have been developed. Also developed has been the ability to perform three-dimensional building frame extraction from single satellite images (see figure below), providing a powerful tool in support of modeling and change detection within cityscapes.

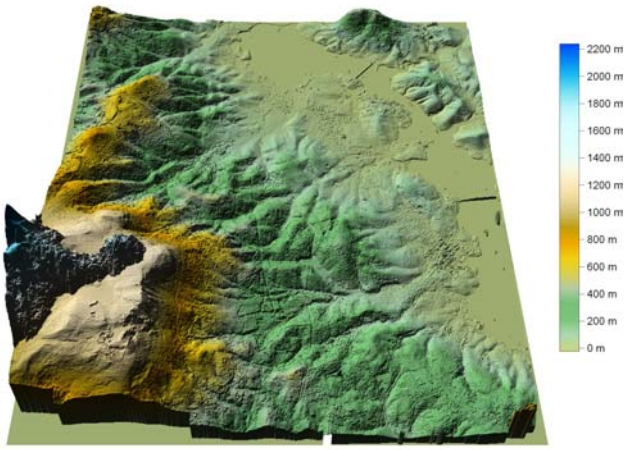
A second initiative related to providing a solid software toolbox to support future research tasks has made good progress, with functionality for improved generation of orthorectified and pansharpened high-resolution satellite imagery completed. Currently underway is the development of a graphical user interface and software tools to facilitate stereo image processing in support of image matching and image-to-image registration.

A third work phase, which is nearing completion, has centred upon an evaluation of the metric potential of stereo high-resolution satellite imagery for automated digital surface model (DSM) generation. In this investigation, an IKONOS stereo pair was used to extract a surface model covering the city of Hobart,

including much of Mount Wellington (see figure below). By comparing the DSM to both first- and last-pulse airborne laser ranging (LIDAR) data, it was found that the accuracy of the IKONOS DSM was in the order of 2m RMS in bare-ground and built-up areas. Such a high level of heighting precision first required application of newly developed sensor orientation models which provide bias-free gepositioning to 1m accuracy throughout the stereo scene with the utilisation of only minimal ground control data.



Semi-automated 3D building frame extraction from satellite imagery



Digital surface model of Hobart from IKONOS stereo imagery (black area to the left is cloud cover)

Project 2.2 Fundamental Modelling, Analysis and Systems Development for Integrated Imaging and Positioning Sensors

Project Leader Dr Derek Lichti

Participants

Curtin University of Technology, University of Melbourne, University of NSW
Defence Imagery and Geospatial Organisation
43pl (AAMHatch, Fugro, Lester Franks, Max Braid, McMullen Nolan, Sinclair Knight Merz)

Aims

1. Development of algorithms for identification and correction of systematic errors in Aerial Laser Scanner (ALS) data by exploitation of geometric observables for use by ALS data/service providers
2. Integration of Terrestrial Laser Scanner (TLS) and ALS data for performance evaluation and creation of three-dimensional mapping products such as virtual city models for use by ALS and TLS data/service providers
3. Procedure development for extrinsic calibration (eg bore sight angles and lever arm) of integrated mapping systems that relies upon minimal ground control for use by aerial photogrammetric data/service providers
4. Development of a combined radiometric and geometric approach to automated scene classification for TLS datasets that can be extended to ALS data for use by ALS and TLS data/service providers
5. Model development for tractable correction of systematic navigation errors in aerial imaging systems for use by aerial photogrammetric data/service providers
6. Software implementation of these developments in 'research code' form ready for industry adaptation, use and commercialisation
7. A test facility run by the research team for calibration and quality control services

Summary of work done to date

All six industry participants have been directly involved in the project. Much work has been done on the development of quality assurance procedures for TLS surveys (aims 6 and 7) with several participants. The project Research Fellow, Stuart Gordon, has been preparing reports on the current status of ALS and TLS research as required by the project milestones and conducting research towards aims 1, 2 and 3. A PhD student, David Belton, has been preparing his candidacy proposal on terrestrial laser scene classification (project aim 5) in consultation with industry participants around the country.

Software to be developed will permit extraction of features from 3D terrestrial laser scanner point clouds (main image example) for complex scenes like this road intersection. Small image is looking southeast from the northwest corner of the intersection.

Example of spectral-based feature extraction. Upper right: photographic image of Curtin University campus. Passive colour and near infrared laser scanner point clouds are at left. Classified point cloud is at lower right. Each colour represents and different surface type

Program 3 - Spatial Information System Design & Spatial Data Infrastructures

Program Manager Prof Ian Williamson

The achievement of Virtual Australia is largely dependent on having effective Spatial Data Infrastructure (SDI) and Spatial Information System designs to support efficient access, retrieval and delivery of spatial information to locations where it is needed from locations where it is stored. An SDI comprises data, standards, access network, institutions and policies, and human resources. Spatial data is held, structured, analysed and disseminated in a host of forms. SDIs are central to supporting an information society and its related industry, and in promoting on-line government.

The current Program aims are to

- develop concepts, functions and principles to help develop Virtual Australia using existing federal and state spatial data initiatives on the enhancement of data access and sharing
- investigate and design the technical, legal and institutional components of SI delivery
- to enhance the capability of government, the private sector and the general community to engage in systems based, integrated and holistic decision making about the future of Australia
- identify and develop an integrated data model and process model that supports automated integration of addresses and spatial location by intelligent geocoding processes and algorithms
- develop a formal model of context for spatial information services on the web or mobile services

Project 3.1 – Concepts and Principles for Virtual Australia

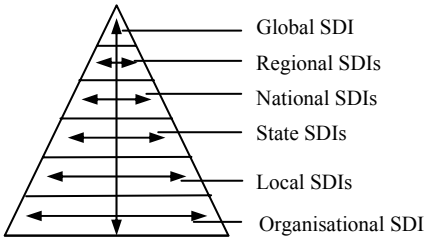
Project Leader Abbas Rajabafard

Participants

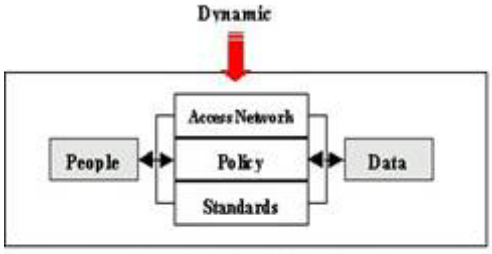
Geoscience Australia, Dept Sustainability and Environment, Victoria, NSW Dept of Lands, Dept of Lands Information, WA , WA DA
University of Melbourne
43pl (Intergraph)

This project will undertake a one-year review and analysis of current spatial information and Spatial Data Infrastructure (SDI) initiatives, including national and related developments in selected jurisdictions at state level in Australia based on SDI Hierarchy, and develop a preliminary set of concepts and principles to facilitate the development of Virtual Australia. This will emphasise the need for seamless integration of SDIs at state and national levels. Current legal, regulatory and institutional issues and limitations concerned with use, access and delivery of spatial data will be identified. Project objectives are to

- review Victoria, NSW, WA and national spatial data and SDI initiatives to identify the potential and limitations of these initiatives
- develop a preliminary set of concepts, functions and principles to show how current SDIs within various jurisdictions can be integrated.



SDI Hierarchy-the complex relationships within and between



SDI Concept- Linking data and people

The research outcomes of this initial one-year project will provide a foundation for identifying best practice and key performance indicators to aid in implementing a Virtual Australia. The project will be guided by the generic concepts and principles of SDIs and the current mechanisms to support the

creation, maintenance and management of a collection of authoritative datasets upon which government decisions are increasingly reliant.

Progress

Project has commenced; project website designed in order to communicate with and update project participants, and updated regularly; Research Fellow appointed; literature review underway; detailed strategy aimed at meeting project deliverables finalised; initial review of SI initiatives underway (Victoria, NSW, WA and national); list of areas and activities to engage and guide project participant involvement in the project has been prepared and sent to participants for finalisation.

Changes to Proposed Research Directions

The direction of the initial 3.5 year project has changed to a one-year focus due to comments and feedback from the CRC. This initial year will lay the foundations for future research in this area by the CRCSI.

Project 3.2 - Intelligent geocoding

Project Leader Assoc. Prof. Bert Veenendaal, Curtin University of Technology

Participants
Curtin University of Technology
Department of Agriculture WA
Department of Land Information, WA
43pl (ESRI, Geomatics Technologies, Lisasoft, NGIS, PSMA Ltd, SKM)

Aims

This project will research and develop intelligent geocoding and addressing models. The outcomes will be better methodologies and procedures for geocoding, integrating and maintaining address datasets. The developments will be used by organisations in government and industry in building, developing, marketing and maintaining national address standard and datasets.

Objectives

- Development and evaluation of an integrated addressing data model and knowledge base to support intelligent geocoding and integration of spatial location, including standard, reverse and contextual translations
- Development of intelligent processes and algorithms for integration and geocoding of urban/rural address data to support a Virtual Australia concept
- Development of intelligent procedures and methods for automating the maintenance and measuring/enhancing the quality of addressing and geocoded data and processes

Work Done

The project has just recently commenced. Current work includes a literature review and defining of the scope and issues involved in geocoding and reverse geocoding.

Project 3.3 - Access to Spatial Data
Project Leader Dr. Stephan Winter

Participants
Dept Sustainability and Environment, Victoria
University of Melbourne
43pl (Intergraph, Lisasoft, Public Sector Mapping Agency, SKM)

Aims

Imagine a traveller, approaching Melbourne by car, and typing in her mobile device *Hotel Windsor*. Currently for such a query she gets a list of links of matching keywords. But what she needs is a phone number, a link for online reservation, a map with route information, and a list of alternative hotels close

by - tailored geographic information to her specific decision needs. Keyword-based search does not consider the context in which the query is posed. Different perspectives on a location require different spatial information. That means a personal guidance service requires an ability to adapt to the individual user needs, ie to identify relevant information (from the web for example) and translate it to specific contexts. This project will contribute to making geographic data accessible by bringing it into context.

This project will develop a formal model of context for spatial information services on the web or mobile services. The application example will be in the domain of way finding services. A formal model of context will allow the derivation of information needs, and in that way guiding geographic data discovery, access, and delivery. The model will be implemented and tested in an agent-based approach, where the agent advises the user and tailors information. This model will interpret information requests for their context, will search for context-relevant information, and access and merge heterogeneous data from different domains for delivery in context-adapted modes.

With such a model at hand the project could

- help data providers to better market their data
- help data brokers / service providers to offer focused services
- help the scientific community to progress in spatial knowledge representation and reasoning.

Next-generation web and mobile services will be built on such models.

Work done

Project commenced; project kick-off meeting; project website; project development and test platform set up; scenarios on the project website; literature research underway.

Program 4 - Earth Observation for Renewable Natural Resource Management

Program Manager Tony Milne

Research Projects within the Program will develop new applications, software and spatial data products from remotely sensed data to more efficiently monitor the environment and to provide basic information to assist resource management. Considerable research is focussed on correcting near-real time imagery from different sensor instruments, across a range of scales, to produce calibrated multi-temporal datasets to quantitatively estimate ground surface features. Modelling and incorporating these datasets into operational routines provide the springboard for commercial initiatives and industry adoption.

Key application areas include developing atmospheric correction algorithms; providing three dimensional topographic analogues from radar and measuring ground surface deformations; characterising soil salinity and vegetation stress using hyperspectral data and developing crop and pasture assessment techniques to improve agricultural production

Project 4.1 Near real-time remote sensing products from MODIS based on NADIR surface reflectance and bio-physical models

Project Leader Craig Smith Geoscience Australia

Participants
Geoscience Australia, Dept of Lands Information, WA
Curtin University of Technology University of NSW
43pl (SKM)

This project will implement, validate and calibrate advanced processing algorithms for MODIS that will result in atmospherically corrected and BRDF normalised data from both moderate and high resolution satellite sensors. This will result in automatic thematic mapping of land surface changes, and more accurate and comprehensive measures of land surface conditions.

The processing requires the use of intellectual property from the many algorithms available from NASA or in the scientific literature for MODIS processing. Project activities include implementing, validating and calibrating them for Australian conditions.

These activities will lead to software for the generation of Below-Atmosphere NADIR reflectance from MODIS and other multi-spectral sensors for use with appropriate interpretive physical models for vegetation condition for Australian conditions, with particular emphasis on QuickBird processing. Achieving this objective makes possible automatic thematic mapping and improved measures of vegetation. It is envisaged that there will be increased value from remote sensing information for precision agriculture, environmental assessment, crop forecasting, automatic land cover change detection and assessing fuel load for wild fire management.

Project 4.2 Digital elevation model generation and differential interferometric synthetic aperture radar (InSAR)

Project Leader – Dr Linlin Ge, University of NSW

Participants

University of New South Wales
Geoscience Australia, Defence Imagery and Geospatial Organisation
43pl (AAMHatch, Apogee)

Aims

The aims of the project are to develop the algorithms, a software toolkit, operational procedures, and sample products for all the three components of the project - InSAR (Interferometric Synthetic Aperture Radar), DInSAR (differential InSAR), and PSInSAR (permanent scattered InSAR) - for use in commercial applications.

The project will generate significant IP in the field of radar interferometry. The CRCSI can therefore provide relevant services either directly through spin-off companies or indirectly through technology transfer to SMEs.

Work done, initiatives and breakthroughs and problems experienced

Airborne Laser Scanner Digital Elevation Models (DEMs), Shuttle Radar Topography Mission DEMs, and Advanced Spaceborne Thermal Emission & Reflection Radiometer DEMs for test sites have been sourced; InSAR algorithms for DEM generation have been developed; and Real Time Kinematic (RTK) GPS data have been collected in the field for the purpose of DEM evaluation.

Project 4.3 A near real time crop and pasture package: integrated remote sensing technologies for improved farm management

Project Leader – Assoc Prof Graciela Metternicht

Participants

Dept of Agriculture, WA, Dept of Land Information, WA
Curtin University of Technology
43pl (Intergraph, Wesfarmers CSBP)
in collaboration with CSIRO

Aims

To deliver an operational, near-real time, easy to access, cost-effective farm package of pastures and crops, containing information on growth rate, crop yield forecast, biomass and pasture quality that can be used by producers to make better tactical and strategic decisions at paddock and farm level. This will require two themes as follows.

Pastures Develop a capacity to estimate paddock-level pasture quality characteristics (botanical composition, nitrogen, fibre, pasture water content, carbohydrate, in vitro dry matter digestibility, organic matter and lignin/cellulose) each month in the winter rainfall dominant Mediterranean region of WA.

Crops Incorporate high temporal resolution remote sensing technology to the existing Stress Index Model (STIN) developed by the Department of Agriculture Western Australia to forecast yield and

estimate plant available soil moisture at the shire level. Such integration will enable a better 'spatialisation' of crop growth status and yield forecasting, in a near real time mode. The project will improve remote biomass and yield estimation in agricultural areas, integrated early detection and mapping of crop planting areas (eg how much is planted and where). These near real time products will enable managers and growers to act on information that tells what is happening now - not what happened last season or in preceding years.

Project 4.4 Development of imaging spectrometry (hyperspectral imagery) products for characterising, mapping, monitoring and managing environmental stress.

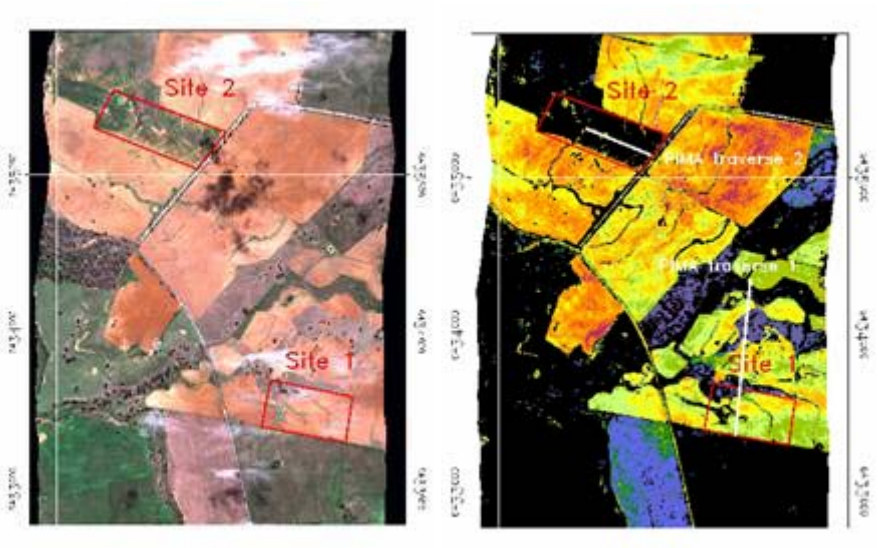
Project Leader Assoc Prof Geoff Taylor

Participants

University of NSW
Others to be determined

The purposes of the project are

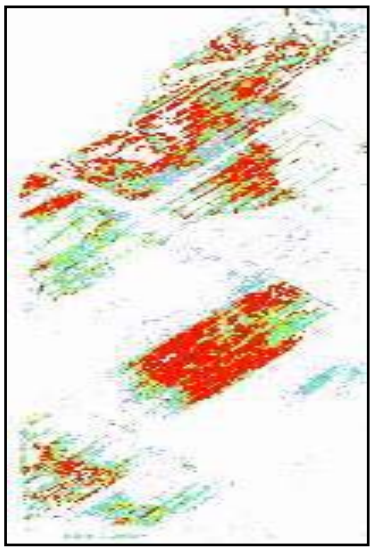
1. To develop user-friendly image-processing software packages which use hyperspectral imagery for a variety of environmental management operations,
2. To determine the spectral properties of soils and vegetation associated with the applications listed in the Business Basis section above and to determine their temporal and seasonal variation.
3. To develop techniques that will allow for the generation of indicators or parameters that are consistent between adjacent swaths and data-takes acquired under differing illumination and climatic conditions.
4. To provide software tools and training that will facilitate the transfer of the technology developed above to commercial entities such as consulting groups, agri-companies and government agencies.
5. To implement the methodologies developed using low-cost, next generation, satellite data.



The image on the left is a true-colour rendition of imaging spectrometry data for the Spicers Creek region near Dubbo, NSW. The area is affected by soil sodicity. The adjacent image (b) shows a map of kaolinite crystallinity for the same area. Areas of low kaolinite crystallinity (reds) have been affected by soil sodicity.

(G Taylor)

Hymap image



Crop vigour

Imaging spectrometry can assess crop stress due to drought, inadequate irrigation, salinity or pests. This has already been demonstrated for

- Pasture grasses
- Cereal crops
- Grapes
- Citrus

(G Taylor)

Program 5 - Modelling and Visualisation for Spatial Decision Support

Program Manager – Prof Ian Bishop

The very high information content of an SDI will not necessarily provide people working in Virtual Australia with the insights that they need to understand the consequences of action (or inaction). Development of knowledge and understanding depends upon an ability to (a) model spatial and temporal relationships, (b) simulate physical processes (c) represent relationships and outcomes in accessible form and (d) work collaboratively within the virtual environment. In short, the program is concerned with analysis, modelling, visualization and collaboration.

This program will not attempt to solve specific real-world problems, nor provide tools for every circumstance. It will research mechanisms for structuring of new generic tools and to develop the tool kits necessary for widespread access to emerging modelling and visualization opportunities.

Aims

To provide access to

- methods to seek out the appropriate data for any given modelling or visualisation task.
- integration of virtual environment development tools with SDI for on-demand three-dimensional models useable within collaborative decision-making environments
- provide intuitive procedures for understanding the uncertainty of both primary and derived data

In addition, to demonstrate the effectiveness of these options through integrative case study application to major environmental issues via research partnerships.

Project 5.1 Support Tools for Spatial Data Mining and Agent-Based Modelling

Project Leader – Dr David Tien, Charles Sturt University

Participants

Charles Sturt University
Others to be advised

There are 3 main approaches to the question of spatial search and image retrieval: text-based search on annotated images (TBSAN), content-based image retrieval and semantic based image retrieval. Currently, there are a number of web search engines, such as Google Image Search, Yahoo Image, AltaVista Image, Ditto, and PicSearch to name just a few. However, these engines are TBSAN. Most of these are based on the technique described in P. Enser's 1995 article, "Pictorial Information Retrieval" in the Journal of documentation. This, in fact, is not spatial image retrieval, but a text search on image descriptions. Textual representation of an image is often ambiguous and non-informative of the actual image content. Filenames may be misleading, adjacent text is difficult to define, and a word may contain multiple senses.

The aim of the Project 5.1 is go beyond the current scope used by Google and Yahoo etc and integrate Content-Based Image Retrieval (CBIR) into the search ability. Although CBIR is not a new idea, the research interests and publications, fuelled by the internet search needs, only took off after 1997.

Project 5.2 - Interfacing visualisation with SDI for collaborative decision making

Project Leader – Prof Ian Bishop

Participants

Geoscience Australia
University of Melbourne
43pl (Fractal Technologies)

Work done, initiatives and breakthroughs and problems experienced

So far, we have reassessed and confirmed the research direction with our research partners mainly through our workshop in Canberra in April 2004. It has been decided that we will develop a prototype for demonstration following our objectives. Two of the images used in defining the objectives are below. We have now evaluated software and have chosen the software packages we are going to use for

development. This will include at least some development based on a (semi-)commercial game engine. As often, each package comes with its own problems, and we are working on solving these.

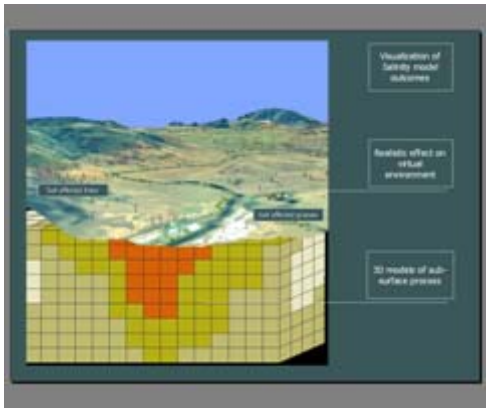
Changes to proposed future research directions

The original aims of objective 2 and 3 were to develop a visualisation platform that combines scientific and realistic 3D model visualisation. We found that there are already a number of software applications that focus on integrating scientific and realistic visualisation per se. However, the effect of scientific models on realistic visualisation (eg salinity models in rural landscapes) is commonly not addressed by commercial visualisation packages. Therefore, objectives 2 and 3 have been changed in this direction. Also, some of our partners suggested that we should consider working on the multi-user environment earlier than outlined. Our current software choices may allow for this.

Progress against contract milestones, synopsis of outputs and outcomes

Review and analysis of development options – we have decided on software packages we want to use and are currently evaluating their strengths and weaknesses.

Review of requirements for objective 1 and 2 – we have decided on our initial strategy and started working on both objectives.



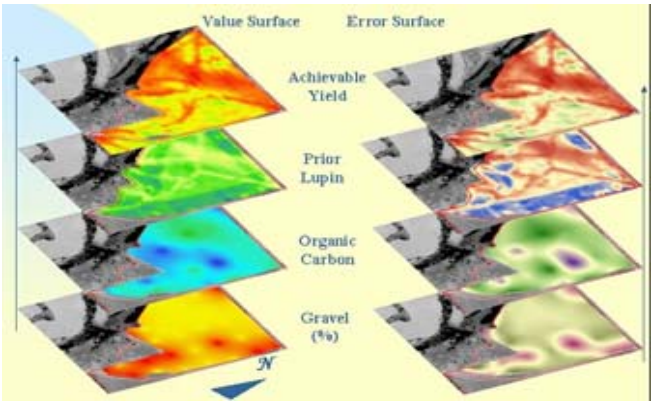
A mock up of the combination of a scientific model with the surface manifestation of subsurface processes.

Project 5.3 – Communicating Spatial Data Quality
Project Leader - Dr Gary Hunter, University of Melbourne

Participants
University of Melbourne, Curtin University of Technology
Others to be determined

The project will design, develop and test solutions for communicating spatial data quality. There are two tasks involved. Firstly, *visualising spatial data quality*: the design, development and implementation of methods and prototype software to enable visualisation of variation in spatial data quality by users of web-based spatial data directories; and provide enhanced techniques for communicating the meaning of data quality statements to users of different skill-levels – and particularly to the rapidly expanding group of non-experts users in our community who need education in this subject.

Secondly, v*isualising error effects in critical application areas:* the design, development and implementation of techniques and user interfaces for quantifying and communicating error and uncertainty at each stage of the application process, by users in federal and state agencies such as agriculture, environmental management and mining, and by consultants servicing these sectors.



The project envisages that for each spatial data layer or map used to help solve a particular problem, there will be an extra map created which shows the error or uncertainty in that map. In this way, we expect to overcome the notion that 'the computer is always right' and provide to users some measure of just how far they can trust their data."

The image is supplied by Dr R. Corner,
Curtin University of Technology.

Program 6 - Demonstrators

Program Manager Peter Woodgate

The demonstrator program brings together key groups in a cooperative relationship to complete demonstrator projects in a short period (about 18 months), typically using existing information and technologies in innovative ways to reveal new areas of research in support of the SI industry and to show the power of SI to existing or new users. This will encourage adoption of SI improve the awareness of the market about "spatial information" capabilities and applications.

Project 6.1 - Regional On-line Spatial Information Emergency Management System
Leader – Mark Carniello, Dept of Land Information, WA

Participants
Dept of Land Information, WA, Dept Sustainability and Environment, Victoria, NSW Dept of Lands, Geoscience Australia
Curtin University of Technology
43pl (Intergraph, NGIS, Sinclair Knight Merz)
External parties on the Expert Reference Group
Vic Country Fire Authority, WA Fire and Emergency Services Authority, WA Dept of Conservation and Land Management, Qld Dept of Emergency Services, WA Dept of Industry and Resources, Western Power Corporation, Bureau of Meteorology, Chevron Texaco

This project will demonstrate the on-line application of Spatial Information technology to regional Emergency Management for both government and private organisations. The project will identify critical requirements in collaboration with end user organisations, define these requirements within a specification, build prototypes based on these specifications and validate the specifications through user testing of these prototypes.

Education

The Education Program will provide educational and training opportunities to people who are, or may become, employed by industries using SI (initially as represented by the CRCSI participants); and will provide a framework of support for the research students involved in CRCSI activities. CRCSI will

- educate existing and emerging scientists and engineers about the advantages of SI applications
- increase awareness and promote an understanding of the many SI applications
- ensure meaningful relationships with other relevant stakeholders

There are three immediate strategies.

Planning and relationships
An analysis of employer skills needs, and of providers servicing those needs, will be undertaken. This will inform the CRCSI short course program and inform future investments. It will also guide CRCSI relationships, in particular to the Australian Spatial Information Business Association, the Australian and New Zealand Land Information Council and the Spatial Sciences Institute (including the SSI's Young Spatial Professionals).

Higher Degree Students
Scholarships for PhD and Masters students will be provided (full and top-up). Participants will be encouraged to bring their own staff into higher degrees by coursework research. Inter-university coordination will enhance degree offerings in several coursework areas, and Honours scholarships and summer schools, amongst other activities, will be considered. Industry short courses will be closely integrated.

Support framework for CRCSI scholars
Industry placements for mutual benefit, and supportive training to prepare students for the market place of their choice will be strongly encouraged. Associate supervisors from the user community will be mandatory for students. CRCSI Conferences will include students.

Short courses will be presented in response to demand and/or for strategic benefit, will be drawn from the research and education activities underway, and will be coordinated with relevant other providers. Exciting areas which the CRCSI can influence include TAFE, school and wider customer awareness. These would require coordination with current providers and will be pursued as and when feasible.

As principles of operation, we will look internationally for inputs to these activities and to our customers; we will look to those areas where we can make a difference as a CRC; and we will embrace current technologies and delivery methods of educational outcomes appropriate to the customers' needs and situations.

CRCSI Student Information

PhD Scholarships

(Masters scholarships will be introduced in the coming year)

David Belton	
Degree of enrolment	PhD
Host (enrolling) institution	Curtin University of Technology
Thesis title (provisional or otherwise)	Extraction of man-made features from terrestrial laser scanner point cloud data
Supervisor(s) (including organisation)	Dr Derek Lichti, Curtin University of Technology
Commencement date	March 2004
Source of funding	Curtin University of Technology (Postgraduate Research Scholarship) & CRCSI (top-up Scholarship)
Program / Project affiliation	Project 2.2
Mark Broomhall	
Degree of enrolment	PhD
Host (enrolling) institution	Curtin University of Technology
Thesis title (provisional or otherwise)	
Supervisor(s) (including organisation)	Merv Lynch & Graeme Wright, Curtin University of Technology
Industry Associate supervisor	Richard Smith, Dept of Lands Information, WA
Commencement date	
Source of funding	CRCSI
Program / Project affiliation	Project 4.1
Weidong (John) Ding	
Degree of enrolment	PhD
Host (enrolling) institution	University of New South Wales (University of NSW)
Thesis title (provisional or otherwise)	Integrated Positioning and Geo-referencing Platform: Development and Testing
Supervisor(s) (including organisation)	Jinling Wang (University of NSW)
Commencement date	July 2004
Source of funding	CRCSI Full Scholarship
Program / Project affiliation	Project 1.3
Simon Fuller	
Degree of enrolment	PhD
Host (enrolling) institution	The University of Melbourne
Thesis title (provisional or otherwise)	Quality Control Issues for Real-Time Positioning
Supervisor(s) (including organisation)	Philip Collier and Allison Kealy
Commencement date	March 2004
Source of funding	CRCSI Full Scholarship
Program / Project affiliation	Project 1.2
Michael Hsing-Chung Chang	
Degree of enrolment	PhD
Host (enrolling) institution	University of New South Wales (University of NSW)
Thesis title (provisional or otherwise)	Differential Radar Interferometry for ground surface displacement monitoring
Supervisor(s) (including organisation)	Linlin Ge, University of NSW
	Chris Rizos, University of NSW
Commencement date	March 2003
Source of funding	CRCSI Full Scholarship
Program / Project affiliation	Project 4.2

Matthew John Hutchinson	
Degree of enrolment (PhD, MSc)	PhD
Host (enrolling) institution	Curtin University of Technology
Thesis title (provisional or otherwise)	Intelligent Geocoding
Supervisor(s) (including organisation)	Dr. Bert Veenendaal, Curtin University of Technology
Commencement date	May 2004
Source of funding	Curtin & CRCSI (top-up Scholarship)
Program / Project affiliation	Project 3.2
Alice O'Connor	
Degree of enrolment	PhD
Host (enrolling) institution	University of Melbourne
Thesis title (provisional or otherwise)	Integrating environmental visualisation with spatial data nfrastructures for collaborative decision making
Supervisor(s) (including organisation)	Ian Bishop &Christian Stock, University of Melbourne
Industry Associate supervisor	John Creasey (Geoscience Australia)
Commencement date	February 2004
Source of funding	CRCSI Full Scholarship
Program / Project affiliation	Project 5.2
Joanne Poon	
Degree of enrolment	PhD
Host (enrolling) institution	University of Melbourne
Thesis title (provisional or otherwise)	Spatial information generation from high-resolution satellite imagery
Supervisor(s) (including organisation)	Prof. Clive Fraser and Dr Chunsun Zhang, University of Melbourne
Commencement date	May, 2004
Source of funding	CRCSI Full Scholarship
Program / Project affiliation	Project 2.1
Martin Tomko	
Degree of enrolment	PhD
Host (enrolling) institution	University of Melbourne
Thesis title (provisional or otherwise)	Personalised way finding directions (provisional)
Supervisor(s) (including organisation)	Stephan Winter, University of Melbourne
	Matt Duckham, University of Melbourne
Commencement date	May 2004
Source of funding	CRCSI Full Scholarship
Program / Project affiliation	Project 3.3

Masters (Research) Student

Abida Iqbal	
Degree of enrolment	MAppSc
Host (enrolling) institution	University of Melbourne
Thesis title (provisional or otherwise)	Data extraction for 3D modelling from multiscale geodatabases
Supervisor(s) (including organisation)	Ian Bishop & Christian Stock, University of Melbourne
Industry Associate supervisor	Hemayet Hossain (Vic Dept Primary Industries)
Commencement date	March 2004
Source of funding	CRCSI Masters Scholarship
Program / Project affiliation	Project 5.2

Collaboration

CRCSI has many participants across Australia. There is also a great diversity in organisation type and size. Respective organisational cultures differ, and are a potential source of friction and misunderstanding, amongst various government agency structures; small service companies and manufacturers; R&D based enterprises and universities. Fostering a CRCSI culture will continue to be a focus of the Governing Board and management.

CRCSI is above all a collaborative enterprise and this is practised in various ways, as described in the following sections.

Internal

The CRCSI has achieved great progress in developing collaborative linkages within the CRC. THE CRCSI is vertically integrated in that leading edge customers are engaged with technology and service providers. In addition many of the customers are also suppliers of the data and infrastructure used by the market in devising new products.

Cooperation amongst geographically spread activities and entities is being assisted through regular telephone and other conferences, efficient email exchange, and coordination of physical meetings by the Board and the executive to allow some time for local site visits and personal interaction. In addition, the substantial level of activity and participants in WA has been recognised and a senior management position appointed in Perth. The website will become increasingly important to connect participants with CRCSI activities and events.

CRCSI communication strategies include

- Annual workshops in each state to bring all participants views into strategic planning, and to encourage understanding across sectors
- Annual Conference of participants for wide-ranging technical discussion and personal interaction
- Annual "satisfaction survey" to be implemented to maintain the engagement of parties
- Project involvement is sought and encouraged for all participants, and projects must have representatives from each area of participants – govt, corporate and academic
- Project Management Groups of wide and diverse membership meet quarterly to discuss project progress and ramifications and potential applications
- Dissemination of project progress reports through a closed web system will allow appropriate information flows and encourage organisational interaction
- Communications Director appointed in June 2004 to drive and resource these strategies, and a Research Director with wide remit to draw players together through program and project seminars for instance
- Board representative seats – for instance two SME representatives sit on the Governing Board
- Representatives on research and industry advisory committees – for instance an SME representative chairs the Industry Advisory & Commercialisation Committee, and both committees have members form each sector in the CRC
- co-location of R&D and management personnel, and activities, in the new CRCSI offices

External

Cooperative arrangements with other CRCs will be actively sought: some 30 CRCs are thought to have strong interests in and applications of spatial information. Initial contact will be made with those of obvious relevance, such as the CRC for Bushfires, predictive mineral discovery CRC, CRC for Sensor Signal and Information Processing and the Australian Biosecurity CRC.

International

The CRCSI plan in this area is to emphasise quality of link over quantity: it is recognised that considerable resources have to be devoted by each party to make such collaborations work and be meaningful. International links are being explored with stand-out organisations such as:

Geoide Network based in the University of Laval in Quebec, Canada (analogous to a CRC, funded through the Canadian programme 'Networks of Centres of Excellence' (http://www.geoide.ulaval.ca)

Space for Geo-Information Collaborative Centre of the European Union – led by Prof Arnold Bregt, based in the University of Wageningen in the Netherlands (http://www.ruimtevoorgeoinformatie.nl)

National

Links have been established with key stakeholder groups, notably ASIBA; SSI and ANZLIC. Mechanisms include board invitations, joint board meetings, membership, committee representation, and invited presentations.

Research Contracts

The CRC has already undertaken several contracts as reported in the later section "Research Grants and Research Contracts". These reflect the relevance of the CRC portfolio and the spread of applications of spatial information.

Management and Operating

The establishment phase of the CRC included a period from January through July 03. Peter Woodgate was appointed as CEO in June 2003. Prior to this Mike Ridout worked as Business Manager from March to July 03, reporting to an Interim Management Committee that operated as a precursor to the Governing Board and was chaired by Bill Charters. Allan Foster and Verity MacDonald assisted early in this financial year. Allan Foster resigned due to ill health in November 2003. Mike Ridout assisted in the Business Manager role, and was Company Secretary, until Graeme Kernich was appointed in March 2004. Mike Ridout was appointed Communications Director in June 2004. Jane Inall was appointed as Personal Assistant to the CEO in November 03 after working on a casual basis for several months.

The University of Melbourne has provided ground floor space in one of its off-campus buildings, rent free for the duration of the CRCSI, with the CRC refurbishing the facilities to appropriate standard. The administration moved into the premises in May 2004 and is now co-located with a substantial number of technical personnel working on CRC projects.

The CRCSI acknowledges and thanks the many people who contributed substantial time and energy to the interim phase and in particular to Prof Ian Williamson.

CRC participants are listed in the initial pages of this report. During the year Defence Imagery and Geospatial Organisation moved from Core to Support status due to perceived risk insurance issues: the change in status will be effected in the 2005 year with no overall loss of DIGO contributions to the CRCSI. The change has been approved by the Commonwealth. Bentley Systems moved from proposed 43pl membership to be the inaugural 'Affiliate Participant.'

Specified Personnel

Title and Name	Role in CRC	Contributing Organisation	2003-04 time
Peter Woodgate	Chief Executive Officer	CRCSI	100 %
Graeme Kernich	Business Manager	CRCSI	33%
Allan Foster	Acting Business Manager	CRCSI	17 %
Michael Ridout	Acting Business Manager	CRCSI	100%
Michael Ridout	Communications Director	CRCSI	
Chris Rizos	Program Manager 1	University of NSW	40 %
Clive Fraser	Program Manager 2	University of Melbourne	35 %
Ian Williamson	Program Manager 3	University of Melbourne	40 %
Tony Milne	Program Manager 4	University of NSW	40 %
Ian Bishop	Program Manager 5	University of Melbourne	27 %
Jack de Lange	Chair, Industry Advisory & Commercialisation Committee	Australian Spatial Information Business Association & 43pl	4 %
Prof Clive Fraser	Chair, Research & Education Advisory Committee	University of Melbourne through CRCSI	4 %

Publications and Patents from CRCSI activities

Category	Authors	Title	Bibliographic detail	Date
Book chapters	Fraser, C.S.	Industrial and Engineering Measurement	*Section 114.3 of the ASPRS Manual of Photogrammetry*, *5th Edition* (Ed. C. McGlone), ASPRS, Bethesda, Md , pp. 1029-1035	2004
	Fraser, C.S.	Free Network Adjustment	*Section 11.2.10 of the ASPRS Manual of Photogrammetry*, *5th Edition* (Ed. C. McGlone), ASPRS, Bethesda, Md , pp. 879-884	2004
	Fraser, C.S.	The Concept of Camera Self-Calibration	*Section 11.2.9 of the ASPRS Manual of Photogrammetry*, *5th Edition* (Ed. C. McGlone), ASPRS, Bethesda, Md , pp. 870-879	2004
	Fraser, C.S.	Measurement Performance of High-Resolution Satellite Imagery	Chapter 6, Theory and Practice of Digital Photogrammetry. Eds: S.Murai, H.Chikatsu, Japan Association of Surveyors, Tokyo, 343p., pp.93-105	2004
Refereed journals	Chang, H.-C., M.-H. Chen, L. Qin, L. Ge, C. Rizos	Ground subsidence monitored by L-band Satellite Radar Interferometry	Geomatics Research Australasia, 79, 75-89.	Dec 2003
	Crompvoets, J., Rajabifard, A., Bregt, A. & Williamson, I.P.	Assessing the worldwide developments of national spatial data clearinghouses	International Journal of GIS, vol. 18, pp 1-25	2004
	Fraser, C.S.	Prospects for Mapping from High-Resolution Satellite Imagery	Asian Journal of Geoinformatics, 4(1): 3-10	2003
	Fraser, C.S., Dare, P.M. and Yamakawa, T.	Digital Surface Modelling from SPOT 5 HRS Imagery Using the Affine Projective Model.	International Archives of Photogrammetry and Remote Sensing, 35(B1): 385-388.	2004
	Fraser, C.S. and Yamakawa, T.	Insights into the Affine Model for Satellite Sensor Orientation	ISPRS J. of Photogramm. & Remote Sensing, 58(5-6): 275-288.	2004
	Fuse, T., Fraser, C.S. and Dare, P.M.	Comparative Analysis of Area-Based Image Matching Techniques for High-Resolution Satellite Imagery	International Archives of Photogrammetry and Remote Sensing, 35(B3): 601-605.	2004
	Hanley, H.B. and Fraser, C.S.	Sensor Orientation for High-Resolution Satellite Imagery: Further Insights into Bias-Compensated RPCs.	International Archives of Photogrammetry and Remote Sensing, 35(B1): 24-29.	2004
	Gordon, S.J. and D.D. Lichti	Terrestrial laser scanners with a narrow field of view: the effect on 3D resection solutions	Survey Review 37 (292): 448-468	2004
	Noguchi, M., Fraser, C.S., Nakamura, T., Shimono, T. & Oki, S.	Accuracy Asessment of Quickbird Stereo Imagery	Photogrammetric Record, 19(106): 128-137	2004
	Otepka, J.O. and Fraser, C.S.	Accuracy Enhancement of Vision Metrology Through	International Archives of Photogrammetry and Remote	2004

		Automatic Target Plane Determination.	Sensing, 35(B5): 873-879.	
	Trisirisatayawong, I., Jongrugenun, T., Phalakarn, B., Satirapod, C. and Fraser, C.S.	Enhancing the Prospects for Mapping from High-Resolution Satellite Imagery in the Developing World	International Archives of Photogrammetry and Remote Sensing	2004
	Yamakawa, T. and Fraser, C.S. (2004).	The Affine Projection Model for Sensor Orientation: Experiences with High-Resolution Satellite Imagery	International Archives of Photogrammetry and Remote Sensing, 35(B1): 142-147.	2004
published conference papers	Bae, K.-H. and D.D. Lichti	Automated registration of unorganised point clouds from terrestrial laser scanners	International Archives of Photogrammetry and Remote Sensing 33 (B5/2)	2004
	Fraser, CS, Dare, PM, Hanley, H.B., Yamakawa, T & Cronk, S	Advances in geometric processing of high-resolution satellite imagery for three dimensional scene analysis	Proceedings. of Spatial Sciences 2003, Canberra,	22-27 Sep 2003
	Fraser, C.S., Hanley, H.B.	Bias-Compensated RPCs for Sensor Orientation of High-Resolution Satellite Imagery	Proceedings of the ASPRS Annual Conference, Denver	2004
	Fraser, C.S. and Yamakawa, T.	Applicability of the Affine Model for Ikonos Image Orientation over Mountainous Terrain	Proceedings. of Joint Int. Workshop "High Resolution Mapping from Space 2003", Hanover	6-8 Oct 2003
	Gordon, S. J., D. D. Lichti, M. P. Stewart and J. Franke	Modelling point clouds for precise structural deformation measurement	International Archives of Photogrammetry and Remote Sensing 33 (B5/2)	2004
	Linlin Ge, Hsing-Chung Chang, Volker Janssen, Chris Rizos	The integration of GPS, radar interferometry and GIS for ground deformation monitoring	2003 Int. Symp. on GPS/GNSS, Tokyo, Japan, 15-18 November, 465-472.	15-18 Nov 03
	Hsing-Chung Chang, L Ge, C Rizos, B Hebblewhite, M Omura	Repeat-pass satellite radar interferometry for mine subsidence monitoring	11th Australasian Ground Control in Mining Conference, Sydney	10-13 Nov 03
	Lichti, D.D.	A resolution measure for terrestrial laser scanners	International Archives of Photogrammetry and Remote Sensing 33 (B5/2)	2004
	Lichti, D.D. and S.J. Gordon	Error propagation in directly georeferenced terrestrial laser scanner point clouds for cultural heritage	FIG Working Week 2004. Athens, Greece	22-27 May 04
	Lichti, D.D. and J.Franke	Feature extraction from terrestrial laser scanners	Photogrammetrie Laserscanning Optische 3D-Messtechnike Oldenburger 28-29 January. 254-261.	2004
	Rajabifard, A. & Williamson, I.P.	SDI Development and Capacity Building	Proceedings of the 7th GSDI Conference, Bangalore, India	2-6 Feb 04
	Richter, K.-F., Klippel, A., Freksa, C.	Shortest, Fastest, - but what Next? A Different Approach to Route Directions	Geoinformation und Mobilität - von der Forschung zur praktischen Anwendung. Beiträge zu den Münsteraner GI-Tagen. Münster: IfGIprints. Institut für Geoinformatik.	2004
	Chris Rizos, Linlin Ge, Hsing-Chung Chang, Andrew Nesbitt	The integration of GPS, Satellite Radar Interferometry & GIS technologies for ground subsidence monitoring	Spatial Sciences Coalition 2003 Conf., Canberra, Australia, 23-25 September, CD-ROM proc	23-25 Sep 2003
	Vozikis, G., Fraser, C.S. and Jansa, J.	Alternative Sensor Orientation Models for High-Resolution Satellite Imagery	Proceedings of 23rd Scientific Conference of the German Society of Photogrammetry & Remote Sensing, Bochum	9-11 Sep 2003
	Williamson, I.P.	Building SDIs – The Challenges Ahead	Proceedings of the 7th GSDI Conference, Bangalore, India	2-6 Feb 04

Public Relations, Presentations & Communication

Presentations to Government, Industry, Research and other Organisations

Date	Title	Presenter	Audience	CRC involvement	Outcomes
9 Jul 2003	Spatial Information Sciences	Peter Woodgate	150 - industry	Keynote speaker	Promotion of CRC, research activities and strategic directions
16 Jul 2003	Queensland Spatial Information Systems Conference	Peter Woodgate	70	Keynote speaker	Promotion of CRC, research activities and strategic directions
8 Aug 2003	NEWTECH Conference	Peter Woodgate	100	Keynote speaker	Promotion of CRC, research activities and strategic directions
Aug-Sep 2003	Program Workshops	Program Managers and Project Leaders	200 – industry, academia, govt users	Internal research planning workshops	Planning of CRC research activities and directions
23-25 Sep 03	SIS Annual Conference	Peter Woodgate	500	Keynote speaker	Promotion of CRC, research activities and strategic directions
24 Oct 2003	Bureau of Rural Sciences	Peter Woodgate	40	Seminar presentation	Promotion of CRC, research activities and strategic directions
14 Nov 2003	Bureau of Meteorology and CSIRO Divn Atmospheric Research	Peter Woodgate	8	Internal presentation	Exploring collaborative links
25Nov 2003	Landcare Crown Research Institute	Peter Woodgate	6	Presentation	Exploring collaborative links
27 Nov 2003	Meeting of the Surveyors General	Peter Woodgate	30 – government users	Presentation	Exploring collaborative links
27 Nov 2003	Institute of Geological and Nuclear Sciences	Peter Woodgate	8	Presentation	Exploring collaborative links
18 Dec 2003	NGIS Industry Breakfast series	Mike Ridout	90 – industry and government users	Invited presentation	Promotion of CRC, activities and strategic directions to potential new participants
26 Jan 2004	Pastoral & Veterinary Institute Conference	Peter Woodgate	40	Presentation	Exploring collaborative links
2004	Gippsland Regional Conference	Peter Woodgate	70	Presentation	Promotion of CRC, research activities and strategic directions
24 Mar 2004	Web enabled GIS Strategies Conference	Peter Woodgate	120	Keynote speaker	Promotion of CRC, research activities and strategic directions
28 Apr 2004	Dept Primary Industries Future Sciences Forum	Peter Woodgate	200	Keynote speaker	Promotion of CRC, research activities and strategic directions

Date	Title	Presenter	Audience	CRC involvement	Outcomes
1 Jun 2004	GIS for Emergency Management Forum	Peter Woodgate	100	Keynote speaker	Promotion of CRC, research activities and strategic directions
Feb 2004	Presentation to Board of Australian Spatial Information Business Association	Peter Woodgate	10	Internal Presentation	Strategic collaborative links
Feb – Mar 2004	Seminars with 43pl industry members in each Australian region	Peter Woodgate, Mike Ridout	83	Internal workshops	Strategic directions and industry input
Mar 2004	Joint Board meeting with the Australia and New Zealand Land Information Council board	CRCSI Board	23	Joint Board meeting	Strategic collaborative links
Apr-May 2004	Seminars with CRCSI Participants in each Australian region	Peter Woodgate, Mike Ridout	128 – CRCSI participant personnel	Internal workshops	Development of Strategic Plan
8 Jun 2004	CRCA Conference	Mike Ridout	200	Presentation on 43pl – the way CRCSI interacts with SMEs	
Jun 04	Developments in public participation and collaborative environmental decision making	Ian Bishop	Keynote address GIS research conference – Norwich UK	Topic for about 40% of talk	Promotion of CRCSI research Program 5
Jun 04	Visualization for planning and management in natural and built environments	Ian Bishop	Presentation to GIS research group Chinese Academy of Sciences, Beijing	Topic for about 30% of talk	Collaborative projects under negotiation

Grants and Awards

Awards prizes, medals, and election to Academies	Recipient	Description
Award for Best Papers by Young Authors International Society for Photogrammetry and Remote Sensing	Dr Derek Lichti	20th Congress, Istanbul, Turkey, 2004
Student Sponsorship from the IEEE Geoscience & Remote Sensing Society	Mr Michael Hsing-Chung Chang	Travel award to IGARSS2004 in Anchorage, Alaska, to present a paper in the Student Prize Competition

Research Grants and Research Contracts

Research Grants					
Researcher	**CRC Participant**	**Title**	**Source**	**Period**	**Amount**
Simon Fuller	University of Melbourne	Quality Control Issues for Real Time Positioning	University of Melbourne (PCAS scholarship)		$ 600
Linlin Ge & Chris Rizos	University of NSW	Real-time atmospheric modelling for centimetre-level positioning based on Global Navigation Satellite System continuously operating reference station networks	ARC-Linkage	2004-2007	$ 525,264
Linlin Ge& Chris Rizos	University of NSW	Integrated GPS and Interferometric SAR Techniques for Ground Subsidence Monitoring	ARC-Discovery	2002-2004	$ 369,000
Linlin Ge	University of NSW	Equipment (Software and Hardware) Support for New Research Direction: Radar Remote Sensing	University of NSW -RIBG	2004	$ 60,000
Linlin Ge	University of NSW	An Integrated Ground Deformation Monitoring System Based on the Integration of InSAR, GPS and GIS Technologies	ARC-Linkage International	2003-2004	$ 21,300
Linlin Ge	University of NSW	Generation of High Accuracy and High Resolution Digital Elevation Models Using Multi-modal Satellite Radar Interferometry	University of NSW -FRG	2003	$ 20,000
Allison Kealy	University of Melbourne	Real-time atmospheric modelling for cm-level positioning based on continuously operating global navigation satellite system reference station networks	ARC	2004-2007	$ 525,264
Graciela Metternicht	Curtin University of Technology	Development of New Generation Tools for Regional-Scale Mapping of Noxious Weeds	ARC-Linkage	2004 - 2007	$ 149,300
Stephan Winter	University of Melbourne	PhD tuition waiver grant for Martin Tomko	University of Melbourne	2004-2007	$ 84.000
Research Contracts and Consultancies					
Researcher	**CRC Participant**	**Title**	**Source**	**Period**	**Amount**
Linlin Ge	University of NSW	Differential Radar Interferogram of the Burakin Area, WA, Using Satellite Radar Data	Geoscience Australia	2003	$ 21,900
Linlin Ge	University of NSW	Monitoring Ground Subsidence Due To Underground Mining Using Integrated Space Geodetic Techniques	Australian Coal Association Research Program	2002-2003	$ 80,000
Allison Kealy	University of Melbourne	Evaluating the performance of future GNSS infrastructure	Dept Sustainability and Environment, Victoria	2004	$ 2,000
Allison Kealy	University of Melbourne	Atmospheric Modelling for GNSS Reference Station Networks	Dept Sustainability and Environment, Victoria	2003-2004	$ 30,000

Performance Measures

The CRCSI Board is concerned to establish the right culture within the CRC in order to maximise the benefits of bringing together high quality resources from across the SI community. A culture of innovation, enabling the CRCSI to build on capabilities that have already been brought together is essential.

With the right management structures in place, the CRCSI will pursue new business development opportunities based on collaboration, and on attraction of personnel and ideas of the highest quality. It is the task of all CRCSI personnel, from student to administrator, from researcher to director, to maximise our impact on Australia's economic benefit.

As part of its strategic planning the CRCSI produced a new set of performance indicators that covered and in some cases extended those within the Commonwealth Agreement. Formal adoption of the new set of indicators will be sought in the coming year.

The performance of the CRCSI will be measured by the following six indictors by 30 June 2010. The CRCSI will also be subject to external review by the CRC Programme of the Department of Education, Science and Training. A further performance measure about education will be added when the Education Program Plan has been completed.

1 **The CRCSI participants will obtain significant tangible and intangible benefits as a result of their participation**. This will be measured annually through a comprehensive survey of stakeholders. The survey should show that at least 75 % of respondents meet this measure in the first year, with the number increasing in each subsequent year. Participants can determine their own definition of 'direct and significant tangible and intangible benefit.'

2 **The CRCSI will generate at least $5.3 million of new revenue in the first seven years**. This revenue will be in addition to the shareholder, supporting partner and Commonwealth funds committed in the founding contracts. The revenue will be derived from the commercialisation of CRC IP, contract research, new grant funds, new shareholder funds and third party contributions.

3 **The CRCSI will ensure that at least one stakeholder from each of the industry, government and education sectors is involved in each CRC project, with at least two of the sectors making a major contribution**. A 'major contribution' is defined as equivalent to 20 percent of an effective full-time person per annum. In addition, the CRC will monitor the amount of time spent by researchers in the offices of users, and the amount of time spent by employees of the non-university participants in the research environment.

4 **The average annual turnover in revenue of 43pl members will increase more than the industry average**. The industry average will be drawn from independent survey data.

5 **25 PhD and research Masters candidates will have research degrees in progress or completed**.

6 **At least 75 percent of projects will be rated as 'world classes by an independent review.** The independent panel will include at least one international person and 'user' experts. World class will be defined by direct comparison with the best known examples of similar work overseas, the functionality of project outputs, the quality of research papers, and the number and quality of international connections and collaborations, among other criteria.

Appendix 1 - Glossary and Acronyms

43pl	43 Pty Ltd, a company representing the SME consortium as a core participant to the CRCSI
ACC	Audit & Compliance Committee
ANZLIC	Australia and New Zealand Land Information Council
ASIBA	Australian Spatial Information Business Association
ASIERA	Australian Spatial Information Education and Research Association
CORS	Continuously Operating Reference Station
DEM	Digital Elevation Model
DInSAR	differential InSAR
GB	Governing Board
GIS	Geographical Information Systems
GPS	Global Positioning Satellites
ICC	Research & Education Committee
INS	Inertial Navigation Systems
InSAR	Interferometric Synthetic Aperture Radar
PSInSAR	permanent scattered InSAR
REC	Industry & Commercialisation Committee
SDI	Spatial Data Infrastructure
SISL	Spatial Information Systems Ltd
SSI	Spatial Sciences Institute

Appendix 2 – Executive and Meetings Attended

CRCSI Governing Board	Meetings attended	Meetings held in term of appointment
Em Prof Bill Charters	*5*	*5*
Peter Woodgate	*5*	*5*
Mary O'Kane	*5*	*5*
Roland Slee	*3*	*5*
Bill Richards	*4*	*4*
Tony Burns (alternate is Chris Grant)	*3 (1)*	*4*
Neil Williams (alternate is Peter Holland)	*4 (1)*	*5*
Grahame Searle	*5*	*5*
Warwick Watkins (alternate is Des Mooney)	*4 (1)*	*5*
Colin Sutherland	*5*	*5*
Jannie van Deventer	*5*	*5*
Michael Ridout (Company Secretary to March 04)	*4*	*4*
Graeme Kernich (Company Secretary from March 04)	*2*	*2*
Audit and Compliance Committee		
Mary O'Kane	*2*	*2*
Warwick Watkins	*2*	*2*
Neil Williams	*2*	*2*
Graeme Kernich (Company Secretary from March 04)	*2*	*2*
Michael Ridout (Company Secretary to March 04)	*2*	*2*
Research and Education Advisory Committee		
Clive Fraser	*3*	*3*
Peter Woodgate	*3*	*3*
Bill Charters	*3*	*3*
Peter Loughrey	*2*	*2*
Roland Slee	*3*	*3*
Colin Sutherland, University of NSW	*3*	*3*
Bruce Thompson	*0*	*0*
Industry Advisory and Commercialisation Committee		
Jack de Lange, ASIBA	*3*	*3*
Tony Burns	*1*	*3*
Hun Gan	*0*	*0*
Peter Woodgate	*3*	*3*
Grahame Searle	*3*	*3*
SISL Board		
Bill Charters	*4*	*4*
Peter Woodgate	*4*	*4*
Mary O'Kane	*4*	*4*
Roland Slee	*4*	*4*
Michael Ridout (Company Secretary to March 04)	*4*	*4*
Graeme Kernich (Company Secretary from March 04)	*2*	*2*