# Crcosi

# Annual Report



enhancing 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

crc for spatial information





# **Participants**

### **Core Participants**

Western Australian Government - Dept Agriculture and Food & Dept of Land Information New South Wales Government - Dept of Lands, Queensland Government - Dept Natural Resources Mines & Water Victorian Government - Dept Sustainability and Environment & Dept Primary Industries Australian Government - Geoscience Australia Charles Sturt University Curtin University of Technology University of Melbourne University of New South Wales

43 Pty Ltd

### Support Participants

Australian Government - Defence Imagery and Geospatial Organisation ESRI Australia Intergraph

### Sustaining 43pl members

AAMHatch

Alexander & Symonds Pty Ltd Apogee Imaging International Advanced Spatial Technologies Beveridge Williams & Co Pty Ltd Brazier Motti Brown & Pluthero Pty Ltd C. R Hutchison & Co Pty Ltd CSBP Limited D.M. Gerloff & Associates Pty Ltd Digital Mapping Solutions ER Mapper Asia Pacific Fugro Spatial Solutions Pty Ltd Geodata Information Systems Geomatic Technologies Glenndew Pty Ltd Howell Spatial Industries Pty Ltd Intergraph Land Equity International Pty Ltd Leica Geosystems Lester Franks Survey & Geographic LISAsoft Pty Ltd LogicaCMG Pty Ltd Mapinfo Australia Pty Ltd Max Braid Surveyors Pty Ltd Max Braid Surveyors Pty Ltd McMullen Nolan & Partners Pty Ltd Navigate Pty Ltd NGIS Australia Pty Ltd Omnilink Pty Ltd Omnistar

Peter W Burns Pty Ltd PSMA Australia Limited QASCO Surveys Pty Limited Reeds Consulting Pty Ltd Searle Consulting NQ Sinclair Knight Merz Pty Ltd Social Change Online Spatial Information Technology Enterprises Ltd Todd Alexander Surveyors Webmap Pty Ltd we-do-IT Pty Ltd Whelans International

"More than 80% of respondents (45) expect that 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"

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

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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# CRC for Spatial Information



o 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 leads to the concept of Virtual Australia, ie the holistic representation of the vast array of information about our world in three dimensions and at any useful scale. In simple terms this means one can remotely access map-based information, combine it with information from other sources, conduct analyses, view the information in three dimensions, conduct forecasts, 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.

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

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

### Statement of Purpose

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

he CRC Commonwealth Agreement Objectives were refined in the Commercialisation and Utilisation plan approved by DEST in 2005:

- Promote the seamless exchange of spatial information (SI) between all information users in Australia through new SI products, thereby enhancing commercial, environmental and social management activities
- Foster the flow and level of commerce in SI and the transfer of spatial data technology
- Create a long term partnership of users, from community groups, non-government organisations, small-tomedium enterprises and industry corporations, to local, state, federal and international governments and the education sector
- Enhance interoperability between the diverse but complementary SI collection, processing and delivery systems, namely: satellite positioning (GPS), geodesy and kinematic mapping, satellite earth observation, metric information retrieval, socio-economic and commercial inventory and accounting, geographic information systems and web-based decision-support services
- Become a player of significance in the international SI community, both in technology development and commercial innovation
- Provide the science and technology infrastructure to allow SI applications to grow and expand

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### **CEO's Report**

We have just completed our third year of operation and it has been a most satisfying one for the CRCSI. In December last year we completed a major review of our strategic directions. Based on a comprehensive process of consultation with over one hundred of our stakeholders we refined our strategic vision of 'Virtual Australia'. Stated simply we envisage an industry that in the future is capable of providing information products to anybody, anywhere, at any time. The technologies that will facilitate this vision now embrace both our traditional ones of global navigation satellite systems, remote sensing, spatial data infrastructures and visualisation and the emerging supranet technologies of smart sensor chips and their enabling infrastructure.

The drive to make Australia ever more capable in these technologies has seen the CRCSI grow in membership. In addition to our four founding universities, seven government agencies and 43 companies we have taken on four new companies and have applications from another dozen that we are considering.

The CRCSI places a very strong emphasis on being user driven. We are harnessing the expertise of our researchers to undertake transformational research with demonstrated applications. This year the CRCSI brought in \$1.1 million of new revenue, more than doubling our annual target. Our in-kind contributions reached \$12.9 million for the year also more than doubling our expectations. The CRCSI has now significantly out-performed its aggregate revenue generation and in-kind expectations since inception.

Our industry world-wide is growing at over 20 percent per annum. Staff and skill shortages are being keenly felt in Australia. In 2005 we undertook a comprehensive survey of the training needs of the industry. This year we began to implement the findings of the survey in a new generation of training courses, thirteen of which were run. Much work is still required to develop the courses that industry wants and this work will continue to be a priority.

Our research and demonstrator programs have now invested over \$28 million. They deploy over 300 fulltime and part-time researchers from our joint venture partners. These programs have lead to our first commercialisation 'Hazwatch', a web-services emergency information management system. Hazwatch is being brought to market by iintegrate Systems Pty Ltd and the CRCSI is pleased to be an equity partner of this start-up company together with another of our joint venture partners NGIS Pty Ltd. We are also most fortunate to have received great support from the Western Australian Department of Land Information and the New South Wales Department of Lands in progressing Hazwatch to this stage. Our second commercialisation is also underway with Millmapper, a product designed to use laser technologies to monitor the rate of wear on the grinding mills of minerals processing plants. We are

partnering with the start-up Scanalyse Pty Ltd and another of our joint venture partners Curtin University of Technology on the commercialisation of Millmapper. We have several more commercialisations in the pipline

In May a senior delegation, lead by the Chairman, visited China at the invitation of the Deputy Secretary General of the Chinese Academy of Science, Prof. Guo Huadong. The visit was most successful and resulted in an agreement to collaborate on several specific areas of mutual interest including environmental modelling, agriculture, water and digital technologies. Several jointly funded projects are already under development. Whilst there we also accepted an invitation to become founding members of the International Society of Digital Earth (ISDE) and to join its Executive Committee. The ISDE is dedicated to the promotion of international cooperation in the use of advanced technologies, and especially spatial technologies, for developing economic, social and environmental well-being. We also met the Chinese Minister for Science and Technology Mr Xu Guanhua.

In June three of our Executives travelled to Canada to attend the Annual Conference and Board meeting of GEOIDE, a large and long established research joint venture with a similar suite of objectives to our own and which is one of the Canadian National Centres of Excellence. Whilst there we signed an MOU to progress joint research in a number of areas including positioning, metric imagery, visualisation, and sensor systems. The agreement also sets out to foster the development of students and young researchers through international exchange and other activities.

Our joint venture partners have regularly signalled to us that they wish the CRCSI to be a bridgehead to new markets and opportunities overseas. The China and Canada developments will substantially progress this priority.

Our continued good progress owes much to the statesmanship of our founding Chairman, Emeritus Professor Bill Charters, our very capable and hard working Board, our highly capable team of executives, science program managers, research leaders, researchers, educators and staff. I am also deeply gratified by the sustaining support of our 59 joint venture partners.

Peter Woodgate

Chief Executive Officer



Cooperative Research Centre for Spatial Information



# Chairman's Overview

n the past year the CRC has moved to strengthen and consolidate its R&D and Commercialisation activities in line with the new Strategic Plan and Key Performance Indicators as agreed by the Governing Board.

Considerable work has been undertaken by the CRC Management team in order to streamline the Third Year Review process and to put in place a realistic and strong Supplementary Bid for the CRC.

In his role as an Independent Board Director Peter Woodgate has fostered and maintained an excellent working relationship with the Governing Board and its Board Committees which has led to a smooth operation of this somewhat complex structure.

Several commercialisation activities are now underway and others are being developed through SISL with active participation of 43PL and its members and the appropriate universities and government agencies.

International linkages have been actively sought and formal arrangements are now in place with China and Canada and joint collaborative work is scheduled to start in 2006/2007. Recent discussions with New Zealand and the Netherlands indicate a substantial interest in stronger networking on projects involving common R&D Objectives

There has been a continuing outstanding effort by all Governing Board Directors and the CRC Visitor to ensure that the CRC performs to the highest standards in achieving its stated objectives.

It has been my pleasure to work as Chairman with such a dedicated group of professionals during the early formative years of the CRC. I am sure that under the strong leadership of the incoming Chair Professor Mary O'Kane the CRC will go on to many future successes in the rapidly expanding field of spatial information.

Emeritus Professor Wm WS Charters Chair CRCSI





Cooperative Research Centre for Spatial Information



# Governance, Structure and Management

### **Corporate Structure**

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 Advisory and Commercialisation Committee and the Virtual Australia Standing Committee. An Audit Committee overviews all governance and management activities. Management comprises a four member Executive and two executive support staff, five Science Program Managers, and twenty Project Leaders. An Education Reference Committee 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 CRC. 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

Strategic direction Policy Budget Achievement of Strategic Plan

CEO appointment

### Executive

Strategic Planning Operational Management Business Development Commercialisation Ensuring programs interconnect and link to the market

Member and client relations

### Science Managers

Independent project input and advice (project development; work quality; technical and commercial networks)

Internal links Market interface

Research utilisation

### **Project Leaders**

Research leadership

Project stakeholder communication and relations

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Project mgt (staff and budget), esp. meeting milestones & reporting

Internal liaison

Cooperative Research Centre for Spatial Information



# Governance, Structure and Management

### **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 other independent directors including the CEO
- two representatives from each of 43pl and university colleges
- three representing the government college

Directors as at 30 June 2006 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.



At the CRCSI launch: Mark Judd, 43pl Chairman; Bill Charters, CRCSI Chairman; The Hon. Elaine Carbines, MLC; The Hon. Gary Nairn, MP; Peter Woodgate, CRCSI CEO

"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]

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# Governance, Structure and Management

Director	<b>Organisation</b> (Alternate)	Key Skills
Bill Charters	Independent (Chair)	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, and Licencing, Spatial Industry experience technical knowledge, Business Management, Australian R&D environment, and applications, research management
Mary O'Kane	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
Roland Slee	Independent (Vice President, Fusion Middleware Sales, Oracle Corporation Australia Pty Ltd)	Negotiation, licencing, Computer hardware and software knowledge and experience, Spatial and computing technical knowledge, Financial Management, Marketing, Business Management, International experience
Bill Richards	43pl (Fugro Spatial Solutions Pty Ltd) John Lazarus, Managing Director, Fugro	Negotiation, Spatial Industry experience and technical knowledge, Computer hardware and software knowledge and experience, financial management, Business Management, Governance, International experience
Tony Burns	43pl (Land Equity Pty Ltd) Chris Grant, Land Equity Pty Ltd	Intellectual Property management, Negotiation, Spatial Industry experience and technical knowledge, Marketing, financial management, Australian R&D environment, business management, International experience
Bruce Thompson	Dept Sustainability & Environment, Victoria	Intellectual Property management, negotiation, Spatial Industry experience and technical knowledge, financial management, business management, research management, government policy
Steven Jacoby	Dept Natural Resources, Minerals & Water, Queensland	Negotiation, Spatial Industry experience and technical knowledge, Marketing, financial management, Australian R&D environment, business management, research management, government policy
Warwick Watkins	Director-General, Dept of Lands, NSW (Deputy Chair) <i>Des Mooney</i> , NSW Dept of Lands	Negotiation, Intellectual Property management, Spatial Industry experience and technical knowledge, financial management, Australian R&D environment, business management, research management, government policy
Les Field	University of NSW James Walsh, UNSW	Negotiation, capital raising, licencing, intellectual property management, Marketing, financial management, Australian R&D environment, business management, research management
Jannie van Deventer	Dean of Engineering, University of Melbourne	Negotiation, capital raising, licencing, Intellectual Property management, Marketing, financial management,



# Governance, Structure and Management

### Audit & Compliance Committee

The Audit and Compliance Committee meets as required - once this year - to support the audit process and CRCSI fiduciary and other protocols. Membership at 30 June was Mary O'Kane (Chair), Warwick Watkins and Bruce Thompson. 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 two 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	Research Director, CRCSI (Chairman)
Peter Loughrey	ESRI Australia
Roland Slee	Independent Board Director $-$ CRCSI and Vice President, Oracle
Bruce Thompson	Director, Dept Sustainability and Environment, Victoria and Board Director, CRCSI
Peter Woodgate	CEO, CRCSI
Graeme Wright	Dean, Curtin University of Technology

### Industry Advisory & Commercialisation Committee

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

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

### Spatial Information Systems Limited (SISL)

CRCSI established SISL to hold its intellectual property and oversee its exploitation. The CRCSI Governing Board is also the Board of SISL. SISL acts as the commercial agent for the CRCSI participants to identify, protect, use and commercialise the Centre Intellectual Property.

### 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 CRCSI. 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 CRCSI Board are elected from nominations by the membership of 43pl.

43pl is itself a core participant in the CRCSI. The proprietary limited company binds over 40 small to medium enterprise (SMEs) 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.

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# Governance, Structure and Management

During the year four new companies joined CRCSI through 43pl: iintegrate Systems Pty Ltd, Scanalyse Pty Ltd, Astrovision Pty Ltd and VPAC Ltd. The first two are start up companies carrying forward CRC research and development outcomes; the latter two are larger entities attracted to the CRC for its potential to enhance their business competitiveness. In addition ERMapper, a well known Australian spatial information company, moved from being an Affiliate to full membership of 43pl.

### **CRC** Visitor

CRCSI draws on the expertise and experience of Professor John Lovering AO, FAA, FTSE with regard to strategic direction and operations. John is an eminent Australian geologist and the former Vice Chancellor of Flinders University. He has been Chairman of a number of public and private company boards and formed Geotrack International Pty Ltd to market a new petroleum exploration technique. He has served on national and international scientific and government committees. He has considerable experience in natural resources management including as Presiding Officer of the Natural Resources Council of South Australia from 1992 to 1994, President of the Murray-Darling Basin Commission from 1994 to 1999 and Chairman of the Environment Conservation Council (Victoria) from 1998 to 2002. He is currently a member of the Board of Southern Rural Water, Chair of the International Centre of Excellence in Water Resources Management (ICEWaRM) and Chair of the Melbourne Water Supply/Demand Strategy (WaterSmart). John's term as Visitor has been extended to the end of the 2007 year. His role incorporates

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







### 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 collaboration to build institutional capacity.'

This purpose is 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 has a Board and DEST approved Commercialisation and Utilisation Plan which 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) has been established as 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 CRCSI 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. The details of the commercialisation plan for the CRCSI, including the patent and licencing 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 commercialisations 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.

Apipeline 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 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.

### 3D Multipath Simulation – provisional patent

An outcome of project 1.1 is a provisional patent application that targets problems that presently exist in GPS network site installation and data quality, concentrating on signal interference and site multipath. Commercial partners are being sought from outside the CRCSI.

### Loka Deva – 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

A planned 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 will make 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.

### **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.

In addition all PhD students were given specialised training in IP and commercialisation culminating in a two day "Bootcamp." This two-day course will be run with a wider group in the coming year.

### 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 2005 survey reveals growth above that of industry norms. Key indicators include average revenue growth of 11% for GIS data services and digital data supply; 19% for software supply but only 1% for traditional surveying. The CRCSI is working with ASIBA to try and get comparable information from the wider Australian industry.

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."





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 and 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
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, Mines & 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

### Support Participants

ESRI Australia	Project participant Perth
Defence Imagery and Geospatial Organisation	Participation in CRC wide planning workshops Canberra, Melbourne
Intergraph	Project participant REAC member Melbourne, Perth





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)

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### **43pl Participants**

AAMHatch	Project participant Workshop participant Perth, Sydney, Melbourne
Alexander & Symonds Pty Ltd	Project participant Workshop participant Adelaide
Apogee Imaging International	Project participant Workshop participant Adelaide
Advanced Spatial Technologies	Workshop participant Perth
Astrovision	Sydney
Brazier Motti	Workshop participant, Townsville
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
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
Glenndew Pty Ltd	Melbourne
Howell Spatial Industries Pty Ltd	Workshop participant 43pl director Adelaide
lintegrate 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
Leica Geosystems	Workshop participant, Sydney
Lester Franks Survey & Geographic Pty Ltd	Project participant; Workshop participant Devenport, Adelaide
LISAsoft Pty Ltd	Project participant Workshop participant Melbourne, Adelaide

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."

Reasons given by 43pl members for CRCSI participation:

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

### Furthermore, the independent survey of endusers of the Third Year Review reports

"...the level of engagement between the CRCSI and respondents is high"

" ... ten 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"

" ... 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."





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)

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### **43pl Participants** (cont.)

()	
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
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	Project participant Workshop participant Sydney
Spatial Information Technology Enterprises	IACC Chair Workshop participant Brisbane
Todd Alexander Surveyors	Merged with Lester Franks
VPAC	Melbourne
Webmap Pty Ltd	Workshop participant Brisbane
we-do-IT Pty Ltd	Workshop participant Melbourne
Whelans International	Workshop participant Perth
Wrenfeld Pty Ltd	Workshop participant 43pl director Canberra

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### Progress against Contractual Targets / Milestones - COMMERCIALISATION

Schedule 1 in the Commonwealth Agreement specifies the following milestones for the Commercialisation / Technology Transfer Program for 2005-06. Table 2 below presents the information required by the DEST reporting guidelines.

### Table 2 COMMONWEALTH AGREEMENT MILESTONES

Type of Milestone and/or Output	Description of all 2005 - 06 milestones and/or outputs incl. past milestones which have not been met (and date)	Achieved 05-06 (yes/no)
If achieved, progres milestones and/or o	s during 05-06 and planned activities in 06-07 - OR - Reasons why outputs have not been achieved & Strategies to achieve unmet milestones	
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)	$\checkmark$
Output 8.1.1	Four market ready technology packages in Year 3 for SISL to seek adopters	$\checkmark$
1 - HazWatch - arisin and licence term	ng from emergency management demonstrator project [negotiation of equity s for the start up company "iintegrate Systems"]	/
<ul> <li>2 - Scanalyse - arisin [convertible note</li> <li>3 - 3D Multipath Sim be picked up by i</li> <li>4 - Barista feature e [06-07 plans for c</li> <li>5 - loka deva portab</li> </ul>	ng from the laser scanning expertise in program 2 at Curtin University e negotiated with the start up company "Scanalyse Pty Ltd"] nulation System - [provisional patent applied for from project 1.1, but yet to industry] extraction software package from program 2 commercialisation] ble location device [market analysis with view to finding production partners]	
Commercialisation Milestone 8.1.1.6	Demonstrator projects underway: 1 - Emergency management [HazWatch] - Dec 03 2 - Portable location device [lokadeva]- Dec 04 3 - Roadmap for lokadeva 05-06 4 - CORS Network Study 05-06	$\checkmark$
<ol> <li>HazWatch being</li> <li>loka deva being</li> <li>further developn</li> <li>Project 1.1 expe of CORS network</li> </ol>	commercialised through start-up company iintegrate Systems Pty Ltd commercialised through 43pl founding member company Geomatic Technolog nent of market through the roadmap demonstrator project rtise being applied to end-user needs through market and technology analysi c options	gies, with s
Outcome 8.2	Increased level of technology awareness in wider industry	$\checkmark$
Output 8.2.1	Industry/professional development program established & recognised by Jun 05	$\checkmark$
The short course tee course a month. Thi from July 06.	chnology transfer program has been established and is now offering over a is will expand into the online area with the roll out of the Education portal	
Tech Transfer Milestone 8.2.1.3	Recognition of driving the Action Agenda forward - Jun 05 ongoing	$\checkmark$
CRCSI has a recognis four pillars" of the a active member of the training and skills no education provision	sed key role in all aspects of the action agenda. In particular it is "one of the Australian SI industry along with ANZLIC, ASIBA and SSI. The CRCSI is an ne Spatial Education Advisory Committee and has done a national survey of eeds. Its web services are planned to grow substantially in 06 - 07 with online and more short courses for industry.	2



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 CRC will be realised when spatial information is made useful and available to all at any time and in any place. Implicit in this vision is that the needs of SI users will be met through the development of the necessary supporting products and services. These will provide accessibility and knowledgeable use of SI within a favourable environment of regulatory policies and institutional frameworks. An enhancement of industry and user capabilities is essential if the broad spectrum of SI needs within society is to be satisfied. New developments in the acquisition, analysis, synthesis and delivery of SI are being continually called for. This in turn requires active research and development in the science and technologies of positioning, modelling and data processing, integration and archiving, and dissemination and visualisation of SI.

In forming projects the CRC focuses on the needs of the user of SI and is responsive to the future needs of the Australian SI industry. This demands early stage planning for user adoption and utilisation of research outcomes, along with commercialisation of technological innovations for the benefit of CRCSI participants, the SI industry and Australia.

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 2005 Strategic Plan

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### Key Achievements

ighlights of the research year included the migration of project outputs and expertise into commercial initiatives of high potential. These include HazWatch and Scanalyse, 3D Multipath Simulation and "loka deva", with other initiatives emerging such as the Barista software and the establishment of a large project looking at visualising the behaviour of salinity in the WA wheatbelt.

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.

Importantly the Board and invited stakeholders considered a new set of performance indicators for the CRCSI, many of which directly and indirectly affect the research activities. These include encouragement of some core projects of significant resources, underpinning some international CRCSI collaborations, and recasting the current set of milestones into a more current set of indicators that will reward quality and user driven research and development.



Amount \$	Descriptor (ordered by chronology)	Agency
25,000	WA Senior R&D Position	DLI WA
10,000	Project 4.4 Data	DPI NSW
245	Hazwatch trials	DLI & Dept of Lands NSW
50,000	Contribution to new Project 4.5	Dept of Lands NSW
120,000	Project 1.1 extension	DLI WA
14,400	Vic Roads Contract	VicRoads
13,998	L&W Contract	Land and Water Australia
158,000	Microsoft contribution to Project 6.1	Microsoft
72,488	Project 6.1 Mercury '05 Emergency Management Demonstration	WA Police, Fed Govt
55,000	Project 4.4 Extension	Rural Fire Service NSW
10,000	DinSAR Collaboration	SCT

### **External Contracts and Grants**

These contribute to the CRCSI through showing the relevance of the research and the expertise of the personnel involved in CRCSI projects.

Furthermore, several CRCSI researchers attracted significant Commonwealth competitive grant funding of some \$1.1 million.

Amount \$	Descriptor (ordered by chronology)	Agency
412,188	Sensor integration for low-cost robust agricultural machine automation / A D Dempster, Rizos C., Wang J., Grejner-Brzezinska D.A	Australian Research Council Linkage 2006-2009
470,000	Cognitively Ergonomic Wayfinding Directions for Location-Based Services / Dr S Winter, Dr M. Duckham, Dr L. Kulik	Australian Research Council Linkage 2005-2008
160,000	Automatic Fusion of Geoinformation: the Intelligent Geo-mediator architecture / M Duckham and Kulik, L	ARC Discovery Grant 2006-2008
50,000	SOAR-Radarsat 2 / L Ge	2006

### National Research Priorities

The National Research Priorities (NPRs) 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, which synonymous with spatial information, is highlighted in federal government descriptions of designated NPRs as an example of a Priority Goal, namely Breakthrough Science. Projects within the CRCSI's portfolio are also aligned with other NPRs, 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 NPRs. All CRCSI projects thus fit into the NPRs to greater or lesser degree and each is briefly described in the following.

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### 1.1: Enhancing Australia's Core Geodetic Infrastructure

Project 1.1 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

Project 1.2 will develop 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

This project aims to 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.

### 2.1: Automated Mapping and Feature Extraction from Space, Aerial and Terrestrial Imagery

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, 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

This project aims to 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

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.

### 3.3: Access to Spatial Data

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.

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### 4.1: Automatic near real-time thematic mapping based on MODIS

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.

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

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.

# *4.3:* Near real time crop and pasture package: integrated remote sensing technologies for improved farm management

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.

# 4.4: Development of imaging spectrometry products for characterising, mapping, monitoring and managing environmental stress

The project 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 nonexpert users to routinely use these methods.

### 5.1: Support Tools for Spatial Data Mining

The Project 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.

### 5.2: Visualisation with SDI for collaborative decision making

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.

### 5.3: Communicating Spatial Data Quality

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.





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### 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.

### 6.2 & 6.4: The Location Positioning Device "loka deva"

will use 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 bum-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.

### Collaboration

CRCSI has many participants across Australia some 47 companies had formalised collaborative arrangements with CRCSI activities in the year, along with 9 government departments and four 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"

### 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 was adopted by the Board to provide 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 ASIBA (the business association), SSI (the professional body) and ANZLIC (government agencies). 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 CRCSI training needs analysis. These are important to give strategic advice and context to the CRC.

### 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). An MOU was signed with GEOIDE in the year and joint activities are being developed.
- Chinese Academy of Sciences A collaborative research agreement was signed with the CAS in the year and joint activities are being developed.





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### Collaboration Projects and Participants

Research and Development collaboration within the CRCSI as indicated by the me participants in each project and the me sectoral project teams. Indeed it is a project selection criterion that represe projects must come from each of the p public and academic sectors.	ion is strong umber of umber of cross entation on private,	43pl (Number of 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
1.1 Enhancing Australia's Core Geode	tic Infrastructure	2	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$	
1.2 Quality Control Issues for Real-Tir	ne Positioning	5		$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		
1.3 Integrated Positioning & Geo-refe	erencing Platform	3			$\checkmark$				$\checkmark$		
2.1 Automated Mapping & Feature Ex Space, Aerial & Terrestrial Imager	traction from Ƴ	3	✓	✓	✓			$\checkmark$	✓	$\checkmark$	
2.2 Fundamental Modelling, Analysis a Development for Integrated Imag Positioning Sensors	and Systems ing and	6						~	✓	✓	
3.2 Data integration, modeling and st	andards	5				$\checkmark$	$\checkmark$			$\checkmark$	
3.3 Access to Spatial Data		3		$\checkmark$				$\checkmark$			
4.1 Near real - time remote sensing p based on NADIR surface reflectan bio-physical models	products from MODIS ce and	1	~				~		~	~	
4.2 Multi-sensor, multi-scale image an for environmental and natural res	nd terrain system ource analysis	2	✓						~		
4.3 Agriculture, land cover classificat monitoring and assessment	ion, natural resource	2				$\checkmark$	✓	✓		$\checkmark$	
4.4 Imaging spectrometry (hyperspec products for characterising, mapp managing environmental stress	tral imagery) ping, monitoring and	2	✓					✓	✓		
5.1 Support Tools for Spatial Data Min Based Modelling	ning and Agent	2			$\checkmark$						$\checkmark$
5.2 Visualisation for collaborative dec	cision making	1	$\checkmark$					$\checkmark$			
5.3 Communicating Spatial Data Qual	ity	1	$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$		$\checkmark$	
6.1 Emergency Management Demonst	rator System	2	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$			$\checkmark$	
6.2 & Location Positioning Device [lokad	deva]	2		$\checkmark$	$\checkmark$				$\checkmark$		
8.1 Commercialisation - Hazwatch de	velopment	1			$\checkmark$	$\checkmark$					
8.2 Commercialisation - Scanalyse		1								$\checkmark$	

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able 3 below reports on the Commonwealth Agreement research milestones for 2005-06 and any milestones carried over from previous years.

Progress overall is excellent. Many projects have refined tasks within their original directions. A few projects are concluding in response to either a changing external environment or to capture new opportunities.

The following table follows DEST Reporting Guidelines and presents the 2005-06 Milestones from the Commonwealth Agreement, and the associated Outputs and Outcomes even when these latter fall outside the year to indicate forward plans where appropriate.

Table 3	COMMONWEALTH AGREEMENT MILESTONES
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). Delivery Targets: 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	changed
New Milestone 1.1.1.1	Report on theoretical background and state of the art electronics for signal interference detection.	Dec 2005	$\checkmark$
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 electroma gnetic signals which may interfere directly with GPS signals at CORS site)	Dec 2006	On target
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.		
New Milestone 1.1.2.1	Presentation of 3D site models for a number of CORS stations with different site properties.	Jul 2005	$\checkmark$
New Milestone 1.1.2.2	Demonstration of prototype site multipath modelling software	Dec 2006	$\checkmark$

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Table 3 (cont.)

### COMMONWEALTH AGREEMENT MILESTONES

Output 1.1.3 Bias modelling for sparse CORS networks to support decimetre (or higher) accuracy, real-time GPS positioning. Delivery Targets: 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 focused to delivery of guidelines and recommendations for developing and maintaining a seamless national geodetic infrastructure through CORS stations New Milestone Report of survey of international procedures and protocols. Oct 2005 1.1.3.2 Completion of draft standards and protocols for seamless Australian New Milestone Dec 2006 On target 1.1.3.3 CORS networks. Single-base RTK vis-à-vis network-RTK design strategies & validation. Delivery Targets: By June 2005 for strategies to integrate various RTK implementations (from Output 1.1.4 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	Delay of 6 mths
New Milestone 1.1.4.2	Presentation of results from Earth rotation and polar motion studies.	June 2006	Delay of 6 mths
New Milestone 1.1.4.3	Release of recommendations for improved height datum.	June 2007	On target
New Output 1.1.5	The task will generate information to assist DLI, 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	$\checkmark$
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	$\checkmark$
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	$\checkmark$
New Milest one 1.1.5.4	Report to DLI, WA containing numerical information which will assist DLI in assessing future directions for CORS networks	June 2006	$\checkmark$
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	$\checkmark$
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.			f algorithmic aints. GPS is so. Today, ision of inues to ng obsolete. early, R&D mologies, the satellite ited where ble to take ons.

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.

**Cooperative Research Centre for Spatial Information** 

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Tab	le	3	(cont.)
		•	(conc.)

COMMONWEALTH AGREEMENT MILESTONES

Output 1.2.1 Data processing refinements to achieve millimetre level GPS positioning. *Delivery Targets* 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		$\checkmark$
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		$\checkmark$
Milestone 1.2.1.3	Description & Achievement date: Implementation and testing of real-time software system.	Dec 2006	On Target
New milestone	Develop and implement RT-QC module	Mar 2006	$\checkmark$
New milestone 1.2.1.3.3	Testing and modification of RT-QC module for CORS data	Jun 2006	$\checkmark$
New Milestone 1.2.1.4	Review existing data transmission standards and recommend most appropriate	Sep 2005	$\checkmark$
New Milestone 1.2.1.5	Develop a new message type within the recommended standard	Sep 2006	On Target
Output 1.2.2	Hybrid high accuracy GPS and pseudolite positioning systems. Delivery Targets: 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 re [detailed ab	esearch direction meant this output was not pursued. Instead additional tasks were love]	e added to Miles	stone 1.2.1.3
Milestone 1.2.2.1	Guidelines on the use of pseudolites (hardware and signal propagation issues, etc.) Milestone no longer applicable	Dec 2004	Changed
	Change in research direction meant this output was not pursued. Instead additional tasks were added to Milestone 1.2.1.3 [above]		
Milestone 1.2.2.2	Mixed data models for a variety of implementation modes (single- and dual-frequency; network & single-base modes, etc.)	Dec 2005	Changed
	Change in research direction meant this output was not pursued. Instead additional tasks were added to Milestone 1.2.1.3 [above]	Dec 2006	Changed
Milestone 1.2.2.3	Implementation and testing of hybrid GPS and pseudolite positioning system - by December 2006.		
	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. Delivery Targets: 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	Jun 2005	
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	On Target
Milestone 1.2.3.2	Implementation within receiver hardware platform - 36months	Jun 2006	Delayed
	Milestone Delayed until June 2007. 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.	Jul 2007	





Table 3 (cor	commonwealth agreement milestones	5	
Output 1.2.4Web-based GPS positioning services. Delivery Targets: 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 ha longer applicable	as been varied to focus on the provision of RT-QC data to CORS and mobile for the project: development lies now with one of the CRCSI participants	e users this of s, Geoscience	utput is no Australia.
Milestone 1.2.4.1	AusPos upgrade to handle GPS data files from standard survey practice (e.g. single-frequency, short observation spans)	June 2005	n/a
	Project has been varied to focus on the provision of RT-QC data to CORS output is no longer applicable for the project: development lies now wir participants, Geoscience Australia	and mobile u th one of the	sers this CRCSI
Outcome 1.3	Mobile and Automated Mapping Systems. 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		
Output 1.3.1	Output 1.3.1 Test and evaluate appropriate MEMS-INS sensor technologies. Delivery Targets: by December 2004 for design of test strategy for MEMS sensors, by December 2005 for completion of studies and the selection of the most appropriate sensor hardware for integrated systems.		
Milestone 1.3.1.2	Selection of MEMSINS hardware	Dec 2005	$\checkmark$
Output 1.3.2	An integrated GPS+INS development platform. Delivery Targets: by December 2004 for development of microprocessor-based platform that can integrate INS and GPS sensor technologies, by December 2005 for synchronisation of all sensor inputs (ready for data processing).		
Milestone 1.3.2.2	Configuration of sensors and synchronisation of data outputs	Dec 2005	$\checkmark$
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 1.3.3.2	Description & Achievement date: Navigation filters for loosely- coupled & tightly-coupled integrated systems by December 2005.	Dec 2005	$\checkmark$
Milestone 1.3.3.3	Optimal Kalman filter for real-time implementation	Dec 2006	On Target
Output 1.3.4	<ul> <li>An integrated, low-cost, portable GPS+INS positioning and attitude determination system for automated mapping applications.</li> <li>1.3.4 Delivery Targets: June 2005 after commencement of project for design of physical package (including power, comms &amp; sensor interface sub-systems), by December 2006 for full implementation of integrated positioning/attitude determination system.</li> </ul>		
Milestone 1.3.4.1	Detailed design of hardware package (though selection of appropriate MEMS technology awaits Output 3.2)	Jun 2005	$\checkmark$
Milestone 1.3.4.2	Integrated, low-cost, portable GPS+INS system ready for incorporation into future automated mapping system	Dec 2006	On target
Outcome 2.1	The development and implementation of advanced methodologies, procedures and computational processes and systems for automated information extraction from metric imaging sensors. 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.		
Output 2.1.1	Development of improved models and techniques for sensor calibration and object feature positioning from digital imagery (space borne, airborne and terrestrial) and laser scanning (airborne and terrestrial). Delivery Targets: New models, software systems and procedures for sensor calibration, July 2005 Note: Terrestrial Laser Scanning component has been moved from Project 2.1 to 2.2		
Milestone 2.1.1.3	Description & Achievement date: Development of industry-ready, alternative sensor calibration and orientation techniques for high resolution satellite imaging systems, July 2005	Jul 2005	$\checkmark$





Table 3 (cor	t.) COMMONWEALTH AGREEMENT MILESTONES	S		
Output 2.1.2 New techniques and computational tools for automated object feature reconstruction and modelling from imagery and laser scanning. <i>Delivery Targets:</i> New software systems and tools for technology transfer to industry, December 2006				
Milestone 2.1.2.1	Develop new image matching formulations and techniques for multi- image geometry and stereo high-resolution satellite imagery, Jul 2005			
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	On target	
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 2.1.4	Techniques and tools to exploit capabilities of emerging imaging techno broader applications domain within the spatial information industry <i>Delivery Targets</i> : Technology assessment and validation, with development application for spatial information product generation, July 2010	logies and fac ent tools to s	ilitate a upport	
Milestone 2.1.4.1	Review emerging imaging and ranging technologies and evaluate attributes for metric application within spatial information; largely ongoing with initial milestone	Dec2005	$\checkmark$	
Milestone 2.1.4.2	Description & Achievement date: Development and experimental testing of emerging technologies for 3D object measurement, mapping and modelling; ongoing with first-stage milestone at	July 2006	$\checkmark$	
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	On target	
Outcome 2.2Advanced 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. This project aims to 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. The research team has also given rise, outside of Commonwealth Agreement forecasts, to novel scanning applications being commercialised through project 8.2 Scanalyse				
Output 2.2.1	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 2005	Changed	
	Delayed to Dec 2006 due to delays to 2.2.1.3 and 2.2.2.2	Dec 2006		
Milestone 2.2.1.3	Experimental validation of enhanced imaging and laser scanning systems for spatial and spectral applications	Jul 2005	Delayed Dec 06	
Note - Sensor calibr	Note - Sensor calibration developments for terrestrial laser scanners has commenced due Dec 2006. Original milestone 2.1.1.2			
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		$\checkmark$	
Milestone 2.2.2.2	Development of procedures and quality control measures and experimental testing of integrated technologies,		Delāyed Dec 06	





Table 3 (cor	commonwealth agreement milestone	S	
Outcome 3.1	<ul> <li>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> <li>user needs analysis and market identification at local, state, national and regional levels for spatial data</li> <li>the legal, regulatory and institutional issues and limitations concerned with the use, access and delivery of spatial data</li> <li>benchmarking and comparative analysis of the SDI hierarchy, and</li> <li>strategic SDI design for Virtual Australia.</li> </ul> </li> <li>[Note at the Governing Board's 2004-2005 request this project was approached as a one year exercise to scope further work.]</li> </ul>		
Output 3.1.1	User needs analysis and market identification at local, state, national of spatial data. Delivery Target:2006	and regional le	evels for
Milestone 3.1.1.2	Completion of user needs and market identification report including analysis, publication and distribution	2005	$\checkmark$
Output 3.1.2	The legal, regulatory and institutional issues and limitations concerned with the use, access and delivery of spatial data Delivery Target: 2006		
Milestone 3.1.2.2	Development of recommendations for legal, regulatory and institutional issues and limitations concerned with the use, access and delivery of spatial data	2005	$\checkmark$
Outcome 3.2	Data integration, modeling and standards framework to support the seamless compilation of spatial datasets for the Virtual Australia 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 interoperab New data integration framework, models and procedures, December 20	ility. Delivery 106	Targets:
Milestone 3.2.1.1	Review spatial data integration issues and evaluate alternatives and solutions,	Dec 2004, ongoing	$\checkmark$
Milestone 3.2.1.2	Development of a framework and overarching model for spatial data integration	Dec 2006	On Target
Output 3.2.2	Design and development of a prototype database to support data integr Virtual AustraliaDelivery Targets: Database model, database, December	ration and mod 2006.	deling for a
Milestone 3.2.2.1	Review of database requirements for a Virtual Australia database (links from 3.1)	Dec 2005	n/a
	Milestone not pursued due to Project 3.1 not being extended beyond 1 year.		
Milestone 3.2.2.2	Development and evaluation of a Virtual Australia data model and prototype database	Dec 2006	n/a
	Milestone not pursued due to Project 3.1 not being extended beyond 1 year.		
<ul> <li>Outcome 3.3</li> <li>Outcome 3.3</li> <li>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:         <ul> <li>distributed www and WAP services modeling including the development of clearer links between SIS design and tools for SI access</li> <li>improved spatial data/information discovery using existing search engines</li> <li>the next generation of search engine tools to strengthen the spatial dimension in www searches</li> <li>delivery of location based services to multiple mobile devices</li> </ul> </li> <li>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.</li> </ul>			





Table 3 (con	t.) COMMONWEALTH AGREEMENT MILESTONES	S	
Output 3.3.1	Distributed www and WAP services modeling including the development SIS design and tools for SI access Delivery Target: 2006	of clearer lin	ks between
Milestone 3.3.1.1	Description & Achievement date: Review current developments in distributed www and WAP services modeling	2004	n/a
	Milestone no longer applicable. Project moved beyond this technology	-	
Milestone 3.3.1.2	Description & Achievement date: Design criteria for distributed www and WAP services modeling and improved links between SIS design and tools for SI access	2006	n/a
	Milestone no longer applicable Project moved beyond this technology and instead focussed on user requirements.		
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	$\checkmark$
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	$\checkmark$
Output 3.3.2	Improved spatial data/information discovery using existing search engin	es. Delivery T	arget: 2006
Milestone 3.3.2.1	Review current search engine design and identify limitations from a spatial perspective Annual Report 04-05 reported that - Work now undertaken in Project 5.1. Work focussed on mobile user ontologies.	2005	$\checkmark$
Milestone 3.3.2.2	Guidelines and specifications for improved spatial data/information discovery using existing search engines	2006	changed
	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	$\checkmark$
New Milestone 3.3.2.3	Develop a formal model of cognitive route directions	Sep 2006	On Target
New Milestone 3.3.2.4	Develop a formal model of context-driven search and identification of elements for route directions	Dec 2006	On Target
New Milestone 3.3.2.5	Design a test environment for filling the formal model of cognitive relevant route directions	Mar 2006	On Target
New Milestone	Implement model with industry partner (LISAsoft)	Jul 2007	On Target
Outcome 4.1	1.1 Near real- time satellite image processing and distribution of MODIS data. 1.2 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. 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		
Output 4.1.1	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. Delivery Targets: 24 months from commencement of project to calibration and validation of algorithms suitable for Australian conditions.		
Milestone 4.1.1.2	Research of an operational method for aerosol optical depth determination from MODIS spectral data	Dec 2005	$\checkmark$





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Table 3 (cor	commonwealth agreement milestones	S	
Milestone 4.1.1.3	Use of aerosol optical depth to derive measure of air quality from MODIS DB data	July 2006	$\checkmark$
Outcome 4.2	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) rad 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 an 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 un		
Output 4.2.1	Establish reliable methods of elevation model generation and levels of a DEM?s generated from ERS, Radarsat, Envisat and SRTM datasets. Delivery Targets: Jul 2005	accuracy assoc	ciated with
Milestone4.2.1.1	Evaluate interferometric SAR DEM generation using sensor systems outlined in 4.2.1	Jan 2005	$\checkmark$
Output 4.2.2	Design and implement reliable methods of differential interferometric S measurement of ground surface deformations and displacements at the accuracy. Delivery Targets: 24 months from commencement of project. [July 06]	SAR generation sub-centimet	n for the er level of
Milestone 4.2.2.1	Production of differential interferograms for detecting ground movements between two acquisition dates from operational satellite imagery, 6-18 months	Jan 2006	$\checkmark$
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	Jul 2006	$\checkmark$
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	On Target
Output 4.2.4	Determination of the hyperspectral indicators of soil degradation: erosic acidity. These will be morphological, mineralogical and biotic in charact Delivery Targets: 12 months from implementation of project [July 05]	on, salinity, so cer.	odicity and
Milestone 4.2.4.1	Analysis of the sensor specifications required to measure the various spectral indicators of soil degradation, 12 months	Jul 2005	Changed
	Project delayed in start with expanded milestones. See New output 4.4	below.	
Milestone 4.2.4.2	Development of methodologies for producing standard format image products (listed in 2.4) that can be used to characterize, map and monitor soil degradation, 6-12 months. Project delayed in start with expanded milestones. See New output 4.4 below.	Jul 2005	Changed
Outcome 4.3	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 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.		
Output 4.3.1	t 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. Delivery Targets: Technology assessment and methods for improved land utilization at farm level, 24 months from commencement of project.		
Milestone 4.3.1.1	Review models of land utilization applicable for decision making at farm level.	Jul-05	$\checkmark$





Table 3 (con	nt.) COMMONWEALTH AGREEMENT MILESTONES	S	
Output 4.3.2	Implement and validate techniques for quantification of biomass and gr pastures/crops across paddocks and farms on a regular basis. Delivery Targets: Value-added products, new methods, technology asses detect near real time limitations in crop growth due to climate and plan	owth rate of sment and vali nt disease [Jan	dation to 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 2006	delayed
	Underway, but delayed with crop season season ? new target Dec 2006	Dec 2006	
Milestone 4.3.2.2	Field experimental validation of processing techniques for quantifying biomass and growth rates of pastures/crops at farm level	Jul 2006	
	Underway, but delayed with crop season season ? new target Dec 2006	Dec 2006	
Output 4.3.3	Define the parameters involved in modelling scenarios of exceptional ci from seasonal times-series analysis of climatic and remote sensing (MOD Delivery Targets: Technology assessment, tools and procedures for multi mapping of real time changes in land condition due to exceptional circu	rcumstances (e DIS) data. I-temporal, mu Imstances [Jan	eg drought) lti-source 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.	Jul 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 OutputDetermination of the hyperspectral indicators of soil degradation: erosion, salinity, sodicity and acidity. These will be morphological, mineralogical and biotic in character. Delivery Targets: 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.			dicity and erspectral retation
New Milestone 4.4.1.1	Spectral library and reports for soil salinity surficial materials, soils, stressed crops and native vegetation & noxious weeds.	Oct 2005	$\checkmark$
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	On Target
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; actuality maps, salinity risk maps, DEMs, vegetation stress maps, change maps	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-temp	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





Table 3 (con	nt.) COMMONWEALTH AGREEMENT MILESTONES		
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 mo web-based (Java) interface running on PCs, distributed computer netwo architectures. Delivery Targets: June 2009	bile agent sys orks and massi	tem with a vely parallel
Milestone 5.1.1.2	A conceptual, generic model for adding spatially aware, mobile, cognitive/ adaptive agents to CAMs for modelling spatial processes evolving in time.	Dec 2005	N/A
	Change of project scope		
Output 5.1.2	A spatial data mining toolkit for decision support which works across dis different software platforms. Delivery Targets: June 2006	stributed data	sets and
Milestone 5.1.2.1	A spatial query language for data mining (SPMML) in XML building on PMML (Predictive Model Markup Language) (links to Program 3)	Jun 2004	n/a
	Change of project scope		
Milestone 5.1.2.2	Implementation of SPMML and testing across multiple architectures and datasets	Dec 2005	n/a
Milestone 5.1.2.3	A graphical interface to SPMML for use by the non-professional computer user.	Dec 2006	n/a
	Change of project scope		
Outcome 5.2	<ul> <li>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 location</li> <li>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 scientifiprocess models of surface and sub-surface events to enhance understanding of land management decisions</li> </ul>		
Output 5.2.2	Three dimensional model generator (automated) from GIS/SDI data, wi integration of other 3D data from ancillary sources : Dec 2005	th potential fo	r
Milestone 5.2.2.2	Automated procedures for working from SDI based land cover, cadastre, utility and other infrastructure data to 3D surface based objects.	Jun 2005	$\checkmark$
Milestone 5.2.2.3	Include ability to link automatically generated models with other 3D data and output from modeling exercises	Dec 2005	$\checkmark$
Output 5.2.3	Adoption and integration with above procedure of scientific visualization (including options for 3D geological modeling) Dec 2005	on toolkit/soft	ware
Milestone 5.2.3.2	Development of scientific visualization tool box in common environment with development under 2.2.	Mar 2005	n/a
	Milestone not pursued under 2.2		
Milestone 5.2.3.3	Integration with developments under 2.2 to permit use of both SDI and specialized scientific data (incl ground survey, geophysics, GPS, LIDAR, IFSAR etc) in 3D environment.	Dec 2005	n/a
	Milestone not pursued under 2.2		
Output 5.2.4	Incorporation of all the above within a real-time multiple access point Delivery Targets: Sep 2007	interface	
Milestone 5.2.4.1	Selection of real-time interface environment and definition of multi-user protocols.	Mar 2006	$\checkmark$
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	✓
	Whole systems testing, refinement and demonstration through incorporation into large demonstrator project being explored.	Sep 2007	

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Table 3 (cont.)       COMMONWEALTH AGREEMENT MILESTONES			
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 5.3.3	Working prototype of simple online uncertainty visualisations. Sep 2005		
Milestone 5.3.3.1	Conduct questionnaire of users of the case study data to determine the types of tasks or processes users perform when evaluating the case study datasets online. Annual Report 04-05 reported that - Delayed -Sep 2005	Sep 2005	$\checkmark$
Milestone 5.3.3.2	Design and develop an online uncertainty viewing tool. Annual Report 04-05 reported that - Delayed Mar 2006	Mar 2005	$\checkmark$
Milestone 5.3.3.3	Identify the limitations in current data and metadata online structures that inhibit uncertainty visualisations.	Jun 2005	$\checkmark$
Milestone 5.3.3.4	Modify existing data into test datasets that will accommodate developed visualisations.	Sep 2005	$\checkmark$
Output 5.3.4	Description: Working prototype with advanced uncertainty visualisation Delivery Targets: December 2006	enabling user-	interaction
Milestone 5.3.4.1	Design and develop advanced uncertainty visualisation tools.	Mar 2006	$\checkmark$
Milestone 5.3.4.2	Add capacity for user interaction with full suite of uncertainty visualization tools.	Dec 2006	On Target







# 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 will

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

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

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); Mike Stewart then 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.

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 exponentially in the coming year and will provide remote and regional Australia with access to educational resources through modern learning technology methods. Other organisations, such as SSI and ANZLIC, will be invited to use the Portal facility to maximise the benefits to the spatial information industry. The further development of the Portal will be central to activities in the coming year.

The CRCSI was invited to join 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.

Of significance was the analysis of a national survey of industry training needs to inform the CRCSI short course program and future planning. All ASIBA and SSI members received the survey. Results have been widely distributed to relevant groups such as ASIBA and SSI and ANZLIC.

The Postgraduate Courses program led by Mike Stewart and Bert Veenendaal is underway with two on-line Masters units being developed, one at Curtin and one at UNSW. Two more are in progress including one at the University of Melbourne.

The Short Courses program led by Geoff Taylor has established a base at UNSW, and is presenting technical courses for industry courses across Australia - a total of 13 courses ran in the financial year, with another dozen planned for next year. 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 were convened during the year, focussed on new R&D project generation and on specific topics where new technologies may bring new business opportunities.

The second Annual CRCSI conference was held in Melbourne, with very good feedback from the two days' events. It was combined with a commercialisation workshop with six international speakers. The 2005 conference outcomes included a report to the board on research initiatives; significant networking; and new research and business opportunities across the CRC activities.

Nineteen PhD and five Masters students have been recruited, awarded full or top-up CRCSI Scholarships and are being supervised with industry and end-user input. Each student is strongly encouraged to have an industry based "co-supervisor." CRCSI Participants are encouraged to bring their own staff into higher degrees by coursework research. This saw one enrolment from government and two from industry (43pl). A "placement scheme" for students to spend time with end user organisations was trialled but was not pursued.

The support framework for CRCSI scholars includes supportive training to prepare students for employment. During the year a number of students attended courses on commercialisation and on communications, and a dedicated two day Commercialisation Bootcamp was held for all students in Melbourne.





# Education and Training

# Progress against Contractual Milestones/Targets - EDUCATION

Table 4	COMMONWEALTH AGREEMENT MILESTONES		
Milestone and/or Output	Description of all 2005-06 milestones and/or outputs incl. past milestones which have not been met (and date)		Achieved 05-06 (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		
	19 PhDs and 4 Masters enrolled; completions to commence in year 4 as planned	Jun 2006	$\checkmark$
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.		$\checkmark$
	Work ongoing on new and online units		
Milestone 7.1.1.4	Establish student conference adjoining major CRC-SI conference, and allied enrichment programs.	Nov 2005	$\checkmark$
	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	$\checkmark$
	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: 9 courses in 2005-06 [doubling each year]	ongoing	$\checkmark$
	13 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	Sep 2005	$\checkmark$
	Commercialisation workshop with 6 international speakers and 130 attendees [& 200 CD-ROMs distributed]		
Milestone 7.2.1.2	Recognition by relevant stakeholders as a prime driver in achieving the Action Agenda objectives	ongoing	$\checkmark$
	Invitation to SEAC membership; Activities such as training needs analysis; financial benchmarking survey; industry workshops held 05-06. This will increase in 06-07 as the Education Portal gains momentum.		









# CRCSI Annual Conference

he 2005 CRCSI Conference brought together researchers, collaborators, shareholders, other sponsors and related stakeholders to critically evaluate progress and make plans for future investments.

The internal conference was held in Melbourne in September 2005 following a Commercialisation Workshop that featured six international speakers. A full house of 130 attended both days - about third each from academia, government and 43pl and 200 CD-ROMs of the Workshop were distributed.

During the Conference Project Leaders spoke for 15 minutes followed by 15 minutes of robust discussion. Many organisations displayed their corporate banners and promotional materials, and every project had a comprehensive poster.

Evaluation form responses were very positive about the networking opportunities and the ability to get a grasp first hand of all of the activities across the CRCSI. They also indicated a strong preference for keeping the event an internal one for CRCSI participant staff only.

A report was prepared from the conference presentations and debates. This went to the Governing Board and the recommendations considered before wider release.









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# **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:

A major conclusion of the Third Year Review industry survey of all CRCSI end user Participants and 43pl companies was "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 form each sector in the CRCSI
- 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

A major conclusion of the Third Year Review industry survey of all CRCSI end user Participants and 43pl companies was "SMEs are engaged through 43pl, which is both innovative and successful"

### 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.

A major conclusion of the Third Year Review industry survey of all CRCSI end user Participants and 43pl companies was "SMEs are engaged through 43pl, which is both innovative and successful"

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.

# Communication Strategy

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 CRCSI 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 CRCSI buy units annually (as their cash contribution through to the CRCSI). 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...

"... 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."





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# Specified Personnel

Title and Name	Contributing Organisation	Role in CRC	time%
Peter Woodgate	CRCSI	Chief Executive Officer	100
Graeme Kernich	CRCSI	Business Manager	100
Michael Ridout	CRCSI	Communications Director 100	
Chris Rizos	University of NSW	Program Manager 1 50	
Clive Fraser	CRCSI & University of Melbourne	Research Director; Chair, Research & Education Advisory Committee Program Manager 2	
Tony Milne	University of NSW	Program Manager 4	40
lan Bishop	University of Melbourne	Program Manager 5	26
Jack de Lange	Australian Spatial Information Business Association & 43pl	Chair, Industry Advisory & 14 Commercialisation Committee	







# Strategic Plan Performance Indicators

The CRCSI 2005-07 Strategic Plan has a companion document "Know, think, communicate: key elements of Virtual Australia." The Virtual Australia concept guides the CRCSI in key aspects of its planning. Virtual Australia is defined as "a virtual (digital) model containing and representing all non-trivial objects and their contextual environment from blue sky to bedrock in (real world) Australia." Both documents are available at the corporate web site www.crcsi.com.au.

As part of its strategic planning in December 2005 the CRCSI Governing Board revised and extended the corporate performance indicators. The following indictors will measure the performance of the CRCSI by 30 June 2007. Progress toward this as at 30 June 2006 is given for each indicator.

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 a utilisation plan (where the benefits are primarily for government).

Progress On track:

- Pipeline HazWatch and Millmapper / Scanalyse in the market; 3D Multipath Simulation, Barista and lokadeva in preparation
- 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 to effect this PI.

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 On track:

- 5 new companies have joined
- cash contributions cumulative amount exceeds Commonwealth projection to date by 30%
- in kind contributions cumulative amount exceeds Commonwealth projection to date by 61%
- growth rates of 43pl companies has exceeded that reported in the GIS Consultants 2005 industry survey

### PI 4 - Engage one large new corporate partner.

Progress Yet to be achieved: discussions underway with several organisations.

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 On track. In 2006 \$1,108k has been earned from 13 contracts and consultancies and other sources [\$450k projected].

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# Strategic Plan Performance Indicators

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 23 students completed or underway
- Masters & short courses Masters units and short courses underway

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

Progress On track with applications but yet to achieve major award; Knowledge Commercialisation Australia acknowledgement; three 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 Years 1 and 2 show over 75% satisfaction by Core Participants. 43pl company membership continues to be stable with no departures as at 30 June 06, showing good engagement and several new applicants. 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."







# 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
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
SISL	Spatial Information Systems Ltd
SME	Small to Medium [sized] Enterprises
SSI	Spatial Sciences Institute



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# Appendix 2 – Executive and Meetings Attended

CRCSI Governing Board	Meetings attended	Meetings held in term of appointment
Em Prof Bill Charters	4	5
Peter Woodgate	5	5
Les Field (alternate - J Walsh)	5	5
Mary O'Kane	5	5
Roland Slee	2	5
Bill Richards	5	5
Tony Burns (alternate - C Lunnay)	3 (1)	5
Steve Jacoby	3	3
Grahame Searle (alternate - D Hartley)	2	2
Warwick Watkins (alternate - D Mooney)	4 (1)	5
Bruce Thompson (alternate - T Chan)	4 (1)	5
Jannie van Deventer (alternate - G. Hutchison)	4	5
Audit and Compliance Committee		
Mary O'Kane	1	1
Warwick Watkins	1	1
Bruce Thompson	1	1
Research and Education Advisory Committee		
Clive Fraser	2	2
Peter Woodgate	2	2
Peter Loughrey	1	2
Roland Slee	2	2
Graeme Wright	2	2
Industry Advisory and Commercialisation Com	mittee	1
Jack de Lange	2	2
Tony Burns	1	2
Hun Gan	2	2
Grahame Searle	2	2
Neil Williams (alternate: Chris Pigram)	1 (1)	2
Peter Woodgate	2	2
Bill Richards	2	2
SISL Board		
Bill Charters	5	5
Mary O'Kane	5	5
Roland Slee	3	5
Peter Woodgate	5	5
Tony Burns	3	4
Bruce Thompson	4	4
Les Field	4	4