



CRC for Spatial Information

ANNUAL REPORT 2006-07

'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'.

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



Those who wish a deeper knowledge of CRCSI activities are referred to the corporate web page and are welcome to contact the CRCSI office.

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Core Participants



Australian Government
Geoscience Australia



Queensland Government
Natural Resources and Water



Department of Agriculture and Food
Government of Western Australia



Department of Lands
Reliable from the ground up



Department of Sustainability and Environment



Department of Primary Industries



UNSW



CRC·si is established and supported under the Australian Government's Cooperative Research Centres Programme

Support Participants



Australian Government
Department of Defence



ESRI Australia



43pl members



AAMHatch
Advanced Spatial
Technologies
Alexander & Symonds
Apogee Imaging
International
Beveridge Williams & Co
Brazier Motti
Brown & Pluthero
C. R Hutchison & Co
CSBP Limited
CTF Solutions
D.M. Gerloff & Associates
Fugro Spatial Solutions
Geodata Information
Systems
Geogenx
Geomatic Technologies
GIS Jobs International
Glennedw

gpsAg
integrate Systems
Industrea
Intergraph
Land Equity International
Leica Geosystems
Lester Franks Survey &
Geographic
Lisasoft
LogicaCMG
Pitney Bowes MapInfo
Australia
Max Braid Surveyors
McMullen Nolan & Partners
Navigate
NGIS Australia
Omnalink
Omnistar
Peter W Burns
Position 1 Consulting

PSMA Australia
QASCO Surveys
Reeds Consulting
Scanalyse
Searle Consulting NQ
Sinclair Knight Merz
Social Change Online
Spatial Information
Technology Enterprises
Spatial Vision
Sundown
SuperAir
Trimble
Twynam
V-TOL
VPAC
Webmap
we-do-IT
Whelans

“More than 80% of respondents expect the **CRCSI will add value** to their business in the future and expect that the future **competitiveness of their business will be enhanced** through their participation in the CRCSI”

Third Year Review independent industry survey of non-university CRCSI participants

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CRC for Spatial Information

Vision

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

The application of the vision is 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, 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 linked through this vision.

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 public private collaboration to build institutional capacity.



Chair and CEO Report

The CRCSI has now completed its fourth year of operation.

In late 2006 the CRCSI was successful in winning a supplementary bid. This bid has brought an additional \$15 million of cash and in-kind comprising \$2.7 million from Commonwealth Government, another \$2.7 million cash from new and existing partners and the remainder is pledged in-kind. The bid sees our first new large corporate joining us in Ergon Energy, Queensland's largest energy distributor. We have also been joined by two universities: Queensland University of Technology and the University of New England. In addition, ten new companies have joined us: CTF Solutions, gpsAg, Industrea, PositionOne Consulting, Geogenx, SuperAir, Sundown Pastoral, Twynam Agricultural Group, Trimble, and V-Tol Aerospace. Our existing partner, Queensland Department of Natural Resources and Water, increased its contribution and brought in the Queensland Department of Treasury as well. All of these new partners have joined us to work on four strongly user-led projects in the energy, agriculture, positioning and data provisioning areas. The CRCSI is delighted with this new development.

The CRCSI has also been instrumental in helping with the formation of a new body called the Australian Spatial Consortium which was conceived at the annual Strategic Planning meeting in March 2007 and launched by the Hon. Gary Nairn MP, Special Minister of State in Canberra in August 2007. The ASC has been formed in recognition of the need to create a mechanism to bring together on a formal and regular basis the public and private sectors of the spatial information industry to tackle issues of national significance in a genuine partnership. As a high priority the ASC wishes to facilitate the development of a fully integrated network of infrastructure to permit precise positioning (to the centimetre level) right across Australia, and to roll out a simple licencing mechanism to facilitate speedy access (in near real time) to government held datasets. The ASC is keen to help set the long-term agenda for research in Australia.

There has been very pleasing growth in the number of 43 Pty Ltd (43pl) members and their collective contributions to the CRCSI. There are now 53 members of 43pl. In-kind contributions for 2006/07 were \$1.6 million, over \$1.0 million more than was originally pledged. This growth in the engagement of members is a genuine reflection of the importance of the relationship between the CRCSI and the companies.

We were very pleased to receive the 2007-08 STAR Award for Small Business Engagement, in recognition for our work with our novel SME consortium 43pl.

The CRCSI completed its third year review in December 2006. The independent review panel interviewed about 60 of our staff and stakeholders and noted in their final report that "... the CRC has made significant and given that it has been operating just three years, remarkable progress in its objective of seeing its research results and expertise transferred into use The CRC has done an outstanding job in working with industry and government ...". The report encouraged the CRCSI to further develop the big picture vision for research in Australia.

The CRCSI progressed several commercialisation ventures: HazWatch, now known commercially as Indji, is being developed through iintegrate Systems Pty Ltd, a web services product designed to integrate emergency services information; MillMapper, through Scanalyse Pty Ltd, which significantly reduces the maintenance cost of grinding mills through smart new laser monitoring technologies; and Barista, a low cost software system for processing high resolution satellite imagery. We also commenced the creation of a spin-out company in partnership with the University of New South Wales to commercialise the services of our radar satellite imaging group which has developed world-class capabilities in radar processing.

The CRCSI has again exceeded targets for the generation of new revenue and in-kind contributions from. For the four years to date, our total cash contributions of \$17.0 million exceed our target of \$16.3 million. Most of the additional revenue has come from partners and clients who have provided additional funding to existing projects as well generating new contract research projects. Our cumulative in-kind contributions of \$35.9 million exceed our target of \$27.3 million. The additional in-kind has been provided by all sectors; our companies, the universities and the government.

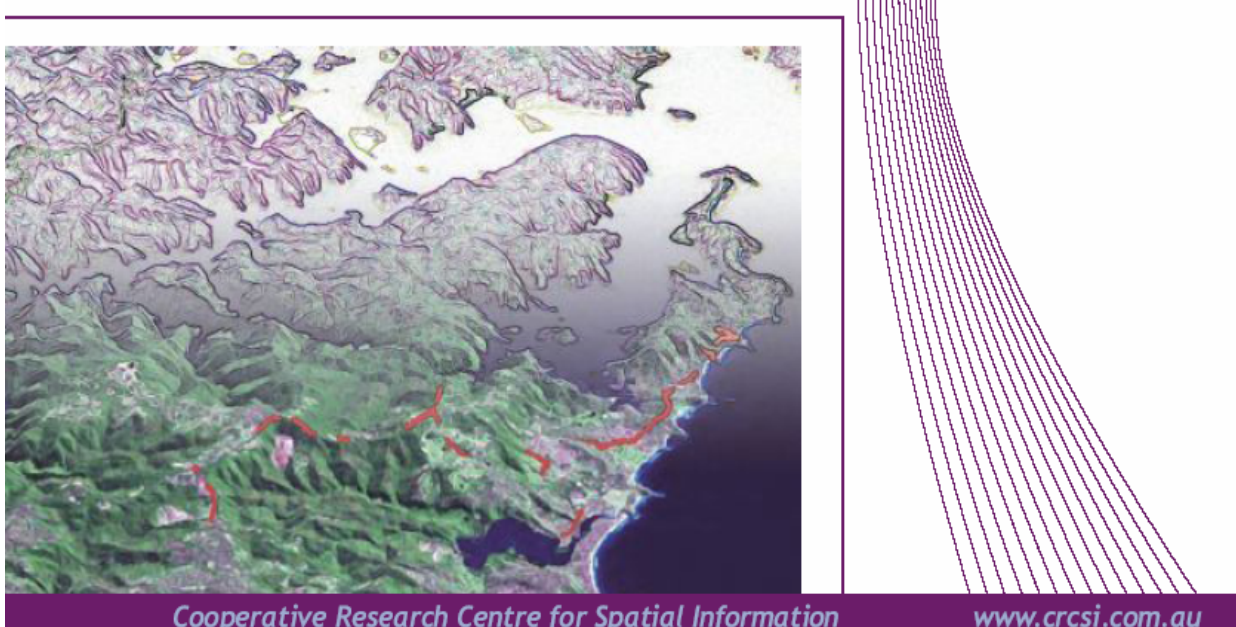
The CRCSI continues to make pleasing progress. This is in no small measure due to the quality and dedication of the Directors of its Governing Board, and the CRCSI's management team, researchers and staff. We would also like to thank all the partners of the CRCSI who continue to support and encourage our current activities and future directions.



Mary O'Kane
Chair



Peter Woodgate
CEO



National Research Priorities

The National Research Priorities (NRPs) are thematic and are underpinned by 'priority goals'. There are four priorities:

1. An environmentally sustainable Australia
2. Promoting and maintaining good health
3. Frontier technologies for building and transforming Australian industries
4. Safeguarding Australia.

Geo-information, a synonym of spatial information, is highlighted in federal government descriptions of designated NRPs as an example of a Priority Goal, namely Breakthrough Science. Projects within the CRC SI's portfolio are also aligned with other NRPs, and especially the Priority Goals of Smart Information Use, Frontier Technologies, Critical Infrastructure and Transformational Defence Technologies.

Spatial Information is a platform technology and as such it is very relevant to all NRPs. In particular, the CRC SI work in remote sensing and earth observation is contributing to natural resource management and related environmental work. Our location based services research and development is helping build what has been called the "fifth infrastructure", that of location. The CRC SI HazWatch and i-loka research products are being implemented in emergency management situations and trialled for potential defence use.

DEST Table 1: National Research Priorities and CRC Research

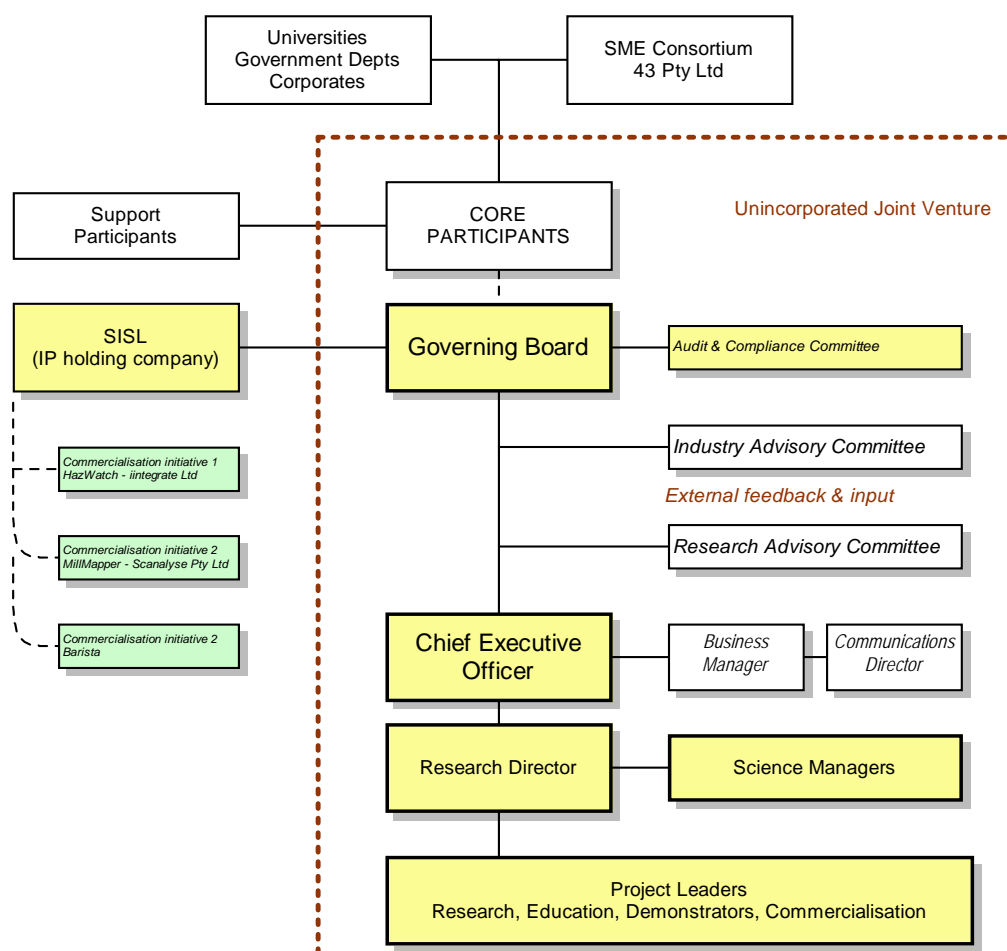
NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA - <i>Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies</i>	
Transforming existing industries	5
Sustainable use of Australia's biodiversity	4
FRONTIER TECHNOLOGIES FOR BUILDING AND TRANSFORMING AUSTRALIAN INDUSTRIES - <i>Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research</i>	
Frontier technologies	69
Smart information use	12
SAFEGUARDING AUSTRALIA - <i>Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems</i>	
Critical Infrastructure	7
Understanding our region and the world	3

Governance and Management

The CRCSI is an unincorporated joint venture but operates as though it were a company. It has an eleven member board of directors comprising four independents and seven nominated members. There are three key Board advisory committees; the Research and Education Committee, the Industry Committee and an Audit Committee.

Management comprises a four member Executive and two executive support staff, four Science Program Managers, and some twenty Project Leaders. An Education Reference Group that meets regularly and Project Management Groups that meet quarterly to review each project make up the key management structures.

Spatial Information Systems Ltd is the IP holding company and commercial agent of the CRCSI. The structure 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 arrangements.



Roles and Accountabilities

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

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 43pl and university colleges
- three representing the government college

Directors as at 30 June 2007 are listed below.

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 CRCSI by Mr Henry Bosch AO.

The Board oversees operations and provides the CEO general policy direction. 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 and Corporations Law.

Audit & Compliance Committee

The Audit and Compliance Committee met once this year. It supports the audit process and CRCSI fiduciary and other protocols. Membership at 30 June was Bill Charters (Chair), Bill Richards and Tony Burns. Pitcher Partners is the auditor for the CRCSI, SISL and 43pl.

Research & Education Advisory Committee

This independent committee provides advice and recommendations to the Board on the research and education activities of the CRCSI. It met four times in the year, jointly with the Industry Advisory and Commercialisation Committee. The Chairman is an observer at Board meetings. Its membership at 30 June was

Clive Fraser	CRCSI Research Director, (Chairman)
Arthur Berrill	Pitney Bowes MapInfo
Peter Loughfrey	ESRI Australia
Roland Slee	Oracle Corporation
Peter Woodgate	CRCSI CEO
Graeme Wright	Curtin University of Technology

Industry Advisory & Commercialisation Committee

This committee advises the Board on industry and commercialisation matters. It met four times in the year, jointly with the Research & Education Committee. The Committee Chairman is an observer at Board meetings. Membership at 30 June was

Jack de Lange	Australian Spatial Information Business Association (Chairman)
Tony Burns	Land Equity Pty Ltd
Hun Gan	Starfish Ventures Pty Ltd
Bill Richards	Fugro Spatial Solutions Pty Ltd
Grahame Searle	Landgate WA
Neil Williams	Geoscience Australia
Peter Woodgate	CRCSI CEO

Spatial Information Systems Limited (SISL)

CRCSI established SISL to hold its intellectual property and oversee its exploitation. SISL acts as the commercial agent for the CRCSI participants to identify, protect, use and commercialise the Centre Intellectual Property. The SISL Board met three times in the

year. The CRCSI Governing Board is also the Board of SISL but has delegated authority to

Mary O’Kane (Chair)

Tony Burns Land Equity Pty Ltd

Bill Charters Independent

Les Field UNSW

Roland Slee Oracle Corporation

Warwick Watkins NSW Dept of Lands

Peter Woodgate CRCSI CEO

43pl – the SME consortium

43pl is a company established as a construct to efficiently manage the large number of small to medium sized enterprises (SMEs) to participate in the CRC. It has a board that oversees the trust, in which member companies hold units proportional to their aggregate cash subscription. Board directors come from each state involved in the CRCSI. Two 43pl representative directors on the CRC Board are elected from nominations by the membership of 43pl.

43pl is itself a core participant in the CRC. The proprietary limited company brings together over 50 small to medium enterprise companies through a unit trust deed. Each SME is a unit trust holder. There are five shareholders in the 43pl company, one from each of Tasmania/Victoria, Western Australia, South Australia/Northern Territory, New South Wales/Australian Capital Territory and Queensland. A company from each state/territory provides the Director for the Board of 43pl. At 30 June 2005 the 43pl Directors were Mark Judd (Chair, Victoria and Tasmania), Jack de Lange (Queensland), Dean Howell (SA), Bill Richards (WA), Ian Batley (NSW & ACT). All states and territories with the exception of the Northern Territory have headquarters of 43pl members.

During the year new companies joined CRCSI through 43pl bringing the total at 30 June 2007 to 53. In addition the CRCSI was won the 2007 STAR Award for Small Business Engagement in recognition of its work through the innovative 43pl structure,

“bouquets for the CRCSI – I have been involved in five or six CRCs, and this one is the most professionally run and rigorous in governance and management”

Third Year Review independent industry survey [of non-university CRC participants]

DEST Table 2.1 Specified Personnel - CEO and Governing Board members

Director <i>Alternate Director</i>	Organisation	Key Skills
Mary O’Kane [Chair]	Independent (Director, M O’Kane & Assoc)	Intellectual Property management, Negotiation, Capital Raising, Computer hardware and software knowledge and experience, Financial Management, Australian R&D environment , Business Management, Governance, International experience, research management
Bill Charters	Independent	Negotiation, Capital Raising, Financial Management, Marketing, Business Management, Governance, Australian R&D environment, International experience, research management
Peter Woodgate	CRCSI Chief Executive Officer	Intellectual Property management, Licencing, Spatial Industry experience and technical knowledge, Business Management, Australian R&D environment, and applications, research management
Grahame Searle <i>David Hartley,</i>	Landgate, Western Australia <i>Dept of Agriculture & Food WA</i>	Negotiation, Intellectual Property management, Spatial Industry experience and technical knowledge, financial management, Australian

		R&D environment, business management, research management, government policy
Linda Kristjanson <i>Graham Wright</i>	Curtin University <i>Curtin University</i>	Negotiation, Intellectual Property management, Australian R&D environment, business management, research management
Roland Slee	Independent (Vice President, Fusion Middleware Sales, Oracle Corporation Australia Pty Ltd)	Negotiation, licensing, Computer hardware and software knowledge and experience, Spatial and computing technical knowledge, Financial Management, Marketing, Business Management, International experience
Bill Richards <i>John Lazarus</i>	43pl (Fugro Spatial Solutions Pty Ltd) <i>Managing Director, Fugro</i>	Negotiation, Spatial Industry experience and technical knowledge, Computer hardware and software knowledge and experience, financial management, Business Management, Governance, International experience
Tony Burns <i>Chris Grant</i>	43pl (Land Equity Pty Ltd) <i>Land Equity Pty Ltd</i>	Intellectual Property management, Negotiation, Spatial Industry experience and technical knowledge, Marketing, financial management, Australian R&D environment, business management, International experience
Bruce Thompson <i>Tai Chan</i>	Dept Sustainability & Environment, Victoria <i>Dept Sustainability & Environment Victoria</i>	Intellectual Property management, negotiation, Spatial Industry experience and technical knowledge, financial management, business management, research management, government policy
Steven Jacoby	Dept Natural Resources & Water, Queensland	Negotiation, Spatial Industry experience and technical knowledge, Marketing, financial management, Australian R&D environment, business management, research management, government policy
Warwick Watkins [Deputy Chair] <i>Des Mooney</i>	Director-General, Dept of Lands, NSW (Deputy Chair) <i>NSW Dept of Lands</i>	Negotiation, Intellectual Property management, Spatial Industry experience and technical knowledge, financial management, Australian R&D environment, business management, research management, government policy
Les Field <i>James Walsh</i>	University of NSW <i>University NSW</i>	Negotiation, capital raising, licensing, intellectual property management, Marketing, financial management, Australian R&D environment, business management, research management

DEST Table 2.2 Specified Personnel - Programme Leaders

Name	Organisation	CRCSI Position / Role
Chris Rizos	Uni NSW	Program Manager 1
Clive Fraser	Uni of Melbourne	Program Manager 2 & 3 CRCSI Research Director
Tony Milne	Uni NSW	Program Manager 4
Ian Bishop	Uni of Melbourne	Program Manager 5
Peter Woodgate	CRCSI	CRCSI CEO
Graeme Kernich	CRCSI	CRCSI Business Manager
Michael Ridout	CRCSI	CRCSI Communications Director
Jack De Lange	ASIBA	Chair, Industry & Commercialisation Ctte.

Research

The CRCSI defines research to include the innovative use and application of emerging technologies as well as the development of new technologies. The CRCSI undertakes world-class research that will lead to new applications of spatial information and enabling technologies that can be used to generate new wealth for its participants.

The Vision of the CRCSI 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.

In forming projects the CRCSI focuses on the needs of the user of SI and is responsive to the future needs of Australian 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 wider industry and the nation.

In the coming years the CRCSI has added a number of new directions to its research, defined within the Supplementary Bid, and these are included in the descriptions below of each current CRCSI project.

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.

CRCSI Strategic Plan

Research - Key Achievements

Highlights of the research year included the migration of project outputs and expertise into commercial initiatives of high potential. These include “loka deva” and Barista software, with other initiatives such as MillMapper and HazWatch consolidating their commercialisation.

A common factor in these CRCSI developments is the involvement of end-user knowledge as explored in the independent industry survey of the Third Year Review.

Each is reported on at the commercialisation section and within the project descriptions section. Up to date information is provided on the website.

Project based outcomes are considered below for all activities undertaken during the year.

External Contracts and Grants

During 2006-7 CRCSI commenced and/or completed a number of consultancy and research projects that were funded externally. These demonstrate the relevance of CRCSI research and the expertise of the personnel involved in CRCSI projects.

Measurement of vertical movements to provide geo-referenced ground surface settlement information using radar imagery. Clients include Mining companies in Australia and Ghana, and Australian State and Federal land and agricultural agencies.

Measurement of horizontal movements over areas adjacent to longwall mining activity using satellite based radar interferometry. Client: Mining company.

Positioning Policy Framework for Victoria. Determining position using mobile devices is now a simple process, and is increasingly being used in government and the wider community. This project developed a policy framework to allow individual business sectors to have confidence that their measurements were fit for purpose, that their spatial data are reliable, and that use of positioning information in legal and commercial environments can be supported. Partners: Department of Sustainability & Environment, Victoria & Geomatic Technologies.

Shallow Water LADS Analysis. Concerns over climate change and global warming are driving increased interest in the inter-tidal zone and adjacent areas. In Australia, the inter-tidal zone is mostly unmapped. Topographic maps typically stop at the high tide mark and hydrographic charts stop at the low tide mark. However the inter-tidal is an area of significant environmental interest. In some places it is also a significant area of land. The project analysed data acquired by the laser-based airborne shallow-water bathymetry system, LADS to assess its potential and suitability for mapping near-shore water depth along the Victorian coastline. Partners: Department of Sustainability & Environment, Victoria & University of Melbourne.

Scoping a National System for Reporting Land-Use Change. It is increasingly recognized that local and regional approaches to landscape monitoring are of limited use. The lack of a standardized approach to monitoring of land-use change also has a number of negative effects for land managers. Without a sense of the areal and temporal extent of land-use change, as well as knowledge of its specific nature, it is difficult to formulate effective policies to address the change, to estimate the eventual impacts of an ongoing change, and to identify the most appropriate responses to maintain a healthy environment, prosperous local and regional economies, and viable human population centres. This project scoped a national system for reporting land-use change. Client: Land & Water Australia.

Development of a metadata entry tool. Access to up-to-date metadata is an important aspect in delivering high quality spatial information services to vast areas of Australia. However, current metadata models/standards are complex and very difficult to handle. The Department of Sustainability and Environment (DSE) is undertaking a Metadata Repository Project which aims to migrate existing spatial information metadata from its current system to a new metadata system based on the ANZLIC Metadata Profile. This project will provide recommendations on which of the existing metadata entry tools to adapt and then report on the adaptation of the selected entry tool to meet the partners immediate short-term needs. Partners: Department of Sustainability & Environment, Victoria & University of Melbourne.

Airborne Laser Scanner and Radar Interferometry for Digital Topographic Modelling In Coastal Environments of NSW. Fine resolution elevation data is essential for improved topographic survey and such diverse applications as flood risk assessment, town planning and disaster mitigation. Data collection needs to be constantly reviewed and updated as more accurate elevation data becomes available, and as topography may have changed in response to, for example, mitigation works and urban development. ALS and InSAR platforms provide a non-intrusive form of survey in inaccessible environments, from which fine resolution DEMs of relatively high accuracy

can be generated. Furthermore, the benefits of satellite technology in repeat monitoring and updating of topographic information are paramount. This project aimed to refine methods of height estimation over diverse terrain using a combination of Airborne Laser Scanner (ALS) and Interferometric Synthetic Aperture Radar (InSAR) data for flood risk management. Partners: University of New South Wales, AAMHatch, Wollongong City Council and the NSW Department of Land.

An independent review of woody vegetation extent mapping using imagery for selected sites in NSW. Client: State Government Agency.

Fuel Loads Assessment. A variety of products, including vegetation indices, canopy identification and biomass assessment and fuel load indices were produced for the assessment of fuel loads. A number of data capture methods were assessed and correlated. Client: State Fire Service Agency.

DEM Availability for Coastal Vulnerability Assessment. The project was undertaken to gain an understanding of the existing and planned coverage of terrain elevation data for the Australian coastal zone that is potentially fit-for-purpose in coastal vulnerability assessment.

Remote Sensing of Forest Cover. Conducted a Web-search on use of satellite remote sensing for forest cover change monitoring in South-east Asia and the Pacific. Client: Commonwealth agency.

Development of Spatial Analytical Guidelines. National guidelines were developed for the representation of feature information within a raster/tiled grid environment, and for aggregation between various scales within a nested raster/tiled grid environment. Client: Commonwealth agency.

Research & Commercialisation Project Synopses

1.1 Enhancing Australia's Core Geodetic Infrastructure will enhance national and regional infrastructure of GPS receiver networks which support the operation of the entire Australian spatial information industry. The project aims to target problems that presently exist in GPS network site installation and data quality, concentrating on signal interference and site multipath. The project outcomes will deliver standards and protocols for creating seamless Continuous Operating Network (CORS) national geodetic infrastructure, and algorithms, software and devices that can be installed within GPS hardware to mitigate effects that impact on data quality.

1.2 Quality Control Issues in Real Time Positioning is developing a real-time quality control system (RT-QC) for the independent and robust determination of the quality of GPS positioning. Users of real-time mobile positioning systems require not only knowledge of position, but also need a definitive statement as to the quality of that position. The developed quality strategies will alert users when positioning quality deteriorates, thereby informing decisions which may be position-critical.

1.3 Integrated Positioning and Geo-referencing Platform will design, develop and test a generic hardware and software platform for positioning and geo-referencing applications. Based on an appropriate microprocessor /Field Programmable Gate Array, the new platform will offer the flexibility to integrate the latest MEMS-INS and GPS receiver hardware. A suite of software for controlling multiple data acquisitions as well as data processing/fusion will be developed to support positioning and mapping operations.

1.4 Integrating electricity, telecommunications and government infrastructure to deliver precise positioning services in regional areas – new project

Commercial, operational and institutional enablers to expand precise positioning services in regional areas - will undertake applied research to develop an extension of the Queensland precise positioning service (SunPOZ) into a regional area to facilitate the adoption of precise positioning services in agriculture, mining, utilities, tourism and

construction. This approach requires several enablers to service adoption to be defined including: User needs, market size and pricing sensitivities; common operating standards; legal structure of the service provider; transfer pricing within the supply chain; and liability and intellectual property rights.

The impact of future GNSS on precise positioning networks in regional areas - will examine precise positioning network and communications architecture for regional areas using existing and future GNSS. The research will include: examining the most cost effective combination of communications methods for delivery of precise positioning services to end users in regional areas; developing techniques to incorporate and utilize a mix of positioning equipment types and equipment generations; developing methods to report "mixed-equipment" network quality and status to end users; assessing the impact of future GNSS equipment on receiver density; definition of test regime to determine the interoperability of new GNSS with existing services.

2.1 Automated Mapping and Feature Extraction from Space, Aerial and Terrestrial Imagery will develop new and improved techniques and tools for geospatial information extraction from digital aerial and high-resolution satellite imagery. Research will be undertaken in the areas of sensor calibration and orientation modelling, 3D surface analysis, image matching and registration, and feature extraction. The techniques and software tools developed will enhance image-based change detection and automated updating of spatial databases.

2.2 Modelling, Analysis & Systems Development for Integrated Imaging & Positioning Sensors will develop new algorithms that will enhance the productivity of airborne and terrestrial laser scanning systems. The research will focus on a feature-based, in-flight calibration technique for aerial scanners and automated extraction of man-made features from terrestrial laser scanner point clouds. The resulting software developments will help to improve aerial mapping accuracy and alleviate a significant processing bottleneck in feature extraction.

3.2 Intelligent Geocoding will develop intelligent geocoding methodologies and models. Research will be undertaken in the areas of geocoding technologies, knowledge bases and learning agents. The techniques and software tools developed will enhance the geocoding processes required by many spatial applications. It will work closely with Australia's G-NAF (Geocoded National Address File) which links each street address in Australia with its geographic location.

3.3 Access to Spatial Data will model access to spatial data for Web and mobile services according to user needs. The project has two objectives: to enable geographic referencing and reasoning from common language and induced contexts, and to evaluate and select data sets according to a given context. The project will improve the accessibility and hence the use of existing spatial data repositories. It is looking closely at what information mobile users actually need and the form in which they need it.

3.5 Information Access and Digital Rights Management – new project - enabling real-time information access in both urban and regional areas, and a working application of integrated location and business focused web-services using spatial information in real-time. Outcomes will combine the private and public sector into a "real-time information market place". The project will research identified problems for accessing and using spatial information from both government and private sectors – getting the right information for the right purpose when it is needed. Research elements contained in the project are: e-commerce business model; technological issues for urban and regional providers and users; and legal issues for information licensing and digital rights management.

4.1 Automatic near real-time thematic mapping based on MODIS will investigate the derivation of thematic maps from MODIS imagery in a timely, automated, manner. The measurement of water vapour, ozone, and the aerosol content of the continental Australian atmosphere from MODIS imagery, will provide the parameters required to atmospherically correct imagery being acquired from other multi-spectral sensors with a similar overpass time to that of MODIS sensors. It will also look at mechanisms to help

better correct for solar elevation and consequential terrain shadow. It is envisaged that this work will lead to increased value of remote sensing information for precision agriculture, environmental assessment, crop forecasting, automatic land cover change detection and assessing fuel load for wild fire management.

4.2 Digital elevation model generation and differential interferometric synthetic aperture radar will develop new and improved interferometric synthetic aperture radar (InSAR) techniques and tools for digital elevation model (DEM) generation and subtle ground movement detection from airborne and space-borne imagery. Research will be undertaken in the areas of InSAR for DEM generation, differential InSAR for sub-centimeter and permanent scatterer InSAR for mm-level ground displacement monitoring. The techniques and software tools developed will enhance image-based ground surface change detection (such as building movements and landslips) and DEM creation as spatial infrastructure.

4.3 Near real time crop and pasture package: integrated remote sensing technologies for improved farm management will develop an operational cost-effective farm package of information products extracted from satellite imagery. Research will be undertaken for pastures and crops in the areas of crop yield forecast, biomass and pasture quality prediction. The information products will allow producers to make better tactical and strategic decisions at paddock and farm level with products delivered over the web in near real time.

4.4 Development of imaging spectrometry products for characterising, mapping, monitoring and managing environmental stress will develop methods and tools for mapping soils and vegetation using hyperspectral imagery. This will require the determination of the spectral properties of soils and vegetation under differing temporal, seasonal and illumination conditions. Software add-ons will be developed that will allow non-expert users to routinely use these methods.

5.1 Support Tools for Spatial Data Mining will integrate content-based image retrieval into satellite imagery search capability. The research will concentrate on the development of new models and algorithms for content-based image retrieval. The technology and algorithms developed, which will be incorporated into different tool sets, will enhance current spatial image search ability.

5.2 Visualisation with SDI for collaborative decision making will automate the creation of three-dimensional environmental models from on-line spatial data for both scientific and community use. The models, which can be visualised and explored using standard software, will also be combined with scientific process models of surface and sub-surface events to enhance understanding of land management decisions.

5.3 Communicating spatial data quality will improve techniques for communicating the quality of spatial data to users with different skill levels. Research will be undertaken in the areas of modelling variation in data quality, communicating new techniques for representing quality information, and understanding the quality of end products derived from environmental modelling processes. The methods and tools developed will permit data users to make more informed choices about the quality of the data needed for their tasks.

Demonstrator Program

The 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 encourages adoption, and improves awareness, of SI applications.

6.1 Regional On-line Spatial Information Emergency Management System has demonstrated how on-demand spatial information can be delivered to emergency management users via the web. The project has built prototypes for several scenarios developed in partnership with subject matter experts from the user community. The

scenarios covered are: bushfire management, emergency notification, on-shore incidents and off-shore incidents. This project concluded and the HazWatch intellectual property was licensed into the start up company iintegrate Systems Pty Ltd.

6.4 The Location Positioning Device “i-loka” is using a number of positioning technologies to build a portable positioning unit (lokadeva) that will provide useable and consistent positioning. The five positioning technologies of GPS, INS, digital imagery, map referencing and mobile telephone Cell ID will be integrated into a system to provide a low cost prototype lokadeva suitable for supporting new location-based services. Design of the first lokadeva is underway and a hip bag type configuration will be deployed with Bluetooth connectivity to an IMATE GPRS enabled phone. Business planning continues within the second phase of the project.

6.6 Platform for Environmental Modelling Support (PEMS) will be a component of the Australian spatial data infrastructure that uses a grid cell (or “raster”) based approach to managing spatial information. It is made up of an agreed standard national nested grid as an overall spatial reference framework, an efficient data rasterisation process based on an agreed methodology, a store of commonly used current and authoritative spatial data and a query/visualisation/ reporting/ data delivery environment to ensure easy access to information for simple analyses and support of modelling and decision support systems. Analysts with little spatial information knowledge can easily view, slice and dice information, and build spatial information into their processes in a consistent and repeatable manner, significantly enhancing tasks such as policy evaluation, strategic planning, impact assessment and decision making more generally. PEMS will also support more advanced geospatial analysis by streamlining labour intensive data preparation and pre-processing tasks.

6.7 Spatial Information Business Improvement Applications at Ergon Energy – new project - will develop an efficient and cost-effective method for accessing a web service to retrieve integrated spatial information, as an alternative to managing this information in-house, for use in GIS business applications. Three utility application areas have been selected to ensure a variety of data sources can be accessed and integrated with different business functions:

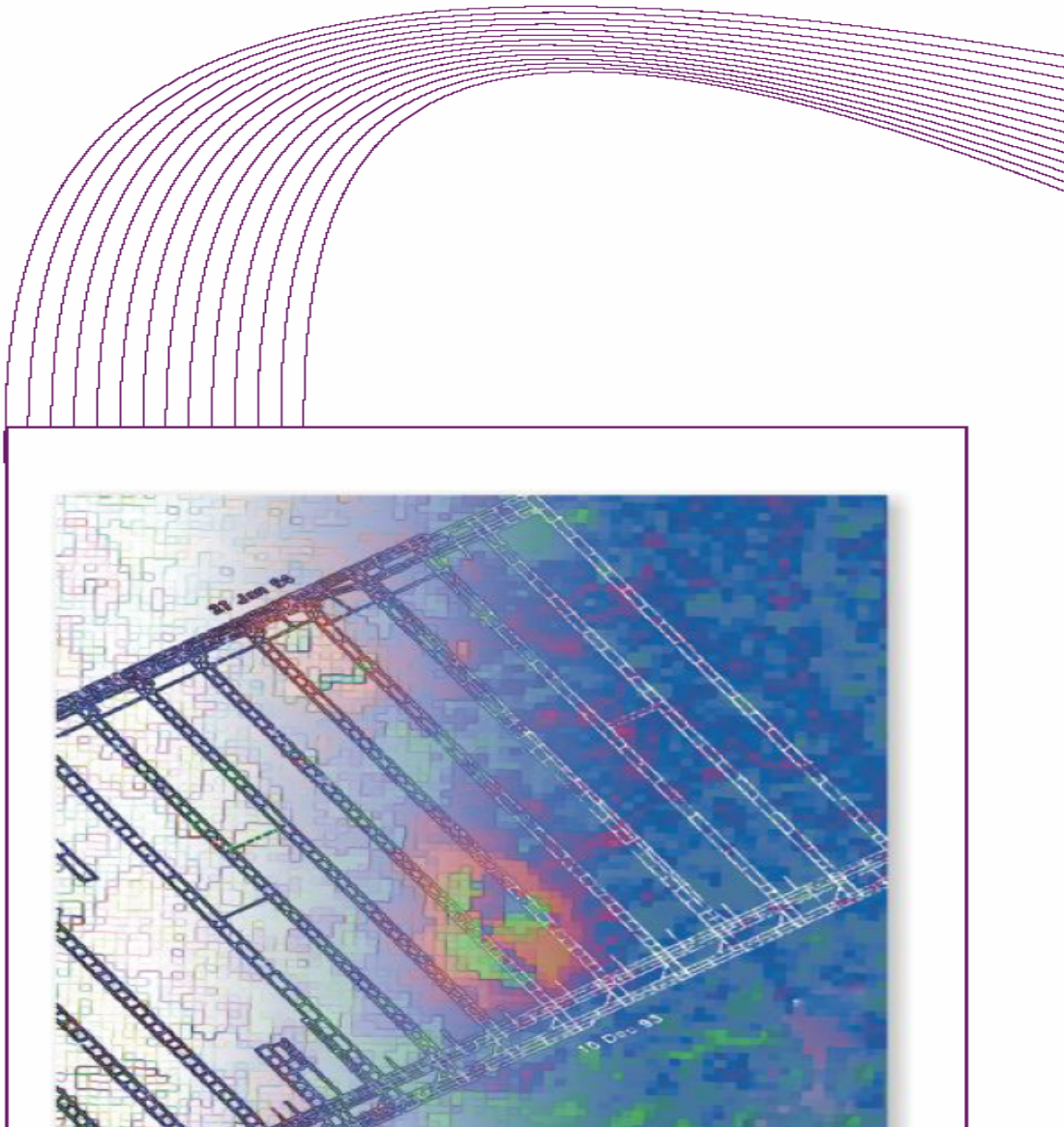
- Vegetation management will use output from image analysis and classification processes integrated with climate, vegetation and topographic data to define maintenance and clearing program priority areas. Mapping products will be usable in the field on hand-held devices.
- Network planning in heritage and native title areas requires combining land titles, environment and heritage data with other topographic data for route planning and costing for network design functions. Output products will be used for fly-through visualization presentations.
- Asset capture and surveillance applications rely on the improved accuracy obtained from the augmented positioning infrastructure (Project 1.1) to test the reliability and cost effectiveness of UAV platforms for asset inspection and image/location capture programs. Data stored in the GIS is the source data for guiding the UAV and data captured is downloaded and delivered via the demonstrator service.

6.8 Clever Cattle & Cropping Systems – new project - will build on expertise and/or technologies of the project partners and also the CRCSI during Years 1 – 4. The project will build on and demonstrate, across two agricultural production systems, the value of readily interpretable, near-real-time and remotely accessible data as a day-to-day management tool for farm managers facing a lack of appropriately skilled labour, a spatially-variable landscape and the increasing cost or scarcity of resources (eg water). The project will address three themes:

- Making sense of paddock variability through sensor and data fusion: will be conducted in 2 test fields (irrigated cotton rotated with irrigated or rain fed grain) operated commercially by project partners Twynam Agriculture and Sundown Pastoral.

- Real-time Field Surveying: will evaluate the use of UAV technology and real-time video streaming as an aid to manage crops, pasture, cattle and on-farm infrastructure (fences, water points). Regular UAV and UAV-mimicking aircraft fly-overs will be conducted over irrigated cotton fields and 2 mixed farming systems.
- Data Visualisation and Interrogation: will integrate the multiple on-farm spatial, point and management datasets into a 2- and 3-D visualisation and interrogation information delivery package.

8.2 MillMapper CRCSI through 3D laser scanning research at Curtin University has played an integral role in developing an innovative software product and service called MillMapper. It is being commercialised through a start up company Scanalyse Pty Ltd. MillMapper provides a three dimensional computer model of the interior of crushing mills used in the minerals processing industry. It automatically extracts features and profiles from the millions of data points captured by a laser scanning device. The software compares the scan with a CAD model of the mill and provides a series of reports. The model it generates can also be interrogated and manipulated to provide sophisticated analyses. The model allows mill operators to extend the life of internal mill liners; replace only those liners that need replacing; increase production efficiency; reduce shutdown time; and operate more safely with no personnel required to enter the mills.



Progress against Contractual Milestones / Targets - RESEARCH

Table 3 below reports on the Commonwealth Agreement research milestones for 2006-07, milestones carried over from previous years; and associated Outputs and Outcomes.

New and amended milestones are in blue font.

Progress overall is excellent. Many projects have refined tasks within their original directions. A few projects are drawing to a close of their planned conduct, and some are devising follow on activities to capture new opportunities. Next year's report will include the Supplementary Bid projects.

DEST Table 3 – Research Outputs and Milestones

Note: the required DEST Table has been reformatted in order to fit better on the A4 page, as described below

Outcome / Output	Description		
Milestone Number	Description	Contracted Achievement Date	Achieved (✓ or No)
	Reasons why not achieved (if applicable) and recovery strategies		
	New Milestones in blue		

Research Program 1 - LOCATION

Outcome 1.1	Reference Station Networks and Their Utility The development of strategies, algorithms and software for making GPS reference station networks capable of addressing an expanded range of user service demands. The ARGN (Australian Regional GPS Network) comprises 15 permanent GPS receivers across Australia and its offshore territories (including several in Antarctica) that have been operated by Geoscience Australia for almost 10 years. The data from this continent-wide network has been contributing to global and national geodesy programs, principally to scientific research into global / environmental / climate change. This data has also been used to support precise positioning in an off-line (i.e. non-real-time) mode via the web service AusPos. At the state level a GPS reference receiver network has been deployed across Victoria, and NSW has indicated its interest in deploying a similar state-wide network. This research project's outputs will be used by all GPS continuously operating reference station (CORS) networks, from the continent-wide to the regional and local scale CORS sub-networks. NOTE This project was refocussed to specific user aims and targeted problems that presently exist in CORS network site installation, and the quality of the raw data derived from CORS networks concentrating on signal interference and site multipath. The project outcomes will deliver standards and protocols for creating seamless CORS national geodetic infrastructure, and algorithms, software and devices that can be installed within GPS hardware to mitigate effects that impact on CORS data quality.		
Output 1.1.1	Strategies for precise, scientific-level GPS data processing to support global / environmental / climate change studies by Geoscience Australia, as well as provision of products to other segments of the community (e.g. in support of AusPos and similar web-based services). <i>Delivery Targets:</i> Start January 2004. 24 months after commencement of project for completion to support scientific applications (Jan 2006), 36months for specialised products to support non-scientific positioning applications (Jan 2007).		
NOTE Original Output not pursued. Output changed and focussed to the specific development of a product for CORS networks - real time detection of site-specific GPS signal interference (including identification of interference sources)			
Milestone 1.1.1.2	Description & Achievement date: Strategies for time-series analysis of resulting position solutions for reference receivers	Dec 2005	<i>changed</i>
New Milestone 1.1.1.2	Tests of models in a variety of locations and seasons - Construction and testing of prototype interference detection device (to detect electromagnetic signals which may interfere directly with GPS signals at CORS site)	Dec 2006	✓
Output 1.1.2	Real-time / near-real-time atmospheric products from Australia-wide / state-wide CORS GPS networks. By December 2004 demonstration of feasibility of atmospheric parameter estimation in off-line mode, by Dec 2006 for real-time product generation able to contribute to Output 1.3, by Dec 2007 for incorporation of outcomes into new wide-area real-time positioning service for high precision applications.		
NOTE Original output changed – Project focussed on the production of software which allowed for the construction and application of CORS site dependent multipath, diffraction models			

New Milestone 1.1.2.2	Demonstration of prototype site multipath modelling software	Dec 2006	✓
Output 1.1.3	Bias modelling for sparse CORS networks to support decimetre (or higher) accuracy, real-time GPS positioning. <i>Delivery Targets:</i> By December 2005 for strategies and methodologies for generating real-time models of GPS measurement biases, By December 2006 for implementation into statewide CORS networks in support of real-time applications.		
NOTE Original Output changed - focussed to delivery of guidelines and recommendations for developing and maintaining a seamless national geodetic infrastructure through CORS stations			
New Milestone 1.1.3.3	Completion of draft standards and protocols for seamless Australian CORS networks.	Dec 2006	✓
Output 1.1.4	Single-base RTK vis-à-vis network-RTK design strategies & validation. <i>Delivery Targets:</i> By June 2005 for strategies to integrate various RTK implementations (from single-base to CORS-based), by December 2006 for detailed design of GPS network elements and their implementation.		
NOTE Original output not pursued - Project output instead focussed on 3 tasks (1) Quantify the quality of GA CORS site displacement models including Earth tides, ocean tides and atmospheric loading. (2) Identify sources of unmodelled height error in GA GPS CORS height time series. (3) Assess impact of existing GA GPS data processing modelling strategy and model errors on daily and weekly coordinate solutions processed using Bernese software; and episodic post-processing practices including those used in AUSPOS solutions			
New Milestone 1.1.4.1	Release of upgraded Auspos systems	Mar 2006	✓
New Milestone 1.1.4.2	Presentation of results from Earth rotation and polar motion studies.	June 2006	✓
New Milestone 1.1.4.3	Release of recommendations for improved height datum.	June 2007	✓
New Output 1.1.5	The task will generate information to assist Landgate, WA in defining a strategy related to GPS CORS network development in WA in relation to the basic requirements for supporting future geodetic infrastructure, and in the context of four primary areas: risks, costs, demands and benefits. The project will provide specifications and recommendations for a future trial of a CORS network in the Perth metropolitan area.		
New Milestone 1.1.5.1	Technical evaluation to DLI, WA of existing positioning services in Western Australia eg AUSPOS, AUTO_GIPSY, OMNISTAR-HP, CSRS	June 2006	✓
New Milestone 1.1.5.2	Technical report to DLI, WA giving an analysis of the potential for CORS spin-off services and the associated cost-benefit model for a potential DLI CORS network, sample network designs for different applications based scenarios for a Western Australian CORS network.	June 2006	✓
New Milestone 1.1.5.3	Report to DLI, WA detailing the optimal configuration for a Western Australian CORS network for supporting geodetic infrastructure.	June 2006	✓
New Milestone 1.1.5.4	Report to DLI, WA containing numerical information which will assist DLI in assessing future directions for CORS networks	June 2006	✓
New Milestone 1.1.5.5	Report to DLI, WA detailing recommendations and specifications regarding the nature of a potential CORS network trial in the Perth Metro area	June 2006	✓
Output 1.1.6	Cost-benefit analysis for CRCST project outcomes and their application to CORS geodetic infrastructure to enhance the AuScope initiative		
New Milestone 1.1.6.1	Cost-benefit analysis for the strategic enhancement of the AuScope CORS geodetic network in Western Australia	Feb 2007	✓
Outcome 1.2	Positioning Technologies for Precise Applications - development and implementation of a range of algorithmic innovations within GPS user equipment for carrier phase-based positioning with minimum constraints. GPS is a positioning technology that has revolutionised surveying and navigation over the last decade or so. Today, GPS forms the basis for the definition and maintenance of modern geodetic datums and the provision of geodetic infrastructure. Recent growth in consumer-based applications will ensure that GPS continues to evolve and the planned modernisation program by the U.S. will prevent the system from becoming obsolete. The EU will develop and deploy a similar system (known as Galileo) by the end of this decade. Clearly, R&D must continue in order to adapt and improve the performance of satellite-based positioning technologies, especially in regard to augmentation strategies that will enhance the capabilities, and overcome the shortcomings, of such systems. This project therefore has as its core objective the harnessing of satellite positioning expertise of the partners to develop high accuracy, low-cost user equipment, augmented where possible with complementary positioning systems such as pseudolites and INS (see Outcome 3), able to take advantage of CORS network infrastructure (see Outcome 1), for a range of professional applications.		

NOTE Project has been refocussed to specifically examine quality issues in regards to CORS networks. Project 1.2 will develop a real-time quality control system for the independent and robust determination of the quality of GPS positioning. Users of real-time mobile positioning systems require not only a knowledge of position, but also need a definitive statement as to the quality of that position. The developed quality strategies will alert users when positioning quality deteriorates, thereby informing decisions which may be position-critical.			
Output 1.2.1	Data processing refinements to achieve millimetre-level GPS positioning. <i>Delivery Targets</i> Dec 2005 completion of stochastic and functional modeling studies, Dec 2006 implementation in software.		
Output 1.2.1 reviewed, changed and expanded. Review current research, monitoring strategies related to Real Time Quality Control (RT-QC) of CORS sites and develop a RT-QC module for a CORS network. Also aimed to specifically address data transmission standards.			
Milestone 1.2.1.1	Description & Achievement date: Critical review of functional and stochastic modelling issues for precise GPS positioning: single- and dual-frequency; network-based and single-base modes	Dec 2005	changed
	Project did not pursue this line of research. Milestone was reset to review existing CORS integrity monitoring strategies		
Milestone 1.2.1.2	Description & Achievement date: Strategies for developing user products: software and hardware	Dec 2005	Changed
	Project did not pursue this line of research. Milestone was reset to review of current research in quality control issues related to CORS sites and existing CORS integrity monitoring strategies		
Milestone 1.2.1.3	Description & Achievement date: Implementation and testing of real-time software system.	Dec 2006	✓
New Milestone 1.2.1.5	Develop a new message type within the recommended standard	Sep 2006	✓
Output 1.2.2	Hybrid high accuracy GPS and pseudolite positioning systems. <i>Delivery Targets:</i> December 2004 for completion of hardware studies concerned with GPS and pseudolite integration, by December 2005 for mixed data modelling, by December 2006 for incorporation of outcomes into new system (hardware/software design).		
NOTE Change in research direction meant this output was not pursued. Instead additional tasks were added to Milestone 1.2.1.3 [detailed above]			
Milestone 1.2.2.3	Implementation and testing of hybrid GPS and pseudolite positioning system – by December 2006.	Dec 2006	Changed
	Change in research direction meant this output was not pursued. Instead additional tasks were added to Milestone 1.2.1.3 [above]		
Output 1.2.3	High sensitivity, low-cost GPS surveying system. <i>Delivery Targets:</i> by December 2005 receiver firmware design and test, by December 2006 for evaluation of receiver hardware & software operation vis-à-vis standard GPS receivers.		
Milestone 1.2.3.1	Low signal power (high sensitivity), carrier phase tracking firmware (RT-QC module for mobile user – GPS only)	Jun 2005	Changed
New Milestone 1.2.3.1	Milestone delayed until Dec 2006 – new milestone defined as – design and implement beta version of RT-QC module for the mobile user (see below)	Dec 2006	✓
Milestone 1.2.3.2	Implementation within receiver hardware platform – 36months	Jun 2006	Changed
	Milestone changed with research direction to implement the RT-QC solution at the server rather than client end, and then deliver to the mobile user client.		
New Milestone 1.2.3.2	Integrated RTQC system for mobile and CORS users	Jun 2008	
Output 1.2.4	Web-based GPS positioning services. <i>Delivery Targets:</i> June 2005 for upgrade of AusPos web service, by December 2006 for implementation of similar web service on statewide / local CORS sub-networks.		
NOTE Project has been varied to focus on the provision of RT-QC data to CORS and mobile users – this output is no longer applicable for the project: development lies now with one of the CRCSI participants, Geoscience Australia.			
Milestone 1.2.4.1	AusPos upgrade to handle GPS data files from standard survey practice (e.g. single-frequency, short observation spans) <i>Project has been varied to focus on the provision of RT-QC data to CORS and mobile users – this output is no longer applicable for the project: development lies now with one of the CRCSI participants, Geoscience Australia</i>	Jun 2005	n/a
Milestone 1.2.4.2	Integrated web service for GPS positioning using variety of data types, network configurations and positioning modes (e.g. static or kinematic)	Dec 2006	

Outcome 1.3	<p>Mobile and Automated Mapping Systems.</p> <p>Develop an integrated positioning/attitude determination system using the latest MEMS-INS sensor and GPS receiver hardware, and state-of-the-art software. Multi-sensor position and attitude determination systems, coupled with imaging sensors, are already being used from vehicle and airborne platforms. This project will develop a new generation of such systems that are more mobile, more compact, lower cost and more automated. This is exemplified by the objective to develop a miniature digital image-based system using the latest developments in mobile computing and sensor technology as a Demonstrator project</p>		
Output 1.3.3	Integrated software systems for real-time GPS+INS positioning and attitude determination... critical review of integrated sensor navigation algorithm options	Dec 2004	
Milestone 1.3.3.3	Optimal Kalman filter for real-time implementation	Dec 2006	✓
Output 1.3.4	<p>An integrated, low-cost, portable GPS+INS positioning and attitude determination system for automated mapping applications.</p> <p><i>Delivery Targets:</i> June 2005 after commencement of project for design of physical package (including power, comms & sensor interface sub-systems), by December 2006 for full implementation of integrated positioning/attitude determination system.</p>		
Milestone 1.3.4.2	Integrated, low-cost, portable GPS+INS system ready for incorporation into future automated mapping system	Dec 2006	✓

Research Program 2 – IMAGE ANALYSIS

Outcome 2.1	<p>The development and implementation of advanced methodologies, procedures and computational processes and systems for automated information extraction from metric imaging sensors.</p> <p>Project 2.1 aims to develop new and improved techniques and tools for geospatial information extraction from digital aerial and high-resolution satellite imagery. Research will be undertaken in the areas of sensor calibration and orientation modelling, 3D surface analysis, and image matching and registration. The techniques and software tools developed will enhance image-based change detection and automated updating of spatial databases.</p>		
Output 2.1.2	<p>New techniques and computational tools for automated object feature reconstruction and modelling from imagery and laser scanning.</p> <p><i>Delivery Targets:</i> New software systems and tools for technology transfer to industry, December 2006</p>		
Milestone 2.1.2.2	New methods and computational approaches to data segmentation and surface modelling from laser scanner and photogrammetrically generated point clouds	Dec 2006	✓
Milestone 2.1.2.3	Experimental validation of developed tools and techniques for digital terrain modelling and object surface reconstruction from imagery and laser scanning	Dec 2007	On target
Output 2.1.3	<p>Automated feature detection, extraction and reconstruction for the updating of geospatial databases.</p> <p><i>Delivery Targets:</i> Software systems, procedures, technology validation and assessment, July 2010</p>		
Milestone 2.1.3.1	Review development options for automated feature recognition, extraction and modelling from imagery and laser scan data	Dec 2006	✓
Output 2.1.4	<p>Techniques and tools to exploit capabilities of emerging imaging technologies and facilitate a broader applications domain within the spatial information industry</p> <p><i>Delivery Targets:</i> Technology assessment and validation, with development tools to support application for spatial information product generation, July 2010</p>		
Milestone 2.1.4.2	<i>Description & Achievement date:</i> Development and experimental testing of emerging technologies for 3D object measurement, mapping and modelling; ongoing with first-stage milestone at	July 2006	✓
Milestone 2.1.4.3	Implementation of developments to support technology transfer of new imaging and ranging systems for industry-ready spatial information generation, with concentration in application areas of topographic mapping, urban scene analysis and GIS, engineering measurement and modelling, and heritage recording; ongoing throughout life of the CRC, with specific milestone dates being tied to appearance of new technologies and first-stage milestone	Dec 2006	✓
Outcome 2.2	<p>Advanced modelling, analysis and systems development tools to provide new capabilities and wider applications of integrated imaging, ranging and positioning technologies for spatial information product generation.</p> <p>This project aims to develop new algorithms that will enhance the productivity of airborne and terrestrial</p>		

	laser scanning systems. The research will focus on a feature-based, in-flight calibration technique for aerial scanners and automated extraction of man-made features from terrestrial laser scanner point clouds. The resulting software developments will help to improve aerial mapping accuracy and alleviate a significant processing bottleneck in feature extraction. The research team has also given rise, outside of Commonwealth Agreement forecasts, to novel scanning applications being commercialised through project 8.2 MillMapper		
Output 2.2.1	New models and computational systems to support both data fusion and enhanced capabilities associated with the integration of multi-source data, with focus upon imaging and laser scanning systems. Delivery Targets: New algorithms and software for enhanced capability of imaging and ranging systems, July 2005		
Milestone 2.2.1.2	Fusion models for terrestrial imaging and laser scanning systems, Dec 2004	Dec 2006	✓
Milestone 2.2.1.3	Experimental validation of enhanced imaging and laser scanning systems for spatial and spectral applications	Jul 2005	✓
Output 2.2.2	Tools to facilitate broader application of integrated imaging, laser-scanning and positioning technologies for automated spatial information generation, especially in the areas of geospatial information products, engineering measurement, heritage recording and urban scene analysis. Delivery Targets: Technology assessment and development tools to allow application of integrated technologies in these areas, December 2006		
Milestone 2.2.2.1	Review of applicable technologies (e.g., imaging, laser ranging, satellite positioning, etc.) and identification of the strengths and limitations of each	Dec 2005	✓
Milestone 2.2.2.2	Development of procedures and quality control measures and experimental testing of integrated technologies,	July 2006	Delayed – Dec 07
Milestone 2.2.2.3	Implementation of developments for industry use for geospatial information products, engineering measurement, heritage recording and urban scene analysis	Dec 06	Delayed – Dec 07
Output 2.2.3	Design, development and analysis of new functional models and computational schemes for integrated sensors (space borne, airborne and terrestrial) Delivery Targets: New models, software systems and procedures for sensor integration, July 2008		
Milestone 2.2.3.1	Computational schemes for terrestrial laser ranging data	Jul 2007	On target
Milestone 2.2.3.2	Models for the integration of low-cost sensors with airborne imaging sensors	Dec 2007	On target

Research Program 3 – SPATIAL DATA INFRASTRUCTURES

Outcome 3.1	Design Concepts for Virtual Australia The Outcome from Project 3.1 will draw on the research and results of other programs and projects in the CRCSI to ensure that Australian SDIs support the Virtual Australia concept. The project will investigate <ul style="list-style-type: none"> • user needs analysis and market identification at local, state, national and regional levels for spatial data • the legal, regulatory and institutional issues and limitations concerned with the use, access and delivery of spatial data • benchmarking and comparative analysis of the SDI hierarchy, and • strategic SDI design for Virtual Australia. [Note – at the Governing Board's 2004-2005 request this project was approached as a one year exercise to scope further work, some of which has been covered through other CRCSI activities]		
Outcome 3.2	Data integration, modeling and standards framework to support the seamless compilation of spatial datasets for the <i>Virtual Australia</i> concept Project 3.2 aims to develop intelligent geocoding methodologies and models. Research will be undertaken in the areas of geocoding technologies, knowledge bases and learning agents. The techniques and software tools developed will enhance the geocoding processes required by many spatial applications. It will work closely with Australia's G-NAF (Geocoded National Address File) which links each street address in Australia with its geographic location.		
Output 3.2.1	Development of data integration models for geocoding and interoperability Delivery Targets: New data integration framework, models and procedures, December 2006		
Milestone 3.2.1.2	Development of a framework and overarching model for spatial data integration	Dec 2006	✓
Output 3.2.2	Design and development of a prototype database to support data integration and modeling for a Virtual Australia Delivery Targets: Database model, database, December 2006.		
Milestone	Development and evaluation of a <i>Virtual Australia</i> data model and	Dec	n/a

3.2.2.2	prototype database	2006	
	<i>Milestone not pursued due to Project 3.1 not being extended beyond 1 year.</i>		
Outcome 3.3	<p>The outcome from Project 3.3 (Access to spatial data) will be the investigation of the scientific and technical aspects of access to and delivery of spatial data by a range of communication technologies and issues concerned with spatial data discovery in support of the Virtual Australia concept. The project will investigate:</p> <ul style="list-style-type: none"> distributed www and WAP services modeling including the development of clearer links between SIS design and tools for SI access improved spatial data/information discovery using existing search engines the next generation of search engine tools to strengthen the spatial dimension in www searches delivery of location based services to multiple mobile devices <p>Project 3.3 aims to model access to spatial data for Web and mobile services according to user needs. The project has two objectives: to enable geographic referencing and reasoning from common language and induced contexts, and to evaluate and select data sets according to a given context. The project will improve the accessibility and hence the use of existing spatial data repositories. It is looking closely at what information mobile users actually need and the form in which they need it.</p>		
Output 3.3.1	<p>Distributed www and WAP services modeling including the development of clearer links between SIS design and tools for SI access</p> <p>Delivery Target: 2006</p>		
New Milestone 3.3.1.1	Review of current developments to support access to spatial information in distributed Web- and mobile services. Review of literature on ontology design, activity specifications, context modeling, situation calculus, and semantic Web.	2005	✓
New Milestone 3.3.1.2	Report on experiments on usability of LBS in different contexts Report to identify information needs of people in selected contexts	2005	✓
Output 3.3.2	<p>Improved spatial data/information discovery using existing search engines</p> <p>Delivery Target: 2006</p>		
Milestone 3.3.2.2	Guidelines and specifications for improved spatial data/information discovery using existing search engines	2006	<i>changed</i>
	Milestone replaced by refined set as follows		
New Milestone 3.3.2.2	Develop a formal model of action ontologies for at least two selected use cases	2006	✓
New Milestone 3.3.2.3	Develop a formal model of cognitive route directions	Sep 2006	✓
New Milestone 3.3.2.4	Develop a formal model of context-driven search and identification of elements for route directions	Dec 2006	✓
New Milestone 3.3.2.5	Design a test environment for filling the formal model of cognitive relevant route directions	Mar 2006	✓
New Milestone 3.3.2.6	Implement model with industry partner (LISAssoft)	Jul 2007	✓

Research Program 4 – REMOTE SENSING

Outcome 4.1	<p>Near real- time satellite image processing and distribution of MODIS data.</p> <p>The objective is to develop and implement algorithms and software necessary to systematically acquire, process and calibrate Direct Broadcast (DB) Moderate Resolution Imaging Sensor (MODIS) data in order to generate standardized Level 2 products of selected Australian land parameters and conditions, including fire detection, burn area mapping, flooding extent and vegetation change associated with land clearing and agricultural cropping. MODIS is a sensor carried on board NASA Terra and Aqua satellites with a DB facility capable of being received in Alice Springs, Hobart, Perth and Adelaide. However, algorithms for automating near real-time atmospheric corrections and the BRDF normalization for wide field of view sensor geometry need to be validated within the Australian context before calibrated Level 2 products involving measures of reflectance and temperature can be derived.</p> <p>Project 4.1 will investigate the derivation of thematic maps from MODIS imagery in a timely, automated, manner. The measurement of water vapour, ozone, and the aerosol content of the continental Australian atmosphere from MODIS imagery, will provide the parameters required to atmospherically correct imagery being acquired from other multi-spectral sensors with a similar overpass time to that of MODIS sensors. It will also look at mechanisms to help better correct for solar elevation and consequential terrain shadow. It is envisaged that this work will lead to increased value of remote sensing information for precision agriculture, environmental assessment, crop forecasting, automatic land cover change detection and assessing fuel load for wild fire management.</p>		
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Output 4.1.1	Development, validation and implementation of algorithms for atmospheric correction, BRDF normalization and aerosol optical depth determination from DB MODIS data acquired over the Australian continent. <i>Delivery Targets:</i> 24 months from commencement of project to calibration and validation of algorithms suitable for Australian conditions.		
Milestone 4.1.1.3	<i>Use of aerosol optical depth to derive measure of air quality from MODIS DB data</i>	July 2006	✓
Outcome 4.2	<p>Multi-sensor, multi-scale image and terrain systems for environmental and natural resource analysis. The new generation of high resolution microwave and optical remote sensing systems provide enhanced capabilities for the geophysical and geochemical detection and discrimination of earth surface materials. Multi-polarimetric and interferometric (InSar) radar provide three dimensional reconstructions with the capacity to generate precise digital elevation models (DEM) of the earth's surface and detect ground surface deformations and displacements. Optical wavelength beam splitting techniques generate multi-channel (Hyperspectral) image data that can be used for feature characterisation.</p> <p>The objectives of this research are to test, validate and implement multi-sensor image processing techniques for deriving high resolution topographic baseline datasets with the capability of measuring sub-centimeter ground deformations and displacements and to produce hyperspectral based value added products for the mapping and monitoring of soil degradation and salinity.</p> <p>Project 4.2 aims to develop new and improved interferometric synthetic aperture radar (InSAR) techniques and tools for digital elevation model (DEM) generation and subtle ground movement detection from airborne and space-borne imagery. Research will be undertaken in the areas of InSAR for DEM generation, differential InSAR for sub-centimeter and permanent scatterer InSAR for mm-level ground displacement monitoring. The techniques and software tools developed will enhance image-based ground surface change detection (such as building movements and landslips) and DEM creation as spatial infrastructure.</p>		
Output 4.2.2	Design and implement reliable methods of differential interferometric SAR generation for the measurement of ground surface deformations and displacements at the sub-centimeter level of accuracy. <i>Delivery Targets:</i> 24 months from commencement of project. [July 06]		
Milestone 4.2.2.2	Incorporate GPS techniques and ground fixed corner reflectors into procedures for monitoring the magnitude and areal extent of ground surface deformations and displacements at the sub-centimeter level of accuracy over time, 18-24 months	July 06	✓
Milestone 4.2.2.3	Validate and implement methods of measuring continuous as well as discrete deformations, subsidence and displacements over extended periods	Dec 2006	✓
Output 4.2.3	Evaluation of the usefulness of image coherence measures based on the degree of similarity in backscattering response between corresponding targets (ground cells) in interferometric data pairs for land based applications.		
Milestone 4.2.3.1	Research the problem of temporal de-correlation in interferometric datasets	July 07	✓
Outcome 4.3	<p>Agriculture, land cover classification, natural resource monitoring and assessment. This project aims to develop operational procedures that allow the routine mapping and monitoring of agricultural resources so that timely assessments of status and condition can be derived to enable informed management decisions to be made at the farm and paddock level of operation. Such procedures will build towards the development of operational systems to track progress towards the goal of delivering economically and environmentally responsible agricultural systems. The primary objective is to develop methods for linking crop and pasture performance to land condition. This involves evaluating the potential of new space-borne sensor data (eg., MODIS, ASTER, Landsat ETM, SPOT-Vegetation and Ikonos) for providing accurate and reliable quantitative biomass information for temperate and Mediterranean pasture systems and cropping environments.</p> <p>Project 4.3 aims to develop an operational cost-effective farm package of information products extracted from satellite imagery. Research will be undertaken for pastures and crops in the areas of crop yield forecast, biomass and pasture quality prediction. The information products will allow producers to make better tactical and strategic decisions at paddock and farm level with products delivered over the web in near real time.</p>		
Output 4.3.1	Evaluate new space-borne sensor data and devise methods and procedures for the detection and mapping of crop/pasture rotations that match current land practices. <i>Delivery Targets:</i> Technology assessment and methods for improved land utilization at farm level, 24 months from commencement of project.		
Output 4.3.2	Implement and validate techniques for quantification of biomass and growth rate of pastures/crops across paddocks and farms on a regular basis. <i>Delivery Targets:</i> Value-added products, new methods, technology assessment and validation to detect near real time limitations in crop growth due to climate and plant disease [Jan 07]		
Milestone 4.3.2.1	Develop new methods for linking crop and pasture performance at the farm level to current condition of the land	Jan 06	delayed
	Underway, but delayed with crop season season – new target Dec 2007	Dec 07	

Milestone 4.3.2.2	Field experimental validation of processing techniques for quantifying biomass and growth rates of pastures/crops at farm level	July 06	
	Underway, but delayed with crop season season – new target Dec 2007	Dec 07	
Output 4.3.3	Define the parameters involved in modelling scenarios of exceptional circumstances (eg drought) from seasonal times-series analysis of climatic and remote sensing (MODIS) data. <i>Delivery Targets:</i> Technology assessment, tools and procedures for multi-temporal, multi-source mapping of real time changes in land condition due to exceptional circumstances [Jan 08]		
Milestone 4.3.3.1	Review and selection of optimal digital image processing techniques that enable extracting multi-temporal information on land conditions to be incorporated into scenario modelling.	July 2007	On target
Milestone 4.3.3.2	Develop protocols for spatial analysis of exceptional circumstances that can be used by Australian Departments of Agriculture for mapping climatic impacts of drought	Dec 2007	On target
New Output 4.4.1	Determination of the hyperspectral indicators of soil degradation: erosion, salinity, sodicity and acidity. These will be morphological, mineralogical and biotic in character. <i>Delivery Targets:</i> 36 months from implementation of project (Sep 2007) Project 4.4 will develop methods and tools for mapping soils and vegetation using hyperspectral imagery. This will require the determination of the spectral properties of soils and vegetation under differing temporal, seasonal and illumination conditions. Software add-ons will be developed that will allow non-expert users to routinely use these methods.		
New Milestone 4.4.1.2	Report on seasonal variation of signatures - soil salinity surficial materials, soils, stressed crops and native vegetation & noxious weeds.	Oct 2006	✓
New Milestone 4.4.1.3	Beta software tools for implementation of processing methodologies	Mar 2007	On target
New Milestone 4.4.1.4	Report on methodologies for handling between swath BRDF effects and for processing multi-swath data sets.	Oct 2007	On target
New Milestone 4.4.1.5	Methodology manuals for the processing of imaging spectrometer data.	Oct 2007	On target
New Milestone 4.4.1.6	Methodologies, software tools for soil condition mapping for agricultural management; soil mineral, organic matter and moisture maps; soil maps	Oct 2007	On target
New Milestone 4.4.1.7	Methodologies, software tools for salt scald, salt-affected soil and halophytic vegetation mapping for catchment management; <i>actuality maps, salinity risk maps, DEMs, vegetation stress maps, change maps</i>	Oct 2007	On target
New Milestone 4.4.1.8	Methodologies, software tools, and demonstrator studies for crop stress assessment for irrigation control and salinity management; short -term multi-temporal maps of crop biomass and stress for selected crops at a within-paddock scale long-term multi-temporal maps of changes to crop stress following mitigation and/or changed farming practices	Oct 2007	On target
New Milestone 4.4.1.9	Methodologies, software tools for native vegetation and/or noxious weed identification, assessment and management	Oct 2007	On target

Research Program 5 – VISUALISATION

Outcome 5.1	To create user-oriented toolkits for modelling spatially explicit complex systems. This will allow users to build spatially explicit models of processes or activities using the generic toolkits using data derived from the SDI. Project 5.1 aims to integrate content-based image retrieval into satellite imagery search capability. The research will concentrate on the development of new models and algorithms for content-based image retrieval. The technology and algorithms developed, which will be incorporated into different tool sets, will enhance current spatial image search ability.		
Output 5.1.1	a hybrid 2 and 3D cellular automata spatial modeling and intelligent mobile agent system with a web-based (Java) interface running on PCs, distributed computer networks and massively parallel architectures. <i>Delivery Targets:</i> June 2009		
Milestone 5.1.1.3	Implementation of the generalised modeling system on a range of architectures	Dec 2006	N/A
	<i>Change of project scope and adoption of a different approach</i>		
Milestone 5.1.1.4	A web-based interface for creating and running spatial models usable by non-computing professionals.	Dec 2007	N/A
	<i>Change of project scope and adoption of a different approach</i>		
Output 5.1.2	A spatial data mining toolkit for decision support which works across distributed datasets and different software platforms. <i>Delivery Targets:</i> June 2006		
New Milestone 5.1.2.1	Spatial Search Engine – Migration of developed algorithms with approved participant functionality into commercial plug-in.	Dec 2007	On target
Milestone	A graphical interface to SPMMML for use by the non-professional computer user.	Dec	n/a

5.1.2.3		2006	
	<i>Change of project scope - used independent platform with embedded algorithms which provides GUI for user</i>		
Outcome 5.2	Establish operational procedures for SDI interface via collaborative virtual environments. The advanced visualisation techniques will improve communication of data and model outcomes and provide common access to decision support tools from diverse locations. Project 5.2 will automate the creation of three-dimensional environmental models from on-line spatial data for both scientific and community use. The models, which can be visualised and explored using standard software, will also be combined with scientific process models of surface and sub-surface events to enhance understanding of land management decisions.		
Output 5.2.4	Incorporation of all the above within a real-time multiple access point interface Sep 2007		
Milestone 5.2.4.2	Development of interface including procedures for working within an immersive environment and communication with other users (e.g. avatars).	Dec 2006	✓
Milestone 5.2.4.3	Whole systems testing, refinement and demonstration	Sep 2007	✓
Outcome 5.3	To provide procedures and tools for communicating information uncertainty which improve the way users evaluate the suitability of spatial datasets for inclusion in their decision-making processes. Project 5.3 aims to improve techniques for communicating the quality of spatial data to users with different skill levels. Research will be undertaken in the areas of modelling variation in data quality, communicating new techniques for representing quality information, and understanding the quality of end products derived from environmental modelling processes. The methods and tools developed will permit data users to make more informed choices about the quality of the data needed for their tasks.		
Output 5.3.4	Description: Working prototype with advanced uncertainty visualisation enabling user-interaction Delivery Targets: December 2006		
Milestone 5.3.4.2	Add capacity for user interaction with full suite of uncertainty visualization tools.	Dec 2006	✓

Research Collaborations

CRCSI has many participants across Australia – over 60 companies had formal collaborative arrangements with CRCSI activities in the year, along with many government departments and six universities. There is 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 is important to 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. The independent industry survey of the Third year Review concluded “SMEs are engaged through 43pl, which is both innovative and successful” and that “end-users are well satisfied”

14 research contracts and consultancies brought in \$426,000 of new income.

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 assisted through regular telephone and other conferences, coordination of physical meetings by the Board and the executive. The website has become increasingly important to connect participants with CRCSI activities and events. The Annual Conference and state based get-togethers are perceived to be of high benefit by our participants.

A comprehensive Communications Strategy adopted by the Board provides a central role in fostering collaboration. This has seen the independent industry survey of the Third Year Review conclude that “the CRC’s communications and networking are both a strength and a principal value.”

Other CRCs

Cooperative arrangements with other CRCs are selectively sought where resources allow and mutual interest is found. Some 30 CRCs are thought to have strong interests in and applications of spatial information. Contact has been made with those of obvious

relevance, such as the Predictive Mineral Discovery CRC, CRC for Sensor Signal and Information Processing and the two Biosecurity CRCs. Focused workshops have developed formal collaborations with the Bushfires and Forestry CRCs.

National

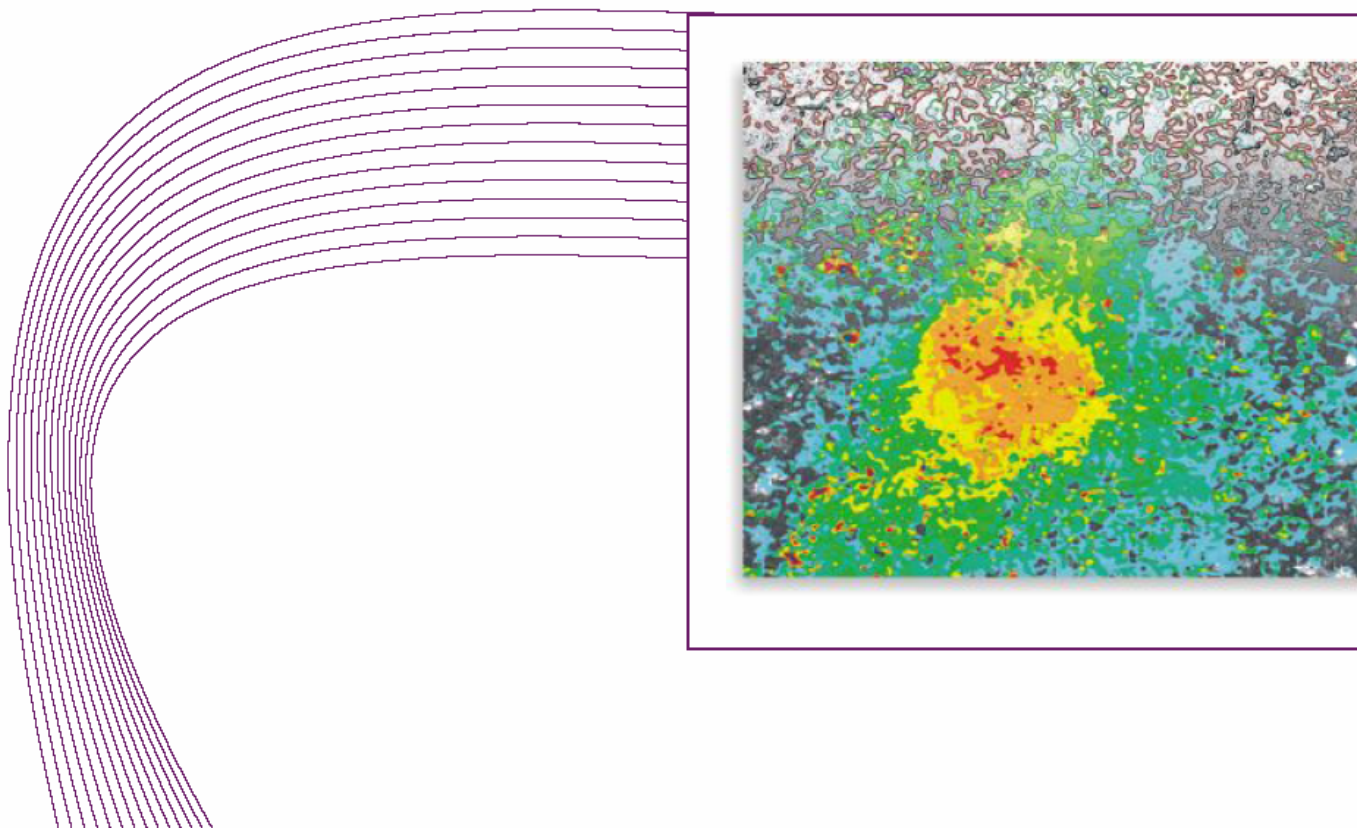
Strong Links have been established with key stakeholder groups, notably the Australian Spatial Information Business Association (ASIBA), the Spatial Sciences Institute (SSI) and the peak government body ANZLIC – the Land Information Council. Mechanisms include board invitations, joint board meetings, membership, committee representation, and invited presentations, shared web links, and collaborations on important initiatives such as the national Spatial Education Advisory Committee; leadership roles within the NCRIS AuScope and related activities; and the commissioning of an independent study “economic impact of spatial information on the Australian economy”. These relationships are important to give strategic advice and context to the CRCSI.

International

The CRCSI plan in this area emphasises quality over quantity. It is recognised that considerable resources have to be devoted by each party to make such collaborations work. Apart from the usual project and individual researcher based links, the following international links are being pursued for strategic reasons and net benefit to our shareholders.

- GEOIDE Network based at the University of Laval in Quebec, Canada (analogous to a CRC, funded as a Canadian ‘Networks of Centres of Excellence’ (<http://www.geoide.ulaval.ca>)). – *strategic link of CRC-wide benefit*
- *Chinese Academy of Sciences* A collaborative research agreement underpins joint activities that are being developed.

Three other international collaborative alliances were maintained during the period with strategic advantage sought for specific projects.



Collaboration – Projects and Participants

Current Projects

Research and Development collaboration is strong within the CRCSI as indicated by the number of participants in each project and the number of cross-sectoral project teams. Indeed it is a project selection criterion that representation on projects must come from each of the private, public and academic sectors.

		43pl and other companies involved	Geoscience Australia	Vic – Dept of Sustainability & Environment	NSW – Dept Lands	WA – Dept of Agriculture	WA – Dept of Land Information	Univ. of Melbourne	Univ. of New South Wales	Curtin Univ. of Technology	Charles Sturt University	Queensland University of Technology	University of New England	Qld – Dept of Natural Resources & Water
1.1	Enhancing Australia's Core Geodetic Infrastructure	2	✓	✓	✓		✓		✓	✓				
1.2	Quality Control Issues for Real-Time Positioning	5		✓	✓		✓	✓	✓					
1.3	Integrated Positioning & Geo-referencing Platform	3			✓				✓					
1.4	Precise Positioning in Regional Areas	8	✓	✓	✓		✓		✓			✓		✓
2.1	Automated Mapping & Feature Extraction from Space, Aerial & Terrestrial Imagery	3	✓	✓	✓			✓	✓	✓				
2.2	Fundamental Modelling, Analysis and Systems Development for Integrated Imaging and Positioning Sensors	7						✓	✓	✓				
3.2	Data integration, modelling and standards	5				✓	✓			✓				
3.3	Access to Spatial Data	4		✓				✓						
3.5	Digital Access & Rights Management											✓		✓
4.1	Near real-time remote sensing products from MODIS based on NADIR surface reflectance and bio-physical models	1	✓				✓		✓	✓				
4.2	Multi-sensor, multi-scale image and terrain system for environmental and natural resource analysis	2	✓						✓					
4.3	Agriculture, land cover classification, natural resource monitoring and assessment	2				✓	✓	✓		✓				
4.4	Imaging spectrometry (hyperspectral imagery) products for characterising, mapping, monitoring and managing environmental stress	2	✓					✓	✓					
5.1	Support Tools for Spatial Data Mining and Agent-Based Modelling	2			✓						✓			
5.2	Visualisation for collaborative decision making	1	✓					✓						
5.3	Communicating Spatial Data Quality	1	✓	✓		✓		✓		✓				
6.4	Location Positioning Device [Iokadeva]	2		✓	✓									
6.6	Platform for Environmental Modelling Support	1		✓										
6.7	SI Business Improvement Applications	3										✓		✓
6.8	Clever Cropping & Cattle Systems	5											✓	
8.1	Commercialisation - HazWatch development	2			✓		✓							
8.2	Commercialisation - Scanalyse	1								✓				

Commercialisation & Utilisation

Strategies and Activities -

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 public-private collaboration to build institutional capacity.'

This purpose is entirely consistent with the objective of the CRC Programme

'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 CRCSI Board (and DEST) approved Commercialisation and Utilisation Plan outlines the strategies for maximising the industrial, commercial and economic impact of CRCSI activities.

Commercialisation of CRCSI Centre Intellectual Property

Spatial Information Systems Limited (SISL) is the holder of Centre Intellectual Property (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. Through 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 in the manner it sees fit. The details of the commercialisation plan for the CRCSI, including the patent and licensing strategies, is documented within the CRCSI Commercialisation and Utilisation Plan.

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. The Project Management Group pro forma agenda for quarterly meetings includes consideration of any commercial aspects pertinent to project progress and output.

Where commercialisation within a project is evident, our strategy is simple; identify potential technologies for commercialisation early through the project proposal process; develop a business case, through quarterly project management group meetings, for presentation to the Governing Board. If approved, this is passed for implementation to the CRCSI commercial agent, SISL. An expression of interest to develop the commercial proposition is then sought from CRCSI participants.

Key Commercialisation Activities

Those organisations selected by the Board to lead the commercialisation of CRCSI opportunities are chosen on the basis of two principles; firstly preference is given to those who have played a lead role in the research and development phase, secondly the choice of the commercialiser must be in the overall best interests of all CRCSI partners.

The strength of the business case presented for commercialisation is a key factor in helping the Board with its final decision.

There are several commercialisation-utilisation activities and results that have been initiated and or achieved this year.

A review of all research and demonstrator projects by a CRCSI Panel at the annual conference, and ongoing monitoring of projects within the quarterly Project Management Groups, has kept focus on commercialisation aspects.

A pipeline of commercialisation / adoption opportunities has been generated, with business cases prepared for the Board to commercialise several project outcomes. Several other projects indicate promising results and commercial opportunities are being explored.

HazWatch – start up company “iintegrate Systems Pty Ltd”

HazWatch is being commercialised through iintegrate Systems Pty Ltd. This is a subsidiary of NGIS Pty Ltd, the 43pl member company that played a key role in the CRCSI emergency management demonstrator project 6.1. The company is a specialist geospatial software developer offering a portfolio of advanced products including the GeoSamba© location server. GeoSamba provides HazWatch the ability to connect many types of information, previously locked away in private and public databases, and to make it available in real-time to emergency response teams from many different agencies and jurisdictions in various locations. The CRCSI has licensed the HazWatch IP to the company and also negotiated equity in the company.

MillMapper - start up company “Scanalyse Pty Ltd”

Scanalyse is developing laser scanning technology products to improve the efficiency of mining and mineral processing operations. The first product, Millmapper, significantly reduces the maintenance cost of grinding mills by providing unique wear detection, monitoring and predictive intelligence. The CRCSI has negotiated commercial terms for an ongoing role in the company. Scanalyse now employs 6 people and is seeking major investment for development and growth.

i-loka – know how

Designed to overcome the limitations of single sensor positioning, with the aim of providing seamless, continuous positioning and recording contextual information, loka can be described as a universal positioning device for humans. Consisting of a human wearable component, known as the Deva, an Internet based communication interface and a server side software component, loka is an end-to-end solution. Having developed a demonstrable and working prototype, the next phase for loka is to secure early stage investment to develop a miniaturised version of the Deva that can undergo thorough field testing in the lone worker or emergency service areas.

The loka development initiative has been supported by a CRCSI consortium of Geomatic Technologies Pty Ltd; PSMA Australia Limited; Department of Sustainability and Environment Victoria; Department of Lands NSW; The University of Melbourne, The University of New South Wales.

Barista - software

An output of Project 2.1 is Barista, a low-cost software system for data processing and metric geoinformation extraction from high-resolution satellite imagery (HRSI). Barista has been designed to have commonly needed image analysis and measurement functions, which makes it an ideal tool for practitioners and non-specialists seeking to extract spatial information from HRSI, especially from single images from the Ikonos, Quickbird, SPOT5 and ALOS satellites. Barista's strength is that it offers easy-to-use, commonly needed spatial information extraction tools which are currently available only in high-end specialist digital photogrammetric workstations. Commercial sales have begun. Initial sales have been made to Infoterra of France and further negotiations are underway.

DEST Table 4 - Commercialisation and Utilisation Outputs and Milestones

Output / Milestone	Description of all 2006-07 milestones and/or outputs incl. past milestones which have not been met (and contracted achievement date)	Achieved 06-07 (yes/no)
Outcome 8.1	Adoption of CRCSI produced technology by Australian entities that leads to significant economic growth in the SI industry (ie in terms of total sector turnover, company profitability, SISL revenue and exports)	✓
Output 8.1.1	4 market ready technology packages in Year 3 for SISL to seek adopters	✓
1 - HazWatch – arising from emergency management demonstrator project [equity and licence terms for the start up company “iintegrate Systems”] 2 - Scanalyse – arising from the laser scanning expertise in program 2 at Curtin University [convertible note negotiated with the start up company “Scanalyse Pty Ltd”] 3 – 3D Multipath Simulation System – [provisional patent applied for from project 1.1, but yet to be picked up by industry] 4 - Barista feature extraction software package from program 2 [06-07 plans for comm’n] 5 – i-loka portable location device [market analysis with view to finding production partners]		
Milestone 8.1.1.6	Demonstrator projects underway: 1 – Emergency management [HazWatch] – Dec 03 2 – Portable location device [lokadeva]– Dec 04 3 – CORS Network Study 05-06 4 – PEMS Demonstrator 06-07	✓
1 - HazWatch being commercialised through start-up company iintegrate Systems Pty Ltd 2 – i-loka being commercialised through 43pl company Geomatic Technologies 3 - Project 1.1 applied to end-user needs through market and technology analysis of CORS network options 4 – Platform for Environmental Modelling Support		
Milestone 8.1.1.7	Five licence deals in place either as company start ups or as viable and profitable technology agreements ... December 2007	On target
1 – HazWatch 2 – MillMapper 3 – Barista 4 – Radar detection services 5 – Project 2.2		
Tech Transfer Milestone 8.2.1.3	Recognition of driving the Action Agenda forward – Jun 05 ongoing	✓
CRCSI has a recognised key role in all aspects of the action agenda. In particular it is “one of the four pillars” of the Australian SI industry along with ANZLIC, ASIBA and SSI. The CRCSI is an active member of the Spatial Education Advisory Committee.		

IP 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.

An IP register of Centre IP, Background IP and nascent IP has been disseminated to all project leaders. Each quarterly Project Management Group meeting discusses commercial issues, concepts and opportunities. These are also considered at Project Leader fora and at the annual conference. CRCSI largely relies on the expertise within the Executive to advise projects on IP and related strategies, accessing expert inputs when required, including that of the CRC Advisory Committees.

During the year the CRCSI’s IP holding company SISL handled the IP transactions described in the Commercialisation Activities section above. Each transaction is reviewed

with considerations of national benefit as well as reflecting the inputs of organisations to the CRCSI activities.

SISL is aware of the National Principles of IP Management and related guidelines and incorporates these into its considerations and strategies

In addition all PhD students and some early career researchers received specialised training in IP and commercialisation culminating in a two day "Bootcamp."

Communication Strategy

A comprehensive Communications Plan was adopted by the Board at the outset of the CRCSI. The independent industry survey conducted as part of the Third Year Review commented favorably on the CRCSI's performance in this regard: "The CRC's communications and networking are both a strength and a principal value"

Communication strategies include

- Regular workshops or "get-togethers" in each state to bring all participants views into strategic planning, and to encourage understanding across sectors. Specific workshops are also held with participants and with sectors
- Annual Conference of participants for wide-ranging technical discussion and personal interaction
- Annual "satisfaction survey" to maintain and understand the engagement of parties
- Regular correspondence and newsletters which include summaries of board minutes immediately following Board meetings
- 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 allows appropriate information flows and encourage organisational interaction
- Communications Director to drive and resource these strategies, and to nurture relationships amongst 43pl SME consortium
- 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 from each sector in the CRC
- co-location of R&D and management personnel and activities in the CRCSI offices
- reliance on a strong web platform for project and other communications. The website is averaging 10 thousand visits per month and is top of the Google ranking for "spatial information" for the third year in a row.
- regular electronic newsletters

Strategies for Developing SME Links

The CRCSI has a unique structure for its SME consortium: members purchase units in a unit trust through which each can participate in the CRC with appropriate flexibility. A resourced set of strategies to engage with these companies is implemented through the Communications Director position. New members of 43pl are encouraged and 5 new companies joined. Two of the founding members have merged.

The industry primarily consists of small firms. In surveying services, the average number of persons employed per enterprise is 4.8 (according to IBIS data); in the remote sensing area, the number is 5 (according to a PWC report). The former Consulting Surveyors Australia organization has estimated that around 70% of its member firms have 20 or fewer employees. Similarly, the PWC report found that around 90% of firms in that sector of the industry had 20 or fewer employees. A survey in 2001 by CTG Consulting included a number of larger firms in the industry but there is still very few employing over 100 staff.

The Australian SI industry has many SMEs. From the outset it was recognised that there was a need for SMEs to be integrated. ASIBA, which has some 400 members, played a strong role in the formation of a unique CRC structure to achieve this. A representative company 43pl is the trust manager. This company is a CRCSI 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, administration 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 43pl value proposition includes

- Access to R&D initiatives and IP
- Neutral ground to meet clients and suppliers
- Growing the business (technical, professional development)
- Meaningful networking into government & academia
- Market development; kudos

"43pl gives us an unprecedented opportunity to bring the small corporates and researchers together in a rapidly growing industry" *Mike Ridout, Communications Director*

The independent end-user survey of the Third Year Review had this to say about the CRCSI engagement with SMEs...

"SMEs are engaged through 43pl, which is both innovative and successful"

"... of vital importance to the fledgling SI sector and to the CRCSI"

"End-users, and particularly SME end users, are well satisfied with their level of access to the CRCSI's research and expertise."

Involvement of End-Users

End users are involved in all aspects of the CRCSI. As required by the Commonwealth guidelines the following tables list "research users" with active and meaningful engagement in the CRCSI during the year. The nature of activities is reported in the project descriptions. Strong SME engagement is a particular strength of CRCSI and is reflected in all aspects of the CRC operation.

With regard to wider anticipated benefits to users, the CRCSI annually conducts through KPMG an independent confidential financial survey of the 43pl companies. The survey continues to reveal growth above industry norms. Key indicators include average revenue growth of 27%; current ratio of 9; 20% growth in number of employees.

Importantly, the Third Year Review's industry survey commented very favourably on the CRCSI engagement with end users, noting that "end users are well satisfied with their engagement levels" and "SMEs are engaged through 43pl, which is both innovative and successful"

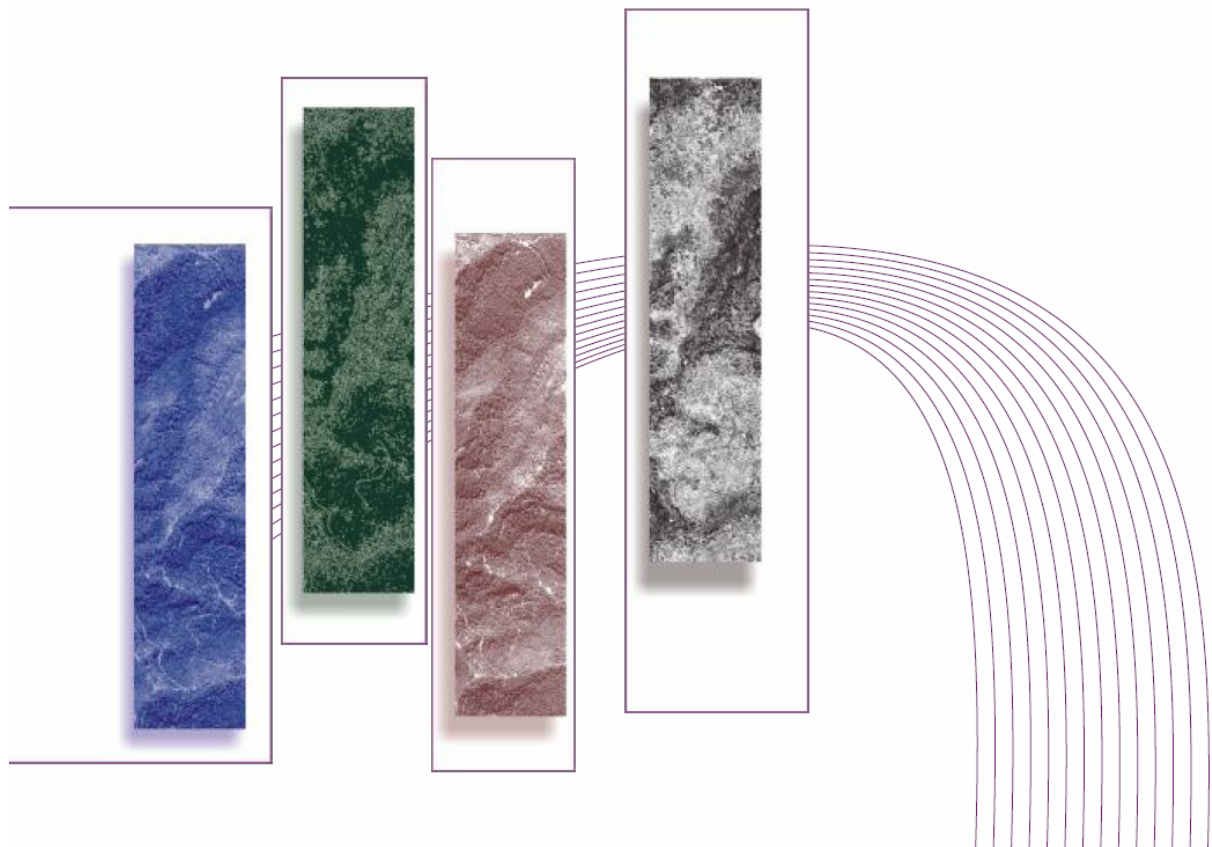
Furthermore it concluded that the CRCSI was "vital to the organisation of the fledgling SI industry, and as creating a cross sectoral collaborative framework that will lead to economic and social benefits to the nation in the long term."

DEST Table 5 - End-user Involvement and CRC Impact on End-users

Industry or other research users and the basis of their Interaction	Type of activity and location of activity	Nature and scale of benefits to end-users (e.g. increase in exports, productivity, employment etc)	Actual or expected benefit to user (where possible, include benefits accruing in \$ terms)
Core Participants			
Dept Agriculture & Food, WA	Research User and contributor. Based in WA, with field stations throughout the Wheatbelt. Participation in CRC wide planning workshops.	Contributing to the development and trialling of CRC research (project 4.3 in particular) with a view to increased farm management efficiency and productivity.	
Dept Sustainability and Environment, Vic	Research User and contributor. Participation in CRC wide planning workshops. Victoria, with regional facilities.	Trialling outcomes of Project 1.2. Principal contributor to Virtual Australia Standing Committee Project engagement	
Geoscience Australia	Participation in CRC wide planning workshops. Project 4.1 Leader Canberra, Perth	Enhanced product (accuracy) Trialling of project outcomes Project engagement	
Landgate (was Dept of Land Information) WA	Project participant Project 6.1 Leader Trialling Project 8.1 outcomes Perth	Enhanced product; Trialling of project outcomes ; business efficiency; support of other operations (viz Shared Land Information Platform); technology awareness	
Dept of Lands, NSW	Project participant Participation in CRC wide planning workshops. Sydney, Bathurst	Business efficiency; technology awareness; Trialling of project outcomes Project engagement	
Dept Natural Resources & Water, Qld	Project participant Participation in CRC wide planning workshops Brisbane	Business efficiency; technology awareness; Trialling of project outcomes Project engagement	
43 Pty Ltd - see below	Project participant Participation in CRC wide planning workshops Australia wide	See below	
Ergon Energy	Research user & contributor Project 6.7 Leader Participation in CRC wide planning workshops	Increase in productivity and decrease in operational costs, estimated in the millions of dollars	
Support Participants			
ESRI Australia Support Participant	Project participant Perth		
Defence Imagery and Geospatial Organisation	Participation in CRC wide planning workshops Canberra, Melbourne		
Intergraph	Project participant REAC member Melbourne, Perth		
43pl Participants			
AAMHatch	Project participant Workshop participant Perth, Sydney, Melbourne	Importantly, the Third Year Review's industry survey commented very favourably on the CRCSI engagement with end users, noting that "end users are well satisfied with their engagement levels" and "SMEs are engaged through	Furthermore, the independent survey of end-users of the Third Year Review reports "...the level of engagement between the CRCSI and respondents is high" " ... ten
Alexander & Symonds Pty Ltd	Project participant Workshop participant Adelaide		
Apogee Imaging International	Project participant Workshop participant Adelaide		
Advanced Spatial Technologies	Workshop participant Perth		
Brown & Pluthero Pty Ltd	Workshop participant Surfers Paradise		
Beveridge Williams & Co	Melbourne		
C. R Hutchison & Co	Melbourne		
CSBP Limited	Project participant Workshop participant Perth		
Digital Mapping Solutions	Perth		
D.M. Gerloff & Associates	Port Headland		

Fractal Technologies	Project participant Perth	<p>43pl, which is both innovative and successful"</p> <p>Furthermore it concluded that the CRCSI was "vital to the organisation of the fledgling SI industry, and as creating a cross sectoral collaborative framework that will lead to economic and social benefits to the nation in the long term."</p> <p>Reasons given by 43pl members for CRCSI participation:</p> <ul style="list-style-type: none"> o Access to R&D initiatives and IP, technical expertise o Neutral ground to meet clients and suppliers o Growing the business (technical, professional development) o Meaningful networking into government & academia o Market development; kudos o Technology awareness and "horizon watching" 	<p>respondents acknowledged that their organisation had already attempted to implement a new idea from the CRC's research ... and several expected to start implementing such new ideas in the near future"</p> <p>" ... more than 80% (45) of respondents expect the CRC will add value to their business in the future and 36 expect that the future competitiveness of their business will be enhanced through their participation in the CRC."</p>
Fugro Spatial Solutions Pty Ltd	Project participant Workshop participant Board director 43pl director Perth, Sydney, Brisbane, Melbourne		
Geodata Information Systems	Workshop participant Sydney		
Geomatic Technologies	Project participant Project leader Workshop participant Melbourne		
Glenn dew Pty Ltd	Melbourne		
Howell Spatial Industries Pty Ltd	Workshop participant 43pl director Adelaide		
Iintegrate Systems Pty Ltd	Project participant Commercialising agent Perth		
Intergraph- Mapping & Geospatial Solutions	Project participant REAC member Melbourne		
Land Equity International Pty Ltd	Workshop participant; Board director Wollongong, Perth		
Lester Franks Survey & Geographic Pty Ltd [Merged with Todd Alexander Surveyors Pty Ltd]	Project participant; Workshop participant Devenport, Adelaide		
Lisasoft Pty Ltd	Project participant Workshop participant Melbourne, Adelaide		
LogicaCMG Pty Ltd	Melbourne		
MapInfo Australia Pty Ltd	Workshop participant Brisbane, Canada		
Max Braid Surveyors Pty Ltd	Workshop participant Melbourne		
McMullen Nolan & Partners Pty Ltd	Project participant Melbourne		
Navigate Pty Ltd	Sydney		
NGIS Australia Pty Ltd	Project participant; Workshop participant Commercialising party Perth, Sydney		
Omnilink Pty Ltd	Workshop participant Sydney		
Omnistar	Project participant Workshop participant Perth		
Position 1 Consulting	Supplementary Bid Brisbane		
Peter W Burns Pty Ltd	Workshop participant Cooma, NSW		
PSMA Australia Ltd	Project participant Workshop participant Canberra		
QASCO Surveys Pty Limited	Project participant Workshop participant Brisbane, Sydney		
Reeds Consulting Pty Ltd	Melbourne		
Scanalyse Pty Ltd	Project participant Commercialising agent Perth		
Searle Consulting NQ	Project participant Workshop participant North Qld		
Sinclair Knight Merz Pty Ltd	Project participant Workshop participant Sydney		
Social Change Online	Workshop Participant Sydney		

Spatial Information Technology Enterprises	IACC Chair Workshop participant Brisbane		
Spatial Vision	Melbourne Project Participant		
Sundown	Brisbane Supplementary Bid		
SuperAir	Brisbane Supplementary Bid		
Trimble	Brisbane Supplementary Bid		
Twynam	Brisbane Supplementary Bid		
VPAC	Melbourne		
V-TOL	Brisbane Supplementary Bid		
Webmap Pty Ltd	Workshop participant Brisbane		
we-do-IT Pty Ltd	Workshop participant Melbourne		
Wrenfeld Pty Ltd	Workshop participant 43pl director Canberra		
Third Parties			
CR Kennedy	Project contributors Melbourne		
Hyvista	Project contributors Sydney	Project engagement and contribution at arm's length	
Various clients both corporate and government	Australia - wide Clients and project participants		



Education and Training

The Education Program provides educational and training opportunities to people who are, or may become, employed by industries using SI. It also provides a framework of support for the research students involved in CRCSI activities.

The CRCSI

- o educates existing and emerging scientists and engineers about the advantages of SI applications
- o increases awareness and promote an understanding of the many SI applications
- o ensures meaningful relationships with other relevant stakeholders

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

The CRCSI established an Education Reference Group under the Chair of Sue Moffat (CSU). Members are Clive Fraser (Chair, CRCSI Research & Education Advisory Committee); Mike Ridout (CRCSI Education Program Coordinator); Bert Veenendaal (Higher education leader, CUT) and Geoff Taylor (Short courses leader, UNSW). This operational group meets as required to drive forward the various education initiatives. UNE and QUT representatives will join in the coming year as their universities join the CRCSI.

Good progress was made during the year. A key achievement has been the establishment of the **Education Portal**, a dedicated web site that offers information and links for all the community as well as being able to offer online education courses through the internet. This will grow in the coming year and provides remote and regional Australia with access to educational resources through modern learning technology methods. Other organisations, such as SEAC, SSI and ANZLIC, can use the Portal facility to maximise the benefits to the spatial information industry.

The CRCSI is a key member of the **Spatial Education Advisory Committee**, a national forum with representatives from SSI, ASIBA, ANZLIC and other industry bodies. This means that the initiatives of the CRCSI can be checked against the interests of the wider community and our activities are informed by national input from all relevant educational interests. The CRCSI is a prime delivery agent for industry skills formation and is involved in ongoing discussions with the academic and organisational sectors to coordinate as much as possible CRCSI offerings.

The **Postgraduate Courses** program led by Bert Veenendaal has five on-line Masters units developed, three at Curtin, and one at both UM and UNSW. Others are in progress including one at the University of Melbourne.

The **Short Courses** program led by Geoff Taylor is presenting technical courses for industry courses across Australia – a total of 15 courses ran in the year, with more planned. Courses are credited with Spatial Sciences Institute "Continuing Professional Development" points. Extensive marketing efforts to tailor courses and sell them have seen increased registrations.

In addition to the short courses for industry, several **workshops** involving 43pl and other user participants are convened, focussed on new R&D project generation and on specific topics where new technologies may bring new business opportunities.

The third Annual **CRCSI conference** was held in Perth, with very good feedback from the two days' events. It highlighted the commercial and adoption achievements of the CRCSI and its participants. Pleasingly, the 136 attendees included a significant proportion of 43pl staff.

Of the nineteen PhD and five Masters students who receive full or top-up **CRCSI Scholarships**, and are being supervised with industry and end-user input, five are in the process of writing up. Students are brought to a professional and networking day associated with each CRCSI Annual Conference. CRC Participant organisations are encouraged to bring their own staff into higher degrees by coursework research.

We have met our Commonwealth Agreement targets for education and will take on more students as a result of the Supplementary Bid. Industry involvement in supervision is strongly encouraged.


Our first graduates are finding employment, with our first PhD and Masters completions going to 43pl companies.

DEST Table 6 - Progress against Contractual Milestones / Targets – EDUCATION


Milestone and/or Output	Description of all 2006-07 milestones and/or outputs incl. past milestones which have not been met (and contracted achievement date)	Achieved 06-07 (yes/no)
Outcome 7.1	Enhanced human resource pool for industry and the community	
Output 7.1.1	Description: constant stream of well-trained researchers (Masters and PhD level), with an industry focus. Delivery Targets: MSc within Year 3, PhDs within Year 4 onwards June 2004 – ongoing	
	<i>19 PhDs and 4 Masters enrolled; completions to commence in year 4 as planned</i>	Jun 2006 ✓
Milestone 7.1.1.1	Establish MSc and PhD and other Post Grad courses across Australia, & strive for full web delivery. These will be applicable to some undergraduate courses as well.	June 2004 – ongoing ✓
	Work ongoing on new and online units – five in 06-07	
Milestone 7.1.1.4	Establish student conference adjoining major CRC-SI conference, and allied enrichment programs.	Sep 2006 ✓
	Student Conference on day prior CRCSI Annual Conference; Commercialisation Bootcamp for all students; selected others attended several courses	
New milestone 7.1.1.5	Provide non-university “co-supervisors” for CRCSI Scholarship holders	ongoing ✓
	14 out of the 23 current students have end-user / industry co-supervisors	
Output 7.1.2	Description: provide, in conjunction with industry partners and primarily members of the SME consortium, customised intensive technology training courses focused at the operational level Delivery Targets: 12 courses in 2006-07	ongoing ✓
	15 separate training course events offered in the year with a further 6 workshops/conferences	
Outcome 7.2	Industry wide appreciation of the role that SI (and hence the CRCSI) plays, as a platform technology for use in varied applications	
Output 7.2.1	National recognition as “the place to go” for SI issues	
Milestone 7.2.1.1	Convene international conference in Australia	1 pa ✓
	September 2006 in Perth	
Milestone 7.2.1.2	Recognition by relevant stakeholders as a prime driver in achieving the Action Agenda objectives	ongoing ✓
	SEAC membership; Activities such as training needs analysis; financial benchmarking survey; industry workshops held 06-07.	


CRCI Scholarship Students


These students have graduated or from their course, or have submitted a (final) thesis.


<u>Martin Hale</u>	Validation of Real-Time GPS Positioning Quality Assurance Indicators	
	Supervisor (academic)	Dr Philip Collier
	Assoc Supervisor (industry)	Mr Peter Ramm, Victorian Dept of Sustainability & Environment
	Completion Date	<i>Submitted</i>
	Source of Funding	Masters Scholarship
	Project affiliation	Project 1.2

Abida Iqbal	Spatial database integration	
	Supervisor (academic)	Mr Ian Bishop, Mr Christian Stock, University of Melbourne
	Assoc supervisor (industry)	Hemayat Hussain, Vic Dept Primary Industries
	Completion Date	September 2007
	Source of Funding	Masters Scholarship
	Project affiliation	Project 5.2

<u>James McIntosh</u>	Comparison of Spatial Accuracy of Disparate 3D Point Cloud	
	Supervisor (academic)	Dr Derek Lichti
	Assoc supervisor (industry)	Sinclair Knight Merz
	Completion Date	December 2006
	Source Funding	Masters Scholarship
	Project affiliation	Project 2.2




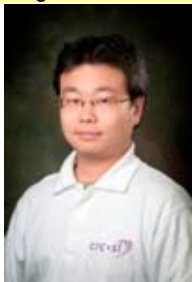
Alice Nairne O'Connor	Integrating environmental visualisation with spatial data	
	Supervisor (academic)	Prof Ian Bishop, Dr Christian Stock
	Assoc Supervisor (industry)	Mr John Creasey, Geoscience Australia
	Completion Date	July 2007
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 5.2


Joanne Poon	Spatial Information generation from high-resolution satellite imagery	
	Supervisor (academic)	Prof Clive Fraser, Dr Chunsun Zhang
	Assoc Supervisor (industry)	Mr John Creasey, Geoscience Australia
	Completion Date	<i>Submitted</i>
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 2.1

Martin Tomko		Generation of Granular Route Descriptions based on City Structure
	Supervisor (academic)	Dr Stephan Winter
	Assoc Supervisor (industry)	
	Completion Date	<i>Submitted</i>
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 3.3

Current Scholarships

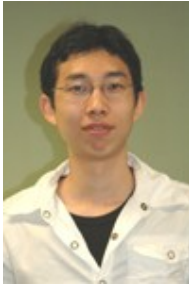
These students are currently studying, and/or submitted a thesis draft.

David Belton		<u>Classification and feature extraction of Terrestrial Laser Scanning point clouds</u>
	Assoc Supervisor (Industry)	Mr Chris Earls, AAMHatch
	Commencement Date	March 2004
	Source of Funding	Doctorate Top up scholarship
	Project affiliation	Project 2.2
Anna Boin		<u>Improved communication of spatial data quality to users</u>
	Supervisor (Academic)	Dr Gary Hunter, University of Melbourne; Matt Duckham and Allison
	Assoc Supervisor (Industry)	Ms Susan Brown, Vic Dept Sustainability & Environment
	Commencement Date	Feb 2005
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 5.3
Mark Broomhall		<u>Near real-time Aerosol Optical Depth Retrieval from Satellite Measurements</u>
	Supervisor (Academic)	A/Prof Merv Lynch, Curtin University of Technology
	Assoc Supervisor (Industry)	Dr Brendon McAtee, Dr Stefan Maier, Department of Land Information. WA
	Commencement Date	October 2004
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 4.1
Michael Hsing Chung Chang		<u>Interferometric Synthetic Aperture Radar</u>
	Supervisor (Academic)	Dr Linlin Ge, Prof Chris Rizos
	Assoc Supervisor (Industry)	Mr John Douglas, Apogee
	Commencement Date	March 2003/Mar 2006
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 4.2

Nicholas Davies	Comprehensive standards for the best practice and quality control	
	Supervisor (Academic)	Dr Derek Lichti
	Assoc Supervisor (Industry)	Lester Franks
	Commencement Date	9 March 2005 <i>on leave 2007</i>
	Source of Funding	Masters Scholarship
	Project affiliation	Project 2.2
Michael Day 	Hyperspectral remote sensing for land management applications	
	Supervisor (Academic)	Assoc Prof Geoff Taylor, Dr Ray Merton
	Assoc Supervisor (Industry)	tba
	Commencement Date	7 April 2005
	Source of Funding	Doctorate Top-up Scholarship
	Project affiliation	Project 4.4
Weidong (John) Ding 	Integrated positioning and geo-referencing platform: development	
	Supervisor (Academic)	Dr Jinling Wang, University of NSW
	Assoc Supervisor (Industry)	Mr Doug Kinlyside, Dept of Lands Bathurst
	Commencement Date	July 2004/Jun 2007
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 1.3
Peter Feng 	Content-based image retrieval and its application in GIS	
	Supervisor (Academic)	Dr David Tien
	Assoc Supervisor (Industry)	Mr Tony Hope, Dept of Lands
	Commencement Date	Dec 2004
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 5.1
Simon Fuller	Quality Control issues for real-time positioning	
	Supervisor (academic)	Dr Phil Collier
	Assoc Supervisor (industry)	tba
	Commencement Date	March 2004
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 1.2
Sue Hope 	Vertical Fusion of Spatial Data	
	Supervisor (academic)	Ms Allison Kealy, Uni Melbourne
	Assoc Supervisor (industry)	Ms Jessica Davies, Geomatic Technologies
	Commencement Date	April 2005
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 5.3
Matthew Hutchinson 	Development of an Intelligent Geocoder to Enable Spatial	
	Supervisor (academic)	A/Prof Bert Veenendaal, Curtin University of Technology
	Assoc supervisor (industry)	Dr Derek Milton
	Commencement Date	May 2004
	Source of Funding	Doctorate Full Scholarship
	Project affiliation	Project 3.2

Marco Marinelli**Assessing error effects in critical application areas**

Supervisor (academic) Dr Rob Corner
 Assoc supervisor (industry) Pat Gethin, CSBP
 Commencement Date April 2005
 Source Funding Doctorate Full Scholarship
 Project affiliation Project 5.3

Alex Ng**Persistent radar interferometry**

Supervisor (academic) Dr Linlin Ge, Prof Chris Rizos
 Assoc Supervisor (industry) tba
 Commencement Date Jan 2007
 Source of Funding Doctorate Full Scholarship
 Project affiliation Project 4.2

Joanne Poon**Spatial Information generation from high-resolution satellite imagery**

Supervisor (academic) Prof Clive Fraser, Dr Chunsun Zhang, University of Melbourne
 Assoc Supervisor (industry) tba
 Commencement Date May 2004
 Source of Funding Doctorate Full Scholarship
 Project affiliation Project 2.1

Noor Raziq**High Precision GPS Deformation Monitoring in an Engineering**

Supervisor (academic) Dr Phil Collier
 Assoc Supervisor (industry) tba
 Commencement Date Mar 2005
 Source of Funding Doctorate Top-up Scholarship
 Project affiliation Project 1.2

Eric Richards**Use of high resolution satellite data**

Supervisor (academic) Dr John Trinder
 Assoc Supervisor (industry) Mr Andrew McCleave, SKM
 Commencement Date Jan 2006
 Source of Funding Masters Scholarship

Adam Roff**Hyperspectral imagery for vegetation management**

Supervisor (academic) A/Prof Geoff Taylor, Dr Ray Merton
 Assoc Supervisor (industry) tba
 Commencement Date March 2005
 Source of Funding Doctorate Top-up Scholarship
 Project Affiliation Project 4.4

Zaffar Sadiq

Database Modelling of Variation in Spatial Data Quality



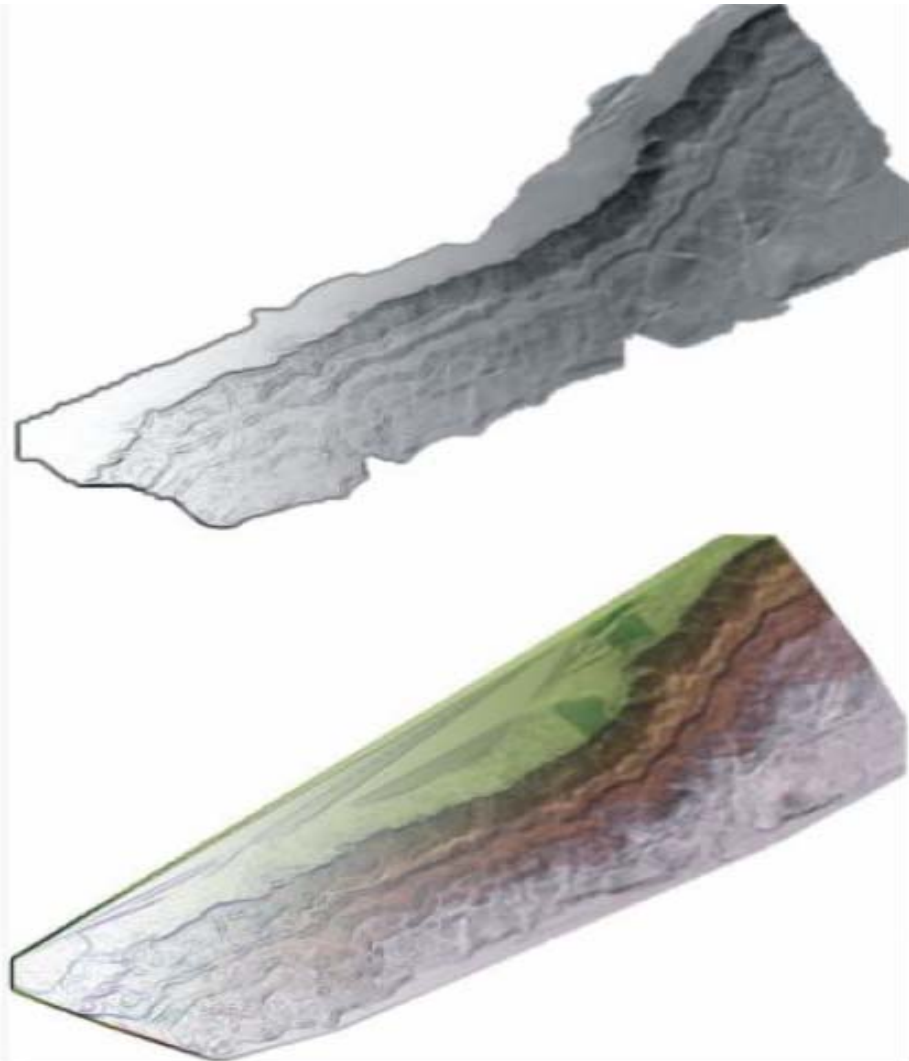
Supervisor (academic)	Dr Matt Duckham
Assoc Supervisor (industry)	Mr Geoff Lawford, Geoscience Australia
Commencement Date	Feb 2005
Source of Funding	Doctorate Full Scholarship
Project affiliation	Project 5.3

Asghar Tabatabaei

GNSS Interference



Supervisor (academic)	Dr Joel Barnes, Mr Andrew Dempster, UNSW
Assoc Supervisor (industry)	tba
Commencement Date	December 2004
Source of Funding	Doctorate Full Scholarship
Project affiliation	Project 1.1



Performance Measures

DEST Table 7: Progress on Commonwealth Agreement Performance Measures

PERFORMANCE MEASURE	05-06 ACHIEVEMENT	06-07 ACHIEVEMENT
CRC Programme Objective 1: To enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development		
Centre Objective 1.1 Position the SI industry as playing a key role in supporting the delivery of economic development, environmental management and social equity in Australia		
Recognition of the CRCSI role within a longitudinal study of the uptake and impact of SI in the wider community	Recognised as one of the four pillars along with ASIBA and ANZLIC and SSI	To be explored in quantitative measure through the Economic impact study the CRCSI has commissioned by ACIL Tasman "The CRCSI is seen as being vital to the organisation of the fledgling SI industry, and as creating a cross-sectoral collaborative framework that will lead to economic and social benefits to the nation in the longer term. [Conclusion 6 of the Y3R independent survey of CRCSI end-user participants]"
Key role played in the ICT CRC Council	CRCSI CEO elected to ICT Council	CRCSI CEO on ICT Council
Centre Objective 1.2 To provide innovative World-class research which will provide the science and technology infrastructure to enable applications to develop and expand		
Invitations and paper presentation at national and international forums (2 in Yr 1, an average of 3 per year thereafter)	133 publications. A number of these papers attracted best paper awards in 2005/06. Invited keynotes presented by CEO and Research Director and Science Program Managers at several conferences each year.	Invited keynotes presented by CEO at several conferences each year. 4 chapters; 17 published or accepted refereed articles; 64 refereed conference papers.
International recognition and participation in international programs of benefit to Australia and the region (5 in total)	3 international collaborative alliances	5 international collaborative alliances
Recognition as "an outstanding CRC"	Key role in organising CRCA conference and workshops Milestone achievements in research education and commercialisation	CRC Programme 2007-08 STAR Award for Small Business Engagement Analysing the Year Three Review DEST comments that "the CRC has done an outstanding job in bringing together and working with industry, government and research participants, and integrating research projects into the Centre's overall strategy and goals" "bouquets for the CRC - I have been involved in five or six CRCs, and this one is the most professionally run and rigorous in governance and management"

PERFORMANCE MEASURE	05-06 ACHIEVEMENT	06-07 ACHIEVEMENT
		respondent to independent survey of the Third Year Review
Centre Objective 1.3 To enhance the growth and use of spatial data infrastructures at all levels for national benefit		
Research outcomes which inform the policy and regulatory framework (a formal position on at least one of the ANZLIC working parties)	CEO on ANZLIC Emerging Issues Committee	Several projects with ANZLIC engagement and leadership as well as others with strategic guidance from ANZLIC members
Centre Objective 1.4 To support the objectives of the Australian Spatial Information Industry Action Agenda (ASIIAA) "Positioning for Growth" 2001		
Annually monitor the output of the CRCSI against the objectives of the Industry Action Agenda	Covered within the CRCSI Strategic Plan for the year, which has had all targets met or exceeded	Covered within the CRCSI Strategic Plan for the year, which has had all targets met or exceeded
Involve external assessors to provide qualitative feedback biennially	Annual Conference involved feedback on all projects from six international experts	Year Three Review [two international and two national experts] reviewed all extant projects and provided feedback to leaders and managers
CRC Programme Objective 2: To enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia		
Centre Objective 2.1: To investigate and develop appropriate policies to address current legal, regulatory and institutional limitations to the access and use of SI		
Number of policy recommendations or standards developed on improving access and use of SI	Contribution to ANZLIC and other bodies' policy formulation.	Contribution to ANZLIC and other bodies' policy formulation. Initiated project on digital access to spatial - and other - information.
Centre Objective 2.2: To foster industry capabilities and growth, and the level of commerce in SI in Australia		
At least two stakeholders participating in each program	Achieved in all projects	Achieved in all projects with the majority having more than three, and all including end-users [particularly 43pl companies]
7 initiatives developed or initiated by the CRC taken up by stakeholders	2 known – HazWatch (integrate Systems) and MillMapper (Scanalyse)	““At least ten organisations are implementing new ideas from the CRC” [Conclusion 8 of the Y3R independent survey of CRCSI end-user participants]
Contribution to sustained industry growth of 10% pa averaged over the next 7 years	KPMG annual financial benchmarking survey of 43pl companies shows growth in excess of this level	KPMG annual benchmarking survey of 43pl companies shows growth in excess of this level “... the CRCSI is very well placed to deliver economic benefit through 43pl Members to the SI industry” [Conclusion 9 of the Y3R survey of CRCSI end-users]
Centre Objective 2.3 To be a player of significance in the international SI community, both in technology development and commercial innovations		
\$3.125m of additional research and consulting contracts attracted by the CRCSI over the life of the centre (consistent with Schedule 3 Table 2)	We are at \$1,086,000 (cash) against the 2006 FY target of \$450,000 [cumulative \$1,270,000 vs \$700,000 budget]	We are at \$1,570,000 (cash) and \$2,055,000 (accruals) against the 2007 FY target of \$900,000 [cumulative budget is \$1,600,000] 14 research contracts &

PERFORMANCE MEASURE	05-06 ACHIEVEMENT	06-07 ACHIEVEMENT
	A second spin off company established	consultancies were carried out and three options on IP signed.
Centre Objective 2.4 To provide education and training to support an internationally competitive SI industry		
70 students, researchers, industry & end users attending courses on average pa	13 technology transfer courses 130 attended the annual technology transfer CRCSI conference in Melbourne with 5 international expert presentations	15 technology transfer courses 3 technology transfer workshops were also held. 136 attended the annual technology transfer CRCSI conference in Perth 25 students and early career researchers attended the commercialisation Bootcamp course
CRC Programme Objective 3 To enhance the value to Australia of graduate researchers		
Centre Objective 3.1 To develop the research capability, capacity, skills base and research talent pool to develop and enhance applications and to support the adoption of SI as required for internationally competitive business		
Number of graduate students completing PhDs and Masters degrees in the CRCSI (total 25 by year 7)	24 underway	22 underway with 2 completions
90% of graduate students produced by the CRCSI who wish to be employed are employed by user and end user stakeholders	Not applicable	1 PhD and 2 Masters employed by end users
Centre Objective 3.2 To increase the efficiency of research training through effective collaboration between universities, government and the private sector		
Over 90% of graduate students having joint supervision and/or close interaction during their research training with stakeholders	75% co-supervised 100% end user interaction	75% co-supervised 100% end user interaction
100% of projects with key inputs from stakeholders	100% end user interaction	100% end user interaction Year Three Review remarks on powerful collaborations
CRC Programme Objective 4:		
To enhance collaboration among researchers, between researchers and industry or other users, and to improve efficiency in the use of intellectual and other research resources		
Centre Objective 4.1 To create long term partnerships of SI providers and users, and of the private, government and academic sectors		
More than 95% of projects involving different categories of participant	100% achieved	100% achieved
Centre Objective 4.2 To provide an innovative environment for commercialisation of new SI technologies		
4 new SI technologies incorporated into commercial ventures due to the CRC	On target - HazWatch and Scanalyse. 80% projects have a commercialisation plan.	On target – Barista [radar measurement and i-loka and position++ in development] 100% projects have a commercialisation plan.

CRCSI Strategic Plan Performance Indicators

As part of its strategic planning in December 2005 the CRCSI Governing Board revised and extended the corporate performance indicators. The following indicators measured the performance of the CRCSI to 30 June 2007.

PI 1 - Creation of a product pipeline: One product launched, one on the way from the demonstrator or research programs, and two identified and ready to be funded. In each case these must be end-user lead. All projects must have a commercialisation plan or an utilisation plan (where the benefits are primarily for government).

Progress – Achieved

- *Products*
 - *HazWatch product in the marketplace with iintegrate Systems Pty Ltd*
 - *MillMapper product in the market place with Scanalyse Pty Ltd*
 - *Barista software has achieved first licence sales*
- *Pipeline*
 - *i-loka in preparation*
 - *Project 4.2 - with its use of radar imagery for land deformation monitoring*
 - *Project 1.2 - Project 1.2 and its 'Position++' product with its positioning accuracy display for CORS systems and the mobile user*
- *Plans*
 - *all projects have appropriate plans*

PI 2 - Rationalise the project portfolio to have fewer, but larger, projects (a large project is defined as one that is greater than \$1 million of cash and in-kind). This is intended to create larger research activities with greater impact and provide a focus on development and commercialisation.

Progress – On track: with the "first round" of projects drawing to a close CRCSI management is planning on several large initiatives. We are now anticipating that we will have 11 major projects including the new Supplementary Bid projects, with the prospect of more rationalisations later this year.

PI 3 - Grow 43pl: 20% increase in the number of companies, 20% increase in their overall cash contributions, 20% increase in their overall in-kind contributions. Also wish to see the overall revenue generated by 43pl companies grow by 20% and that the growth rate of 43pl companies exceeds that of the industry in general.

Progress – Achieved:

- *13 new companies have joined*
- *cash contributions - 2007 amount exceeds Commonwealth projection to date by some 70%*
- *in kind contributions – cumulative amount double the Commonwealth projection*
- *growth rates of 43pl companies, as measured independently by KPMG, has exceeded that reported in the GIS Consultants 2005 industry survey*

PI 4 - Engage one large new corporate partner.

Progress – Achieved

- *Ergon Energy, one of Australia's largest utilities.*
- *In addition 43pl members now include Trimble, Sundown and Twynam*

PI 5 - Establish active engagement with GEOIDE and preferably one other similar organisation overseas: GEOIDE is the Canadian equivalent of the CRCSI. It was established in 1998. Engagement with GEOIDE must be designed to support the other milestones.

Progress – Achieved

- *MOU signed with GEOIDE*
- *Workshop Minute signed with Chinese Academy of Science*

PI 6 - Generate [cumulatively] \$1.35 million of new cash. This drives the CRCSI towards its seven-year target (to June 2010) of \$5.3 million.

Progress – Achieved

- *We are at \$1.57M (cash) and \$2,055,000 (accruals) against this target*

PI 7 - **World-class research and education program:** It will be assessed by independent experts using the Research Quality Framework currently under development by Australia. It will have 22 PhD and Masters students completed or underway. The citation target will be 50 (ie the number of times our papers in aggregate are cited in the literature by other researchers. This serves to measure the impact of our research rather than just the number of papers we produce. It reflects the emerging trend in world's best practice for quality publications). Successfully introduce the Masters program, and ensure alignment of the short course program with industry needs as reflected in the national user survey.

Comment –

- *World class ranking – Australian RQF process still awaited*
- *Students – target exceeded, with 24 students enrolled and starting to complete*
- *Online Masters & short courses – 5 Masters units and short courses underway*

PI 8 - Seek one or more **significant awards:** eg Prime Minister, APSEA, CRC Association, Banksia or similar.

Progress – Achieved

- *2007 STAR Award for Small Business Engagement*
- *Knowledge Commercialisation Australia award for MillMapper*
- *Several student awards have been won by CRCSI Scholarship holders*

PI 9 - **High shareholder and partner satisfaction:** The CRCSI participants have obtained significant tangible and intangible benefits as a result of their participation. This will be measured annually through a comprehensive survey of stakeholders. It should show that at least 75 percent of respondents meet this measure in the first year with the satisfaction level improving in each subsequent year. Participants can determine their own definition of the term 'direct and significant tangible and intangible benefit'.

Progress – Achieved

- *The 2007 survey revealed 100% satisfaction by Core Participants. 43pl company membership continues to be stable and grow. Independent survey of industry by the Third Year Review Panel provides an objective view of end user engagement: "End-users, and particularly SME end users, are well satisfied with their level of access to the CRCSI's research and expertise."*

Selected conclusions of the Third Year Review

"Given the ill-defined and fledgling nature of the Spatial Information industry sector, it is commendable that more than half of the research users believe that the CRCSI has a high level of understanding of the industry's research needs" [Conclusion 7]

"... the best thing about the CRCSI's research is its end-user focus" [Conclusion 14]

"70% of users, and particularly the SME end users, are well satisfied with their level of access to CRCSI's research and expertise" [Conclusion 5]

"At least ten organisations are implementing new ideas from the CRC" [Conclusion 8]

"... the CRCSI is very well placed to deliver economic benefit through 43pl Members to the SI industry" [Conclusion 9]

"CRCSI's research users highly value the increased networking opportunities provided by the CRCSI. The Annual Conference remains a highlight of the research user's networking strategy and the CRC's communication mechanisms are highly regarded. [Conclusion 18]

The CRCSI is seen as being vital to the organisation of the fledgling SI industry, and as creating a cross-sectoral collaborative framework that will lead to economic and social benefits to the nation in the longer term. [Conclusion 6]

Third Year Review

We were pleased to have our Third Year Review conducted by an independent team of reviewers of international eminence. Their report to the Board, including a comprehensive industry survey, and the Board's consideration of each recommendation therein was provided to DEST which noted in a letter response that:

"In relation to your CRC and its Third Year Review DEST notes the following positive achievements and performance:

- the CRC has significantly raised the profile of spatial information in Australia;
- the CRC has done an outstanding job in bringing together and working with industry, government and research participants, and integrating research projects into the Centre's overall strategy and goals; and
- the CRC is largely on track to deliver its outputs and outcomes, and, due to its strong commercialisation ethic and focus, has made remarkable progress in its objective of seeing its research results and expertise transferred into use with tangible results. "

The Third Year Review report includes nine recommendations. Each was immediately analysed by the Governing Board and strategies implemented in every case. Actions undertaken and conclusions are presented below. The Governing Board was very happy with the Review and places a high value on its findings for the near and long term future of the CRCSI.

1 Need a clear vision of the proportion of effort going to fundamental research and to applied research. *The Board has included this in the development of its Strategic Plan for the next period.*

2 Clarify how the Virtual Australia Committee outputs are integrated into the research agenda. *The Virtual Australia Committee has been subsumed into the Strategic Planning process.*

3 An external peer review process should be established for cutting edge research projects. *The Board will continue to seek independent advice and review of key projects as they emerge; and will build relationships with key figures (including the Review Panel) to provide ongoing strategic and specific advice to provide this review.*

4 The CRCSI Board should review the 'college' electoral system to see whether it is the most appropriate for the next stage of the CRCSI's development. *The Governing Board believes its skill matrix is appropriate but will examine the election of directors system annually at its annual performance review. Optimising the structure of the Board of the rebid vehicle, Spatial CRC2, will be a key component.*

5 The CRCSI Board seek legal advice about its current commercialisation decision making processes to ensure that its structure achieves the intended objectives of having a faster, sharper, smaller Board (SISL) with commercial focus and of insulating the CRCSI (and its research funds) from the risks arising in some commercial transactions. *The Board immediately commissioned two professional opinions and adopted their findings.*

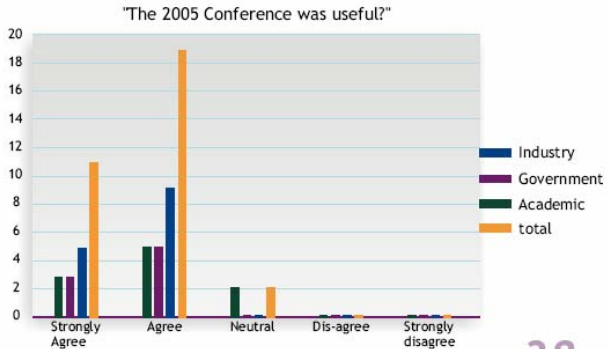
6 The CRCSI continues to use its resources including its links with industry and professional bodies to focus on attracting the highest calibre students to participate in the post graduate program. The Board endorses this and will maintain efforts to attract the best students for appropriate degrees and ensure that funding is made available for scholarships etc.

7 Consideration should be given to increasing significantly the financial contribution of 43pl to the CRCSI given the broad benefits they now derive from CRCSI structure and its

research. *While the financial contribution of 43pl companies has increased substantially, the Board appreciates that the benefits of the CRCSI and 43pl is flowing through to the wider industry not just 43pl; and that the CRCSI actually draws much wider benefits from 43pl as recognised in the independent survey - "43pl remains of paramount importance as a vehicle to gain SME engagement in the CRC's research, to provide a path for adoption of the CRC's research findings and to gain user input to the strategic planning and conduct of research."*

8 The CRCSI ensures that scientific program leaders and other leaders promulgate to all researchers their big picture vision for the application of the research, including its commercialisation. *This has been implemented through the Annual Conference and will be rolled out over the web to maximise opportunity for the message to be maintained.*

9 The current number of PhD students involved in projects is considered low given the large number of researchers involved and the breadth of science areas that underpin the CRCSI programmes. The CRCSI should explore avenues for increasing the number of high calibre postgraduate students included in its programmes. *The Board notes that the industry demand for professionals makes it difficult to attract higher degree students but will maintain its efforts in this regard and will exceed the Commonwealth Agreement requirements in this.*



Appendix 1 Glossary and Acronyms

43pl	43 Pty Ltd, a company representing the CRCSI's national SME consortium
ACC	Audit & Compliance Committee
ANZLIC	ANZLIC - the Spatial Information Council ... formerly known as the Australia and New Zealand Land Information Council
ARGN	Australian Regional GPS Network
ASIBA	Australian Spatial Information Business Association
ASIERA	Australian Spatial Information Education and Research Association
CORS	Continuously Operating Reference Station
CRC	Cooperative Research Centre
CRCSI	Cooperative Research Centre for Spatial Information
DEM	Digital Elevation Model
DInSAR	Differential Interferometric Synthetic Aperture Radar
GB	Governing Board
GFI	Global Forests Initiative
GIS	Geographical Information Systems
G-NAF	Geocoded National Address File
GPS	Global Positioning Satellites
IACC	Industry Advisory & Commercialisation Committee
INS	Inertial Navigation Systems
InSAR	Interferometric Synthetic Aperture Radar
MOU	Memorandum of Understanding
PSInSAR	Permanent Scattered Interferometric Synthetic Aperture Radar
REAC	Research & Education Advisory Committee
SDI	Spatial Data Infrastructure
SEAC	Spatial Education Advisory Committee
SISL	Spatial Information Systems Ltd
SME	Small to Medium [sized] Enterprises
SSI	Spatial Sciences Institute