

Reaping the benefits:

innovation through collaboration



Recent highlights of the Cooperative
Research Centres Programme
2005



Foreword



Australia's Cooperative Research Centres (CRCs) have been highly successful in their endeavour to promote long-term, strategic links and collaborative research between researchers, industry and end-users.

Strategic arrangements with industry enable research and development with broader objectives to open up new directions for Australian industry. The CRC Programme has successfully entrenched collaborative links between industry, educational institutions, researchers, and the Australian and state governments. This has led to ground-breaking research partnerships delivering commercial outcomes.

I was delighted to present the Awards for Excellence in Innovation at the CRC Association's annual conference in May. The award applicants featured in this booklet highlight strong examples of the ability of CRCs to generate innovative ideas and accelerate the commercial application of those ideas. Also featured is the outstanding work of CRC students who are in the unique position of being provided with skills relevant to industry needs.

Science and innovation makes a considerable contribution to productivity and growth in modern economies, as well as to improved social and environmental quality of life. A high performing science and innovation system contributes to the development of new businesses and jobs growth while also providing savings to industry.

Investing in science and innovation is critical for Australia to stay competitive in an increasingly knowledge-based global economy. The Australian Government has placed considerable emphasis on improving funding for research and in prioritising research in recent years.

There are currently more than 70 CRCs funded as part of the Backing Australia's Ability Package—an \$8.3 billion commitment to support Australia's science and innovation. Over the period of Backing Australia's Ability, \$1.8 billion has been allocated to support the CRC Programme.

It is clear from what was showcased here that you don't have to look too far in any direction to see the effects, benefits and application of the CRC Programme—on agriculture; the mining and energy industries; the manufacturing sector; the information and communications technology industry; the environment; and the medical science and technology sector.

I warmly congratulate the CRCs on their efforts.

Dr Brendan Nelson MP

Minister for Education, Science and Training
November 2005

Winners



Australian Cotton CRC (now CRC for Cotton Catchment Communities) **Award winner for innovation arising from the application and utilisation of research**

Dr Brendan Nelson, MP, Federal Minister for Education, Science and Training
Mr Patrick Buerger, Managing Director, AgBiotech Pty Ltd
Associate Professor Peter Gregg, University of New England
Mr Guy Roth, CEO, Cotton Catchment Communities CRC
Hon Tony Staley, Chairman, CRC Association



CRC for Advanced Composite Structures

Award winner for innovation arising from the application and utilisation of research

Dr Brendan Nelson, MP, Federal Minister for Education, Science and Training
Dr Peter Preston, Chairman, CRC for Advanced Composite Structures
Professor Murray Scott, CEO, CRC for Advanced Composite Structures
John O'Hehir, General Manager, Boeing 787 Program, Hawker de Havilland
Hon Tony Staley, Chairman, CRC Association



CRC for Technology Enabled Capital Markets

Award winner for innovation arising from the application and utilisation of research

Dr Brendan Nelson, MP, Federal Minister for Education, Science and Training
Mr Chris Bertinshaw, Chief Executive Officer, Dtecht
Professor Michael Aitken, CEO, CRC for Technology Enabled Capital Markets
Mr George Neal, Director, The Health Bureau Pty Ltd
Mr Michael Bassingthwaighe, CEO, Lysaght Peoplecare
Hon Tony Staley, Chairman, CRC Association



CRC for Tropical Rainforest Ecology and Management

Award winner for innovation arising from education, training and public outreach

Dr Brendan Nelson, MP, Federal Minister for Education, Science and Training
Mrs Adelaide Baird, Yalanji Traditional Owner
Dr Rosemary Hill, Australian Conservation Foundation & Project Leader Rainforest CRC
Professor Nigel Stork, Chief Executive Officer, Rainforest CRC
Mr Steven Nowakowski, Photographer/Publisher Little Ramsay Press
Mr Roy Gibson, Yalanji Traditional Owner
Hon Tony Staley, Chairman, CRC Association



CRC for Cochlear Implant & Hearing Aid Innovation

Award winner for best student presentation

Ms Carrie Newbold, PhD Student, CRC for Cochlear Implant & Hearing Aid Innovation,
Dr Brendan Nelson, MP, Federal Minister for Education, Science and Training
Hon Tony Staley, Chairman, CRC Association

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Introduction



Reaping the benefits contains 28 stories that illustrate some of the ways in which Australia's continued investment in collaborative research adds to our national prosperity.

The stories are based on the 28 entries in the 2005 Awards for Excellence in Innovation. Now in their seventh year, the Awards recognise outstanding examples of the transfer of CRC research results, knowledge and technologies developed for research users including the community, companies and government agencies.

All six industry sectors in which CRCs operate are represented in each of the two award categories: innovation in the uptake and use of research; and innovative education, training and public outreach activities.

The 2005 Excellence in Innovation Award recipients for Uptake and Use of Research are:

- CRC for Advanced Composite Structures, whose research Hawker De Havilland used to underpin its winning tender to make components of the new Boeing 787. The huge contract is likely to span three decades, directly support hundreds of Australian jobs, and result in export sales of \$4 billion
- Australian Cotton CRC, for developing a pest management tool that will reduce insecticide use, substantially cut operating costs, and keep Australia's \$1.5 billion cotton industry sustainable
- CRC for Technology Enabled Capital Markets, for producing the world's first real-time health fraud detection program, which stands to save the health industry \$720 million a year

and for Education, Training and Public Outreach:

- Rainforest CRC, for a unique project, the Yalanji People of the Rainforest Fire Management Book, which explores traditional resource management and transfers oral history into written words, both in English and the Yalanji language.

Other highlights include stories about:

- new vaccines that are increasing profits for our beef feedlot industry, improving animal welfare, and keeping beef products free of antibiotic residues, thus helping Australia remain the world's No. 1 beef trader
- a powerful new weapon against a devastating fungal disease, which will deliver economic benefits to the avocado industry of around \$40 million
- CASTcoat™, a technology set to revolutionise the world car parts industry by dramatically improving the performance of component casting
- a world-first online training program, AUSRIVAS Online, which is providing readily-usable technology transfer for CRC research products
- better hearing for 50,000 hearing-impaired adults and children worldwide thanks to the Australian Design Award-winning Contour™ cochlear implant electrode array
- a method for mapping genes that will allow Australia's wheat industry to produce higher-value wheat for specialist uses and bringing disease-resistant varieties into production more cheaply, quickly and widely
- a new contact lens that is making inroads into the worldwide market for lenses and solutions, currently worth about US\$6 billion a year

- a unique education program designed to attract students to a career in the minerals processing industry, and thus help address a problem that threatens the future of an industry worth \$32 billion a year to the Australian economy
- a way to help property managers reduce the complexity of planning, meet the often conflicting requirements of catchment stakeholders, and still make a profit
- new monitoring technology capable of lifting mine productivity by up to 10% for the nation's \$60 billion minerals and energy sector
- a new Graduate Certificate in Management designed to make researchers better managers

The Awards also recognise the achievements of outstanding early career research scientists and engineers who make a substantial contribution to the CRC Programme. Once again, we gratefully acknowledge CSIRO's generous and continuing support in sponsoring this important segment.

Eight PhD students were selected to attend the CRC Association Conference and demonstrate their ability to communicate effectively about a research achievement to a non-specialist audience.

Carrie Newbold of the CRC for Cochlear Implant and Hearing Aid Innovation won the \$2000 prize. Her work on how tissue growth around cochlear implants affects power use has already doubled the battery life of 'bionic ears'.

We thank the judges who put so much time into assessing the entries. The judging panel for the Awards for Excellence in Innovation comprised:

- Professor Margaret Britz, Assistant Deputy Vice Chancellor Research, University of Melbourne
- Mr Ian Lawrence, Managing Director, STEM Partnership, Melbourne
- Mr Jim Miller, CRC Appraisal Panel, Round 9
- Dr Michael Pannaccio, Principal, Starfish Ventures, Melbourne
- Dr Peter Riddles, Deputy CEO, ImbCom Pty Ltd (commercialisation company for the Institute of Molecular Bioscience), University of Queensland

For Showcasing CRC PhD Students, the judges were:

- Dr John Boyd, Consultant, previous General Manager, CRC Programme in the Industry Department
- Mr David Ellyard, President, Australian Science Communicators
- Dr Sue Stocklmayer, Director, Centre for Public Awareness of Science, ANU
- Dr Geoffrey Vaughan, Chair, CRC Committee (now immediate past Chair)
- Mr Graham Walker, Marketing Coordinator, Education Group, CSIRO

Reaping the benefits of cooperative research is the thread that binds the stories together. Innovation originating in CRCs is helping to build new industries, create new products and jobs, protect the environment, enhance our international reputation for ingenuity and innovation, and generate wealth for present and future generations.

Current CRCA members are listed at the end of the booklet. For more information, visit our website at <<http://www.crca.asn.au>>.

Hon Tony Staley

Chairman

CRC Association

Aussie car parts breakthrough

INNOVATION IN APPLICATION AND USE OF RESEARCH



An Australian technology is set to revolutionise the world car parts industry by dramatically improving the performance of component casting. The research will result in significant economic benefits to metal component manufacturers both in Australia and worldwide.

The new coating technology, CASTcoat™, developed by researchers in the Cooperative Research Centre for Cast Metals Manufacturing (CAST), protects metal casting equipment up to ten times longer than present coatings.

Coatings are applied to protect the equipment used to cast metal components and control the quality of the castings themselves. Until the invention of CASTcoat™, manufacturing companies the world over relied on coatings that needed constant repair and replacement. This was expensive, time-consuming and not very reliable.

Traditional die coats are made from brittle ceramics that are gradually destroyed in order to protect the equipment. Drawing on technology developed to protect jet engines, CAST researchers based at CSIRO invented a new kind of ceramic coating that lasts ten times longer and has a novel application method. This is CASTcoat™, a strong, porous ceramic layer with insulating properties that is resistant to wear and tear and is applied using a thermal spraying process.

The main users of CASTcoat™ will be companies manufacturing lightweight alloy parts for the car industry.

Extensive trials are being carried out to prove the value of the CASTcoat™ technology. Several of Europe's leading die casters who supply quality engine castings to companies such as BMW, Jaguar and Porsche are evaluating CASTcoat™ on challenging components and showing that it significantly outperforms their existing coatings.

CAST has a licence agreement with Acheson Industries, one of the world's two major die coating suppliers, to market the technology to casting companies worldwide. The CASTcoat™ technology was commercialised through a partnership between CAST and FTS, a commercialisation services company.

Left from top: 1. CASTcoat™ Inventors Dr Mahnaz Jahedi and Stefan Gulizia standing in front of a component manufactured using CASTcoat™. 2. Comparison of surface finish shown by a commercial diecoat (left) with CASTcoat™ (right). 3. CASTcoat™ is useful in making a range of metallic automotive components to improve surface finish. 4. A mould used for casting manifolds, the mould is coated with CASTcoat™. CASTcoat™ is applied using plasma spray technology.

CRC for Cast Metals Manufacturing (CAST)

CRC category Manufacturing Technology

Core participants

Industry: Australian Die Casting Association Ltd, Australian Magnesium Corporation Pty Ltd, CAST Centre Pty Ltd, Comalco Aluminium Ltd, Ferra Engineering Pty Ltd; Ford Motor Company of Australia, ION Automotive, Nissan Casting (Australia) Pty Ltd, o.d.t. Engineering Pty Ltd.

University: Deakin University, Monash University, Swinburne University of Technology, The University of Queensland.

Australian Government: CSIRO

State Government: The State of Queensland, The State of Victoria



Real-time health fraud detection

INNOVATION IN APPLICATION AND USE OF RESEARCH

The Capital Markets CRC has produced the world's first real-time health fraud detection technology known as Dtechtive.

Health fraud is estimated to be costing Australia \$1.8 billion per annum. This is around 10% of health claims. Successful early trials of Dtechtive have identified fraud levels of 4%, a possible saving of \$720 million per annum. These savings could mean a substantial difference to the Australian health industry, for example, in reducing waiting lists and increasing available hospital beds.

The problem of health fraud is increasing as electronic claims processing becomes widely used. Compliance processes are generally undertaken months after claims have been paid. The effect of payers delaying action, or not acting at all, is that fraudulent or inappropriate behaviour by claimants becomes entrenched and money incorrectly paid is almost impossible to recover. Only relatively large-scale and easy-to-detect fraud is pursued because of the high overheads associated with enacting legal proceedings.

The CRC team combined with a fledgling consultancy in the health insurance sector to tackle the problem. It adapted leading-edge research in data management, data mining and data visualisation from the capital markets arena to produce Dtechtive, the first product in Australia to implement fraud detection systems at the time claims are first processed. The result is the ability to stop or query suspect and/or fraudulent claims before benefits are paid.

Dtechtive earned its first commercial revenue in March 2005. Demand is so great that 18 private health funds signed up to the program in less than six months.

The research group, guided by experts in health insurance fraud, is constantly modifying the system to reflect new claimant patterns as they are discovered. The long-term strategy for the product is to modify behaviour of claimants through the continuous improvement in real-time detection capabilities.

The CRC has established Dtecht Pty Ltd to take responsibility for the continuing development and marketing of this technology.

Left from top: 1. A visual data mining tool depicting the relationships between health providers and health insurance members. 2. Example of Dtechtive's alert interface as viewed by analysts investigating abnormal health claims.



CRC for Technology Enabled Capital Markets

CRC category Information and Communication Technology

Core participants

Industry: Australian Centre for Advanced Computing & Communications (AC3), ABN AMRO, Credit Suisse First Boston (CSFB), Securities Industry Research Centre of Asia-Pacific (SIRCA), SMARTS Pty Ltd

University: Macquarie University, University of New South Wales, University of Sydney, University of Technology, Sydney



WINNER

New weapons against avocado diseases

INNOVATION IN APPLICATION AND USE OF RESEARCH



Leading research from the Cooperative Research Centre for Tropical Plant Protection has identified a powerful new weapon against anthracnose disease, a devastating fungal disease that is one of the most serious issues facing the avocado industry in Australia.

The industry is currently worth \$70 million a year, with a production volume of 30,000 tonnes. Anthracnose disease has been causing product losses estimated to cost the industry around \$20 million each year.

Anthracnose disease has been intensively studied for over 60 years with no completely satisfactory control measures found. The disease produces lesions on the skin and flesh of ripening avocados, rendering fruit virtually unsaleable. Chemical strategies have traditionally been the primary focus for control, representing a major cost to growers and increasing concerns over the environmental impact of routine spraying programs.

The CRC project took a novel approach to this problem by using the plant's own defences and fertilising regime to prevent anthracnose disease. The research demonstrated that using a specific type of rootstock with 'Hass' avocados (the major cultivar in Australia) resulted in a significant reduction in the incidence and severity of anthracnose lesions in the fruit from the tree. It also showed that fertilisers can play an important role in managing anthracnose.

The new holistic approach developed by the CRC project team is improving growers' profitably and contributing to stronger economies in regional communities by reducing post-harvest fruit losses and fungicide costs. The reduction in the amount of chemicals used in the industry is also delivering health and environmental benefits.

The economic benefits of the research to the avocado industry are estimated at roughly \$40 million, around two-thirds of which is a direct reduction in post-harvest losses to the grower.

This project received major support from the avocado industry as well as CRC industry partners.

Left: The research investment has developed a solution to a major quality concern affecting the avocado industry. The results are being adopted by nurseries and growers.

CRC for Tropical Plant Protection

CRC category Agriculture and Rural Based Manufacturing

Core participants

Industry: BSES Limited, Biogemma

University: The University of Queensland, Charles Darwin University, The Australian National University

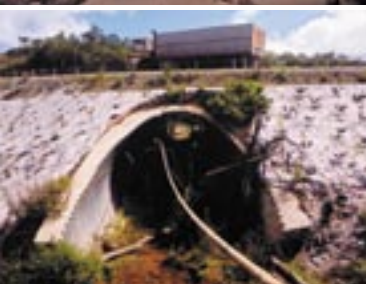
Australian Government: Australian Government Department of Agriculture, Fisheries and Forestry, CSIRO

State Government: QLD Department of Primary Industries and Fisheries, NT Department of Business, Industry & Resource Development.



Helping rainforest animals across the road

INNOVATION IN APPLICATION AND USE OF RESEARCH



Increasing traffic and regular highway upgrades can pose a life and death challenge for canopy- and ground-dwelling animals. In some cases, road deaths are so frequent that they are a real threat to species survival. Examples include the endangered Cassowary and the rare Lumholtz's Tree kangaroo.

While road kills are an obvious and tragic result of the fragmentation of habitat by roads, there are other equally serious consequences. Roads, pipelines, power-line easements and other artificial clearings can also form impassable barriers for forest dwellers, and divide areas to create distinct and non-viable populations of once-thriving species.

Rainforest CRC research has demonstrated for the first time the effectiveness of faunal underpasses and overpasses in solving the problem for tropical rainforest species.

Faunal underpasses are not a new idea, however the CRC's research has extended previous concepts and shown just how successful they can be in enabling native wildlife to move between fragmented areas with ease. Underpasses have been redesigned to include natural habitat around entrances and exits, and inside 'furniture' to protect users from predators such as cats and foxes. On the other hand, faunal overpasses in the form of rope bridges are a very new idea. The rope ladder or tunnel designs allow possums to walk across easily.

The research has been included in a manual of environmental best practice produced by the CRC and the Queensland Department of Main Roads. Many road upgrades in eastern Australia have implemented the new road designs, which are helping Australia safeguard animals and meet its international obligations under the Convention on Biological Diversity. Designs for such environmentally and economically sustainable major infrastructure are essential to maintaining a tourism industry worth billions of dollars.

This is not only smart science, it also adds significantly to the skills base of Australian road engineers, many of whom are involved in large overseas projects.

The project has sparked growing international interest.

Left from top: 1. Underpass 'furniture' at the East Evelyn Road Upgrade (Photo: Miriam Goosem). 2. Operational underpass just after upgrade completion (Photo: Jonathon Munro). 3. Erecting a canopy bridge over a tourist road near Ravenshoe (Photo: Sue Frankcombe). 4. Herbert River ringtail possum using a canopy bridge near Cairns (Photo: Nigel Weston). 5. Aerial photograph of East Evelyn area (Photo: DNRM, figure: Miriam Goosem). Right: 6. Radio-collared Herbert River ringtail possum at a new bridge site near Millaa Millaa (Photo: Nigel Weston)

CRC for Tropical Rainforest Ecology and Management

CRC category Environment

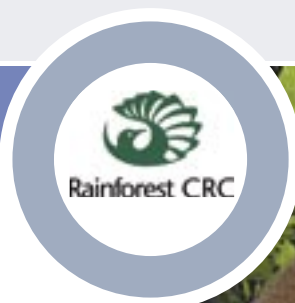
Core participants

Industry: Alliance for Sustainable Tourism, Queensland Tourism Industry Corporation

University: James Cook University, The University of Queensland, Griffith University

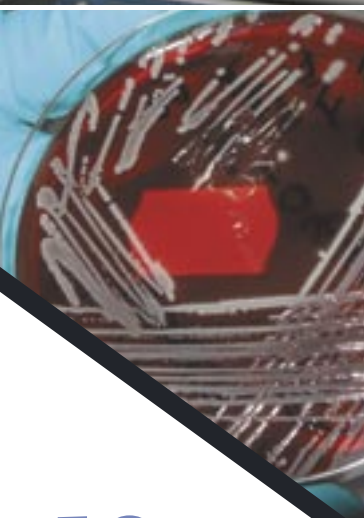
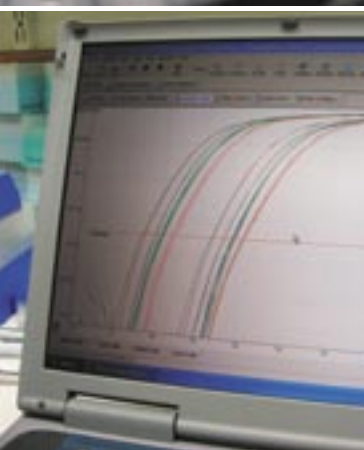
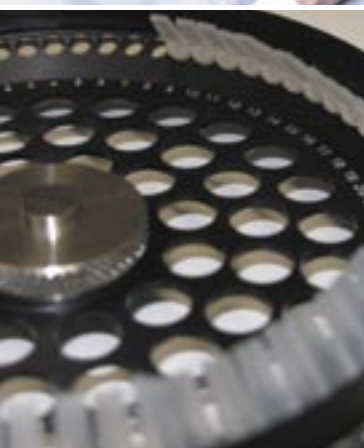
Australian Government: Aboriginal and Torres Strait Islander Commission, Environmental Protection Agency, CSIRO Tropical Forest Research Centre

State Government: QLD Department of Natural Resources and Mines, QLD Department of Primary Industries (Forestry), Queensland Parks and Wildlife Service, Wet Tropics Management Authority



Life saving innovation

INNOVATION IN APPLICATION AND USE OF RESEARCH



Working with partners in microbial genetics, the CRC for Diagnostics has come up with a faster, simpler and cheaper way to genetically fingerprint dangerous micro-organisms. This work, some of which has now been patented, will save many lives by significantly shortening the time to get a result and to implement effective treatment.

Despite antibiotics, the genetic diversity of micro-organisms allows them to evolve and fight back. Pools of variants have different virulence and pathogenicity, and microbial genotyping tells clinicians and public health authorities which variants they are dealing with.

Two common methods are gel electrophoresis, which produces the well-known banding pattern from DNA fragments, and gene loci analysis, which measures fragment length or determines gene sequences. The first method is hard to standardise between labs and tells us nothing of gene content; the second can be slow, laborious and ambiguous.

The CRC's researchers realised that, with the right bioinformatics tool to query burgeoning gene sequence databases, it would be possible to determine the minimum number of genetic differences ('polymorphisms') to investigate for a given genotyping resolution. The difference might be the presence or absence of a single gene, or a different base at one place in a gene (a single nucleotide polymorphism, or SNP). For a typical bacterial pathogen, the minimum number turns out to be seven. With Newcastle University, the CRC developed and patented 'Minimum SNPs' software to carry out this procedure.

Different classes of polymorphism evolve at different speeds, and optimal genotyping needs to use markers both for slow and for fast mutators. Using Minimum SNPs with real-time polymerase chain reaction in work with Queensland Health Pathology, the CRC has developed genotyping practice for golden staph, including methicillin resistant *Staphylococcus aureus*, and *Neisseria meningitidis*, which causes bacterial meningitis. Work has also begun with the Queensland Department of Primary Industries and Fisheries on *Campylobacter jejuni*, a major contaminant of chicken meat.

Top left: Associate Professor Phil Giffard using the software.

CRC for Diagnostics

CRC category Medical Science and Technology

Core participants

Industry: Queensland Medical Laboratory

University: La Trobe University, Queensland University of Technology

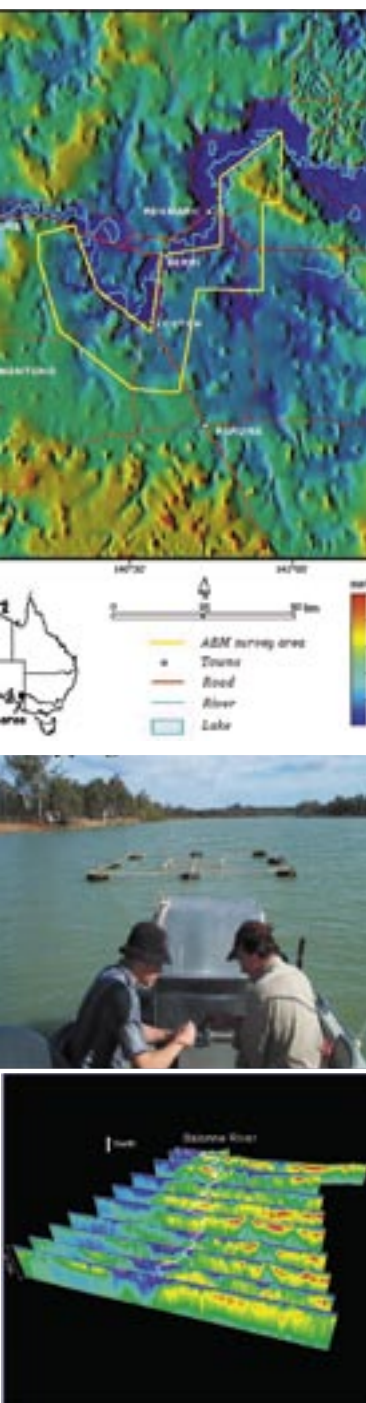
Australian Government: CSIRO Molecular & Health Technologies

Other: Child Health Research Institute Inc



Regolith to the rescue

INNOVATION IN APPLICATION AND USE OF RESEARCH



Researchers are prising open Australia's salinity problems using techniques from the mining industry, detailed knowledge of the earth and innovative modelling software. With South Australian and Queensland government partners, CRC LEME is building 3D maps showing areas of higher and lower salinity in the regolith—the weathered and redeposited rock, sand and clay on top of ancient, undisturbed rock layers.

Salt is distributed unevenly in the regolith. Irrigation or land clearing can mobilise it, with dire consequences for farmers, downstream water users, and ecosystems. Knowing the location of salt can guide the design of salt interception schemes, show where not to irrigate, and save billions.

The CRC LEME project involved work at both ends of the Murray–Darling catchment. In the Balonne district in southern Queensland, airborne electromagnetic (AEM) sensors recorded electrical conductivity in the regolith below, where water flows underground to the Darling River system. After innovative processing and integration with other data, the scientists had a 3D map of saline and fresh groundwater flows—effectively, a guide for future land use and for avoiding expensive problems.

In South Australia's Riverland district, researchers used helicopter AEM and borehole data to map layers of clay, distributed in sand above the watertable. They liken the clay layers to slices of holey Swiss cheese: irrigation above the clay is sustainable, but irrigation above the holes asks for trouble. The scientists also towed a floating electromagnetic sensor array along the Murray River to map salinity 'hotspots'. The engineering scheme calls for highly saline groundwater to be removed via salt interception bores and piped to evaporation ponds, where the solid salt is removed. Salt interception schemes (including boreholes and pumps to stop salt entering the river) can now be sited for maximum effect and minimum cost. Because the downstream cost of each tonne of salt is about \$65,000, the long-term potential benefits may top \$400 million for this stretch of river alone.

Left from top: 1. Detail of a locality map of the Riverland area, South Australia. 2. Identifying hotspots of salinity discharge into the Murray River using a floating electromagnetic pontoon towed behind a dinghy. 3. Airborne electromagnetic conductivity-depth sections across the Lower Balonne study area, assembled to show geological and hydrological features in three dimensions.

CRC for Landscape Environments and Mineral Exploration

CRC category Mining and Energy

Core participants

Industry: Minerals Advisory Council

University: The Australian National University, Curtin University of Technology, University of Adelaide,

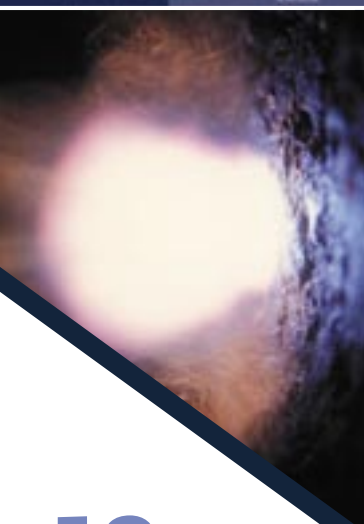
Australian Government: Geoscience Australia, CSIRO Exploration and Mining and Land and Water.

State Government: SA Department of Primary Industries and Resources, NSW Department of Primary Industries.



Spectrolaser makes history

INNOVATION IN APPLICATION AND USE OF RESEARCH



Researchers from the CRC for Clean Power from Lignite have designed and commercialised a revolutionary instrument that is increasing productivity in the mining and mineral processing industries, as well as assisting in environmental remediation.

A high-technology Australian company, Laser Analysis Technologies Pty Ltd, has been established to manufacture and sell the product, the Laser Plasma Spectrolaser. It is now marketing the instruments worldwide.

The Spectrolaser is a new, super-powerful tool for analysing the atomic elements in virtually any material, quickly and cheaply. It produces a bright spark—or plasma—at the surface of the target substance and the composition of the light emitted is analysed by a unique spectrometer and detection system. Every element gives off a characteristic spectral emission, enabling you to tell quickly and easily what elements comprise the material being analysed.

The instrument was initially designed to perform rapid analyses of coal quality, to help power stations operate more efficiently. Coal varies in moisture, organic components, and trace elements. If operators understand the composition of the coal before it is fed into a furnace, they can adjust combustion conditions to improve burning efficiency and reduce fouling.

The Spectrolaser can also be used to analyse minerals, building materials, metals and alloys, pharmaceuticals, manufactured products and to carry out environmental monitoring.

The instrument can be built using a combination of off-the-shelf components and proprietary electronic systems. Further value has been added in the smart software that operates the system, and in creating a library of characteristic emission signatures to automate element identification.

The Spectrolaser continues a long tradition in Australia as a discoverer, developer and exporter of precision scientific instrumentation. This industry earns almost a billion dollars a year from exports, and underpins the quality of a great many of our export products and commodities.

Left: The laser plasma spectrolaser can rapidly determine the elemental make-up of materials. The technology has been developed into a commercial analytical instrument range, the Spectrolaser range.

CRC for Clean Power from Lignite

CRC category Mining and Energy

Core participants

Industry: Alstom Power Ltd, GHD Pty Ltd, Herman Research Pty Ltd, International Power—Hazelwood, IPM Australia Limited, Loy Yang Power Management Pty Ltd, NRG Flinders, TRUenergy Yallourn Pty Ltd

University: Monash University, University of Adelaide, Swinburne University of Technology

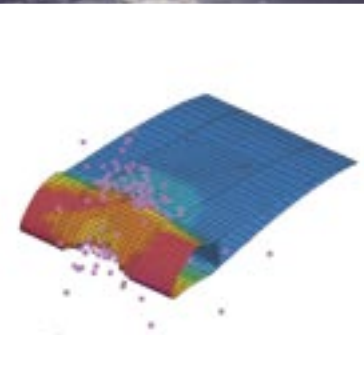
Australian Government: CSIRO—Division of Minerals

State Government: VIC Department of Primary Industries



Stronger lighter aircraft

INNOVATION IN APPLICATION AND USE OF RESEARCH



Research conducted by the CRC for Advanced Composite Structures will result in lighter, stronger, and more economical passenger aircraft that are also more comfortable for passengers.

A core participant in the CRC, Hawker de Havilland, will use the outcomes of the research in the design and manufacture of the wing trailing edge components—flaps, spoilers and ailerons—for the new Boeing 787. These components are crucial for control, landing and braking.

Despite intense competition from aerospace companies around the world, Hawker de Havilland was able to leverage the advanced composites technologies developed by the CRC to gain a place on this select list of design-build suppliers.

A composite structure is made of several different materials. The 787 wing trailing edge components will be made from carbon fibres in epoxy resin using advanced diaphragm forming and liquid moulding technologies developed by the CRC. These technologies allow greater automation and reduce the need for fasteners such as bolts and rivets.

Greater use of composites in the 787 by Boeing and its team will also benefit passengers. As composites don't corrode, cabin humidity levels can be higher and passengers are less likely to feel dehydrated at the end of their flight. Composites also allow more cabin pressurisation. Evidence suggests that the combination of these factors might help overcome deep vein thrombosis and jet lag.

The new 787 will be Boeing's first completely new plane in 15 years. It will be ready for commercial flights in 2008. Thanks to the CRC for Advanced Composite Structures, efficient new technology to design and build the flaps, spoilers and ailerons is available to HdH right now.

Left from top: 1. The new Boeing 787 will lift off in 2008 with CRC-ACS technologies commercialised by Hawker de Havilland. 2. Specialist Finite Element Analysis techniques simulate the impact of birds on a flap. 3. A detail of a wingtip structure made using the new liquid moulding technology.

CRC for Advanced Composite Structures

CRC category Manufacturing Technology

Core participants

Industry: Hawker de Havilland Aerospace Pty Ltd

University: Royal Melbourne Institute of Technology, The University of Sydney, The University of New South Wales, Monash University

Australian Government: DSTO, CSIRO

Other: Composites Australia Inc

CRC-ACS

WINNER



Arming for the battle against global warming

INNOVATION IN APPLICATION AND USE OF RESEARCH



As a party to the United Nations Framework Convention on Climate Change, Australia must submit a National Greenhouse Gas Inventory each year. Accurate national inventories, following guidelines established by the UN's Intergovernmental Panel on Climate Change (IPCC), are essential weapons in the battle to reduce emissions worldwide. Many governments now use emissions trading systems to make reductions cost efficient, so getting the figures right is crucial.

Research by the CRC for Greenhouse Accounting on the fate of carbon stored in wood products will give Australia immediate additional leeway of about 430,000 tonnes of carbon dioxide (CO₂) equivalent, and is likely to influence the way the IPCC measures emissions.

Working with its partners (State Forests of NSW, the Chemistry Centre in Western Australia and the Australian Greenhouse Office), and with waste authorities and local government in Sydney, the CRC's project involved excavations at two landfills to recover wood and paper buried between 20 and 46 years ago. The carbon loss from this material ranged from 1.4% to 3.5%—much lower than the IPCC's range of 20% to 25%, which was based on laboratory tests. On the 2004 inventory figures, this reduces emissions estimates over time by more than 2 million tonnes of CO₂ equivalent.

Australia will now base its estimate on the lower band of the IPCC's current range, and the CRC is collaborating internationally in research likely to lead to a change in the IPCC's decay factors. The research also has implications for carbon trading, as carbon is stored in wood products for the long-term even after burial in landfill. This knowledge may significantly increase the financial returns from carbon trading and provide a greater incentive for planting trees.

Left from top: 1. Biomass weighed on trailer. 2. David Gardner with paper products excavated after 18 years in landfill. 3. Wood products arriving at landfill, North Carolina, USA. 4. Wood products after 46 years in landfill. 5. Paper products after 20 years in landfill.

CRC for Greenhouse Accounting

CRC category Environment

Core participants

University: The Australian National University, The University of Melbourne

Australian Government: CSIRO, Australian Greenhouse Office in the Department of Environment and Heritage, Bureau of Rural Science

State Government: WA Department of Conservation and Land Management, QLD Department of Natural Resources, Mines and Energy, QLD Department of Primary Industries and Fisheries, VIC Department of Sustainability and Environment, Forests NSW.



Vaccines for clean, green, residue-free Australian beef

INNOVATION IN APPLICATION AND USE OF RESEARCH



Bovine respiratory disease (BRD), which causes pneumonia in cattle, is the single most costly disease affecting beef cattle in feedlots, costing the Australian industry \$60 million a year. Until recently, the only treatments were antibiotics and anti-inflammatory drugs, both of which compromised our reputation for producing 'clean, green, residue-free' beef.

The CRC for Cattle and Beef Quality has now delivered two new vaccines to the Australian beef feedlot industry, in partnership with pharmaceutical companies. The vaccines have reduced mortalities and sickness, improved productivity, and reduced the need for antibiotics. These advances are timely: Australia's beef feedlots are packed with about 850,000 head to meet record domestic and export demand.

BRD is a complex disease. Cattle stressed by transport to the feedlot and by mixing with other stock, that carry various bacteria and viruses, end up with compromised lung defences. The bacterial pathogen *Mannheimia haemolytica* proliferates in the lung, resulting in the pneumonia known as BRD. The CRC decided to prevent BRD by developing two new vaccines.

The first, developed with NSW Government scientists, targeted widespread Pestivirus infection. Pestivirus, which probably entered Australia in early colonial times, affects fertility and the health of calves, and predisposes cattle to BRD. After successful trials, CRC scientists supplied master stocks. The vaccine, Pestigard, is now marketed in Australia by Pfizer.

The second vaccine protects against *Mannheimia haemolytica* directly. The CRC funded work by CSIRO scientists at the Australian Animal Health Laboratory to develop the vaccine. After extensive field trials, Intervet (Australia) has sold more than three-quarters of a million doses into Australian feedlots.

The direct results of this work are increased profits for cattle breeders and feedlot operators, improved animal welfare, and beef products free of antibiotic residues, so helping to keep Australia as the number one beef trader in the world.

Left: BRD causes between 50% and 90% of sickness and death in Australian feedlot cattle and is estimated to cost our cattle industry \$60 million a year. The new vaccines benefit cattle, breeders and feedlot operators, and consumers.

CRC for Cattle and Beef Quality*

CRC category Agriculture and Rural Based Manufacturing

Core participants

University: The University of New England

Australian Government: CSIRO

State Government: NSW Department of Primary Industries, QLD Department of Primary Industries and Fisheries

*Now CRC for Beef Genetic Technologies



Boosting Australia's wheat industry

INNOVATION IN APPLICATION AND USE OF RESEARCH



Triticarte® is a novel, low-cost method for mapping genes to speed up breeding improvements in wheat. Cheaper gene mapping will allow the Australian wheat industry to boost profits by producing higher-value wheat for specialist uses, such as in the noodles, breads or biscuits of various cuisines. Disease-resistant varieties for Australian farmers will be brought into production more cheaply, quickly and widely.

The CRC for Value Added Wheat (VAWCRC) and Diversity Arrays Technology (DArT®) Pty Ltd formed a joint venture, Triticarte Pty Ltd, in 2003. DArT® uses 'DNA chips', which are microscopic arrays of DNA fragments that can be scanned thousands at a time. Initially, Triticarte® produced 'libraries' of wheat and barley genes suitable for use in arrays (after wheat, barley is Australia's largest export crop). Consultation with breeders followed, to make sure the final product met their practical requirements.

Wheat breeders sample populations of plants, looking for desirable characteristics. At the same time, they can also collect DNA and send it for gene mapping. Using the data returned, they can relate traits of interest to genes to guide their choice of plants for commercialisation.

Before DArT®, gene mapping was too slow and expensive to be used widely. With Triticarte®, mapping that once took one person four years now takes two days; a map of 500 molecular markers now costs a wheat breeder just \$50. Having breeders adopt Triticarte® has been a major technology transfer exercise, led by the Wheat CRC.

Other partners and sponsors include the Grains Research and Development Corporation, Arnott's Biscuits and Allied Mills. Arnott's is already using varieties from VAWCRC's research program to improve its biscuit products, and 20% of Allied's grist for biscuit flour is derived from VAWCRC work.

Left: Adoption of the Triticarte™ process will add substantial impetus to the wheat industry's efforts to move wheat from bulk commodity status into more profitable, specialist value-added streams.

CRC for Value Added Wheat

CRC category Agriculture and Rural Based Manufacturing

Core participants

Industry: Grains Research and Development Corporation, Arnott's Biscuits Limited, Allied Mills Australia Pty Ltd, C-Qentec Diagnostics Pty Ltd

University: The University of Sydney

State Government: NSW Department of Primary Industries, WA Department of Agriculture



ENCORE event evaluation kit

INNOVATION IN APPLICATION AND USE OF RESEARCH



A significant proportion of Australian domestic tourists and inbound international visitors attend business, sporting or cultural events. The business events sector, for example, is valued at over \$17 billion and employs around 115,000 Australians.

The CRC for Sustainable Tourism began work on event evaluation with Victoria University in 1999, and completed six separate economic impact studies by 2001. The CRC's lead industry partner in this research, Arts Victoria, was then keen to cooperatively develop and distributed a do-it-yourself kit that would help event organisers to calculate economic benefits efficiently. Tourism Victoria and the City of Melbourne joined the team to provide greater input from industry and local government perspectives. Economists from government agencies in all states and territories provided further assistance in modelling the algorithms that would provide a national standard for the kit.

In 2004 the kit was launch under the product name 'Encore'. It is a stand-alone software application that pulls together data, including survey results, expenditure and income to provide an objective report on event profitability and sustainability.

Encore is easy to use, and includes a self-contained template and instructions on collecting data. Encore allows event organisers to measure the direct economic contribution of an event to a state, region or district and demonstrate its impact to sponsors. In addition, the application gathers, measures and tracks visitor demographics and feedback. Data can be reported in tables or charts, and instantly interpreted to reveal the in-scope expenditure achieved by the event.

Local and state governments, community associations and event businesses have been quick to adopt Encore. In a recent example, the local government in Mildura used Encore to evaluate the growth, economic impact and marketing strategies of the Mildura Country Music Festival, the Jazz, Food and Wine Festival, and two major air shows.

Left: Encore is being used to analyse the profitability and sustainability of a wide range of business, cultural and sporting events.

CRC for Sustainable Tourism

CRC category Environment

Core participants

Industry: Australian Federation of Travel Agents, QANTAS, TTF Australia, Australian Tourism Export Council

University: Griffith University, The University of Queensland, Southern Cross University, University of Tasmania, The University of New South Wales, Charles Darwin University, Monash University, James Cook University, Curtin University of Technology, University of Canberra, Murdoch University, University of South Australia, Edith Cowan University, University of Technology Sydney, Victorian University of Technology, La Trobe University, TAFE New South Wales (North Sydney Institute)

Australian Government: Tourism Australia

State Government: Australian Capital Tourism, NSW Department of Environment & Conservation, NT Tourist Commission, Parks Victoria, SA Tourist Commission, Tourism NSW, Tourism QLD, Tourism TAS, Tourism VIC, Tourism WA, WA Conservation & Land Management

Other: Gold Coast City Council



Revolution in mining

INNOVATION IN APPLICATION AND USE OF RESEARCH



Monitoring technology developed by CRCMining and industry partner P&H MinePro Services is capable of lifting mine productivity for the nation's \$60 billion minerals and energy sector.

The breakthrough technology promises to reduce damage, downtime and economic loss by revolutionising the performance of two of the industry's workhorses—electric shovels and large haul trucks.

Electric shovel operators work in an information-poor environment. They receive little feedback on their performance. Traditionally, the operators are financially rewarded for maximising the amount of material they can move in a shift. Without good feedback, this can result in overloading of equipment, causing equipment failure, higher maintenance costs, and even accidents, all of which affect a mine's production rates.

The shovel monitor is designed to improve the performance of both machine and operator by giving the operator direct, real-time feedback on how the machine is working, and highlighting areas for improvement. The information is displayed on easy-to-read graphic touch-screens.

The system extracts information about how the shovel is operating by processing data from a number of channels associated with the electrical drive system. Using smart maths developed by the CRCMining team, it works out the weight of material in the bucket after each dig pass, and then warns the operator if they are attempting to overload a truck.

By providing overall performance information, the shovel monitor also helps mining companies to understand more about how their equipment is operating and how to get the best out of it while avoiding breakdowns.

Off-the-shelf industry-standard components provide the backbone of this new, cost-effective, robust and highly reliable system. It will be marketed by P&H MinePro Services.

This is the first step in a long-term research plan intended to ensure the Australian mining industry remains competitive through the continued development of technologies that reduce operating costs.

Left from top: 1. Anthony Reid pointing to the shovel monitor software. 2. View from the shovel. 3. Victor Chiodi of P&H MinePro Services driving the shovel.

CRCMining

CRC category Mining and Energy

Core participants

Industry: Anglo Coal Australia, AngloGold Ashanti, BHP Billiton, Caterpillar Elphinstone, Hamersley Iron, Komatsu Australia, Lucas Group, P&H MinePro Services, Peabody Energy, Phelps Dodge, Rio Tinto.

University: The University of Queensland, The University of Sydney, The University of Newcastle, Curtin University of Technology.



Better design yields better hearing worldwide

INNOVATION IN APPLICATION AND USE OF RESEARCH



More than 50,000 hearing-impaired adults and children worldwide hear better, thanks to the Australian Design Award-winning Contour™ cochlear implant electrode array developed by Cochlear Limited in partnership with the CRC for Cochlear Implant and Hearing Aid Innovation.

Cochlear implants provide ‘hearing’ through an externally-worn speech processor that receives sound and transforms these sounds into electric signals delivered through an electrode array implanted in the hearing organ or cochlea.

Starting in 1999, CRC HEAR and Cochlear undertook the challenge of improving the interface with the body’s nervous system by addressing limitations in electrode design. Interdisciplinary studies of cochlear geometry, design and curling mechanisms, materials science, biocompatibility, imaging and surgical procedures led to the Contour™ and Contour Advance™ electrode arrays, designed to be positioned closer to the neural elements on the interior wall of the cochlea.

Contour™ and Contour Advance™ are pre-curved to the cochlea’s shape using a novel composite of materials with different memory and biocharacteristics. An internal stylet, that holds the array straight, is withdrawn using a specialised Advance-Off-Stylet™ (AOS) surgical procedure, allowing the Contour™ to assume its final curled position.

CRC HEAR’s project team also helped develop instructional CDs for surgeons and provided surgical consultants to enhance market acceptance.

The Contour™ and Contour Advance™ electrode arrays have now been implanted in more patients worldwide than any other previous electrode design, and AOS is now accepted worldwide as surgical best practice.

By improving the neural interface between implant and the human body, the Contour™ has enabled next-generation miniature ear-level speech processors, providing improved benefits for thousands of children and adults, and helping Cochlear Ltd retain its worldwide competitive advantage.

Cochlear Ltd reported earnings of over \$340 million for financial year 2005, and employs over 500 staff in Sydney in manufacturing, market support and research. Australian public hospitals and clinics also benefit from cost-competitive access to the world’s most advanced cochlear implant technology.

CRC for Cochlear Implant and Hearing Aid Innovation (CRC HEAR)

CRC category Medical Science and Technology

Core participants

Industry: Cochlear Ltd

University: The University of Melbourne

Australian Government: Australian Hearing Services

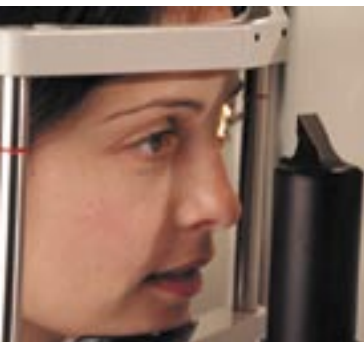
State Government: The Bionic Ear Institute

Above from top: 1. Nucleus 24 Contour Electrode, the world’s most-used perimodiolar array. 2. Nucleus 24 Contour Advance Electrode showing Softip developed by CRC HEAR and Cochlear Ltd. 3. Cross-section highlighting the close proximity of the Contour Advance electrode array to the modiolus of the cochlea, and no damage to delicate cochlear structures. 4. CI24RE Cochlear implant fitted with the Contour Advance electrode.



More oxygen for healthy eyes

INNOVATION IN APPLICATION AND USE OF RESEARCH



O2OPTIX, a new contact lens developed by Vision CRC and CIBA Vision, is making inroads into the worldwide market for lenses and solutions, which is currently worth about US\$6 billion a year. The market is tipped to more than double within five years, as people in younger age groups switch to contact lenses.

The front of the eye (the cornea) needs a lot of oxygen to stay healthy, so a lens must allow oxygen in if it is to be worn for any length of time. The Focus Night and Day extended wear lens, developed in a previous collaboration between CIBA Vision and Vision CRC's predecessor, the CRC for Eye Research and Technology, brought to market a soft lens that can be worn continuously for 30 days and nights. The cost of production, however, limited market penetration into the large daily wear segment where research showed that over 80% of Australia's contact lens wearers continued to use older, less oxygen permeable, lenses.

Vision CRC and CIBA Vision went to work to lower the production costs of the lens material, Lotrafilcon A, while maintaining high permeability and making it even softer. The result, Lotrafilcon B, transmits up to five times as much oxygen as the traditional soft lenses used by most of the world's 100 million wearers. And its price puts it within reach for daily wearers, ensuring that their eyes stay healthier. Using the new material, CIBA Vision produced the O2OPTIX lens, launched in the United States in September 2004 and in Australia in February 2005. Sales so far have been excellent.

Vision CRC's contribution to the project included expertise in ocular physiology, material development and lens design, as well as clinical testing to rapidly and accurately evaluate prototypes and minimise the time to market. The CRC receives a 3% royalty stream, which it will use to fund further research.

Left: The new contact lens is the product of multidisciplinary CRC research and development, and a breakthrough in providing the high levels of oxygen needed for healthy eyes in an affordable, daily wear lens.

The Vision CRC

CRC category Medical science and technology

Core participants

Industry: Institute for Eye Research (Australia)

University: Centre for Eye Research (Australia)

Other: International Centre for Eyecare Education (Australia),
LV Prasad Eye Institute (India)



Magnet®—a new tool for pest management

INNOVATION IN APPLICATION AND USE OF RESEARCH



Australian Cotton CRC researchers have developed a new pest management tool that will reduce insecticide use and ensure the sustainability of the cotton industry.

Magnet®, the product of an 8-year project, is based on highly innovative technology that uses chemicals which can kill insects by luring them to a deposit of insecticide. Less than 2% of a field needs to be treated with insecticide when Magnet® is used. It is applied with equipment similar to that already used by farmers.

Worldwide, major losses are caused by larvae of *Helicoverpa* moths in cotton crops. The pest also affects other crops, causing losses through reduced yields and costs of control in excess of \$US2 billion annually. Australian losses are estimated at over \$A300 million annually.

Insect control represents about 35 per cent of growers' variable costs. Magnet® is not only significantly cheaper than new selective insecticides, it also avoids the major problems of human health and environmental contamination associated with broad-spectrum insecticides directed against *Helicoverpa*. Such problems, and the ability of *Helicoverpa* to develop resistance to insecticides, have even resulted in the collapse of cotton industries in parts of the world. Magnet® will be a significant component of the solution that avoids such a fate for Australia's fifth largest agricultural industry, with exports of around \$1.5 billion.

Magnet® meets a need for technologies that can be developed by Australian companies with the interests of Australian agriculture at heart, but with the potential for export markets. It is being commercialised by regionally-based company, Ag Biotech Australia Pty Ltd. Ag Biotech is 50 per cent owned by grain and cotton farmers, and 50 per cent by scientists dedicated to finding new solutions for pest management in Australian agriculture.

Key aspects of Magnet® have been patented and patent applications are now in the national phase in Australia, the USA, Europe, Brazil and India.

Left from top: 1. A *Helicoverpa armigera* moth feeding on Magnet® (the blue liquid) on a cotton leaf. A small dose of insecticide in the Magnet® soon kills the moth. 2. An aerial view of the farming landscape of the Darling Downs, where extensive field trials of Magnet® have been conducted. Many different host crops for *Helicoverpa* are planted in large fields, and moths can move extensively between these fields. 3. A larva (caterpillar) of *Helicoverpa armigera*. 4. Suction sampling on cotton to determine the impact of Magnet®. 5. The scientists most closely involved with the development of Magnet®—Dr Alice Del Socorro and Associate Professor Peter Gregg, from the University of New England—in a crop of cotton with some of the first batches of Magnet® to come from the production line of Ag Biotech Australia Pty. Ltd.

Australian Cotton CRC*

CRC category Agriculture and Rural Based Manufacturing

Core participants

Industry: Cotton Research and Development Corporation, Cotton Seed Distributors Ltd, Western Agricultural Industries, Queensland Cotton Corp Ltd

University: The University of New England, The University of Sydney

Australian Government: CSIRO

State Government: NSW Department of Primary Industries, QLD Department of Primary Industries and Fisheries, WA Department of Agriculture, NT Department of Business Industry and Resource Development

* Now Cotton Catchment Communities CRC



WINNER

Sharks help diagnose disease

INNOVATION IN APPLICATION AND USE OF RESEARCH



Wobbegong and other sharks may one day save Australian lives and reduce suffering.

As evolutionary survivors, sharks have some of the oldest adaptive immune systems in nature. The Cooperative Research Centre for Diagnostics has developed a unique 'library' of the antibodies produced by shark immune systems, for use in detecting and diagnosing a wide range of human diseases and poisons.

In the past, diagnostic tests have relied on antibodies derived mainly from mice. The CRC has established that sharks have a unique class of antibodies—known as IgNARs (for Immunoglobulin New Antigen Receptor)—that are ideal for disease diagnosis. Researchers have determined the structure of these antibodies and can now produce them entirely in the laboratory, to create highly stable new reagents.

Antibodies can be selected to detect a very wide range of targets, including chemical pollutants, toxins and pathogens. These shark antibodies may play a role as the front-end reagents for detecting toxins, pathogens, and potential biological warfare agents.

IgNARs are extremely stable and resistant to harsh treatments, such as high temperature and chemical treatments, which denature other antibodies. This makes them ideal for practical use in the field. They can be used in portable diagnostic or bio-assay devices in unforgiving surroundings such as deserts or tropical environments.

Scientists have been aware for a long time that sharks have an unusual and highly effective immune system. Understanding how it evolved enables us to know how nature solved the problem of fighting off infectious diseases. This knowledge can be applied in the smart design of the next generation of diagnostics and therapeutics.

The CRC has developed libraries of millions of different antibodies, selected to target specific disease-causing microbes or poisons. It has applied for international patents for the shark-based diagnostic reagents. The provisional patent application was filed on 2 June 2004 and it went to PCT phase on 2 June 2005.

- Left from top: 1. Spotted Wobbegong shark off the coast of NSW (Photo: Dr Rob Harcourt).
2. Wobbegongs and other sharks have some of the oldest adaptive immune systems in nature.
3. Researchers extracted small blood samples from sharks and transferred the samples to the laboratory.
4. The complex structure of a shark antibody.

CRC for Diagnostics

CRC category Medical science and technology

Core participants

Industry: Queensland Medical Laboratory

University: La Trobe University, Queensland University of Technology

Australian Government: CSIRO Molecular & Health Technologies

Other: Child Health Research Institute Inc



Traqua— swimming computer technology

INNOVATION IN APPLICATION AND USE OF RESEARCH

The Australian Institute of Sport is the testing ground for swimming metrics sensors developed by the CRC for MicroTechnology in partnership with Griffith and Swinburne universities and iWRX, an engineering enterprise. Australia's elite swimmers are already benefiting in the run-up to the 2006 Commonwealth Games and the 2008 Olympics.

To take the guesswork out of training, coaches and swimmers need to know stroke rates, lap counts, split times, turn times, stroke symmetry and body rotation. Without wearable sensors, each swimmer would need a dedicated observer, who could only record a subset of these parameters. Although a few other sports, such as cycling have long had access to some electronic performance measurement tools, creating a device for unobtrusive use in the water has been a hard task.

The CRC has now released the fourth generation model of Traqua, which records data from micro-machined, high-precision inertial sensors. Swimmers wear the device in the back of their bathing suits. After training, the data can be uploaded to a personal computer, where sophisticated software does the analysis. Training regimes can then be more closely tailored for optimal performance.

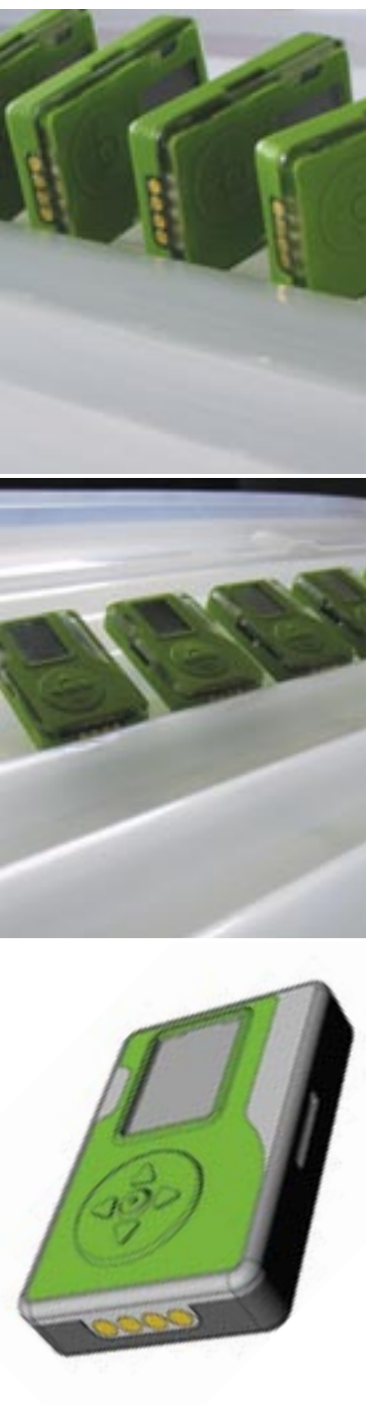
Future versions of Traqua will shrink in size but grow in capability, as the software is developed to reveal more nuanced information, such as stroke analysis.

Traqua will also find applications in other sports. The device has already been used in snow sports, such as snowboarding and mogul skiing, to give precise information about air time during jumping and turns.

Other possible non-sport applications include remote health monitoring in situations such as fall monitoring and obesity remediation, each with customised software.

Traqua has attracted considerable interest from the venture capital community as well as international sporting products manufacturers. The market for this technology is conservatively estimated at \$40 million per year, and a commercial launch of consumer product versions is likely.

Left: The Traqua technology is packaged in a miniature unobtrusive product that swimmers wear in the backs of their bathing suits.



CRC for MicroTechnology

CRC category Manufacturing Technology

Core participants

Industry: Alcatel Australia Ltd, Bioproperties (Australia) Pty Ltd, Robert Bosch Australia Pty Ltd, Cochlear Ltd, Motorola Australia Pty Limited, Cook Australia; MNT Innovations Pty Ltd.

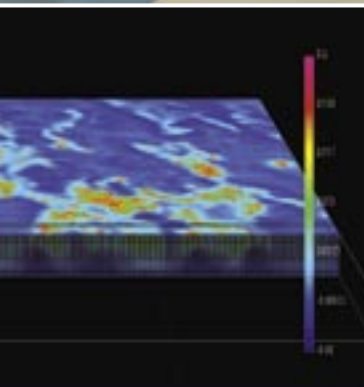
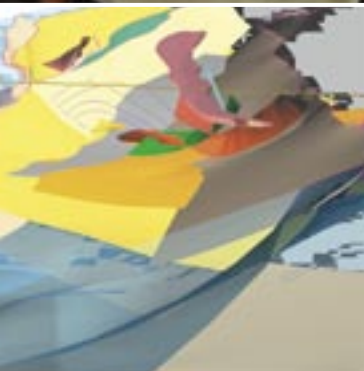
University: Griffith University, Royal Melbourne Institute of Technology, Swinburne University of Technology

Australian Government: CSIRO Manufacturing and Infrastructure Technology, Defence Material Organisation; Australian Sports Commission.

State Government: QLD Department of State Development, VIC Department of Innovation, Industry and Regional Development.



A new look at old rocks



New ideas are as precious as gold. Ironically, explorers need new ideas to find the next generation of gold deposits in Australia. Researchers at the predictive mineral discovery CRC built a large-scale three-dimensional (3-D) geological model of one of Australia's richest areas, the Eastern Goldfields of the Yilgarn Craton, to help explorers do just that—to take a new look at old rocks to stimulate new ideas about the formation of gold deposits and what factors influence their location.

The innovative 3-D geological mapping techniques developed by the pmd*^{CRC} allow explorers to view and interrogate very large, complex datasets simultaneously in new and far more effective ways. It allows them to embark on a virtual journey into the earth and look at geological elements from a different perspective.

Such an ambitious project could not succeed without significant collaboration and cooperation. The willingness of industry and government sponsors to contribute confidential data and knowledge was a significant factor in the success along with the expertise provided by researchers at the Centre's core partners, The University of Western Australia and Geoscience Australia.

The 3-D geological model is an important step forward that will lead to new predictive models for more effective exploration and discovery in the future.

Why is this important? Gold is a foundation of our economy—a major contributor to economic development and sustainability, especially in remote and regional areas—but a lack of new discoveries means gold reserves are being depleted. Providing explorers with the type of information contained in the 3-D model helps Australia attract a larger share of global exploration expenditure as a first step towards successful discovery of new gold deposits. Last financial year, gold was Australia's second largest export commodity, earning an estimated \$5.5 billion. The long-term economic growth and sustainability of the industry is dependent on rigorous, scientifically-based and successful exploration.

Left: New views of old rocks include images (2 & 4) of the Kalgoorlie-Kambalda area of the 3D map showing gold deposits (yellow spheres) and surface fault traces (red lines), and (3) a 3-D geological model.

CRC for Predictive Mineral Discovery

CRC category Mining and Energy

Core participants

Industry: AMIRA International Ltd

University: Monash University, The University of Melbourne, James Cook University, University of Western Australia

Australian Government: CSIRO EM, Geoscience Australia



Factoring biodiversity conservation into pastoral management

INNOVATION IN APPLICATION AND USE OF RESEARCH



The north Australian extensive cattle grazing industry is under pressure on two fronts: to make a profit in an increasingly competitive international beef market, and to protect biodiversity across the tropical savannas. Until now, graziers and conservationists have been suspicious of one another, but the CRC for Tropical Savannas Management has helped to bring them together in what may be the world's largest grazing–biodiversity trial.

The 'Pigeon Hole Project', initiated by Heytesbury Beef and Meat & Livestock Australia, is testing the proposition that profitable grazing operations can also protect biodiversity. Most protected conservation areas in north Australia are separated by extensive commercial pastoral holdings, so many species' fates might ultimately depend on grazing practices that protect biodiversity.

Previous accepted grazing practice has been to add watering points to spread stock across the landscape, lightening grazing pressure by dispersing it. Naturally, this reduces areas with no or little stock, and researchers have suspected that the practice results in reduced biodiversity. The Pigeon Hole Project tests this hypothesis. The project applies differing grazing regimes to a number of paddocks many square kilometres in size, and samples biodiversity at various sites within the paddocks. Establishing the experiment has required considerable investment and the input of the Victoria River District Conservation Association and the local Landcare group.

Objectively demonstrating the sustainability of both grazing and biodiversity will allow for the development of environmental management systems or other forms of environmental accreditation, bringing marketing advantages to the grazing industry.

The Tropical Savannas CRC is uniquely placed to collaborate with its partners. Over many years, the centre has funded projects that brought together pastoralists and researchers from Northern Territory, Queensland and Western Australian government agencies.

Left from top: 1. Dr Alaric Fisher, a project leader with the Tropical Savannas CRC, checks a pitfall trap with some young graziers. Alaric's project has made great progress in breaking down barriers between biodiversity researchers and pastoralists. 2. One of the (smallest) conservation areas within the Pigeon Hole project. Establishment of these areas represented a substantial additional investment in material and labour by the pastoral industry participants, and was supported by the local Landcare group. 3. A diagram showing part of the Pigeon Hole grazing trial, where different grazing treatments are applied in each paddock with a central watering point. 'Conservation areas' of four different sizes (red, yellow, bright green dark green) are embedded in the grazing trial. As well as examining the importance of having areas with no grazing, changes in biodiversity are also monitored in each grazing treatment.

CRC for Tropical Savannas Management

CRC category Environment

Core participants

Industry: Meat and Livestock Australia

University: Charles Darwin University, James Cook University, The University of Queensland

Australian Government: CSIRO NT Director of National Parks

State Government: WA Department of Conservation and Land Management, WA Department of Agriculture, North Australian Indigenous Land and Sea Management Alliance, Northern Territory of Australia, the State of Queensland



Skilled workers for the mineral industry

EDUCATION, TRAINING AND PUBLIC OUTREACH



An innovative network of researchers, industry and high school science teachers is helping to address a problem that threatens the future of the minerals processing industry, worth \$32 billion per year to the Australian economy.

In the midst of a China-led boom in demand for metal, the Australian minerals industry faces a major shortage of professional staff, an ageing workforce and falling numbers of young people choosing a career in the industry. The problem is not Australia's alone; it is a worldwide dilemma.

Fewer and fewer school students are electing to study resources-related disciplines such as extractive metallurgy, engineering, earth sciences and mining at university. Declining tertiary enrolments not only means fewer employees for the industry but also fewer students interested in research careers. This in turn jeopardises the research and technology development needed to keep the minerals industry internationally competitive.

The AJ Parker CRC for Hydrometallurgy is contributing to the national effort to attract more young people to the industry by using a unique education program that links university educators, researchers, mining companies, industry organisations and science teachers. The program is designed to attract future employees to the industry, from school to postgraduate level.

Features of the program include professional enrichment courses for postgraduate students, a summer jobs program for undergraduate students, professional development and networking opportunities for secondary science teachers, and activities for high school students.

Through the program an ever-increasing number of young people have realised that a steady supply of metals depends upon advanced science and technology, not just explosives and excavation.

The program has won wide support from the minerals industry, teachers and students at all levels. One measure of its success is the increasing number of undergraduate and postgraduate enrolments in extractive metallurgy and other resources-related courses. Over time, the program will help to generate many of the metallurgists, mining engineers and other skilled workers needed to ensure the future success of Australia's minerals industry.

Left from top: 1. High school science teachers at AngloGold Ashanti's Sunrise Dam gold mine in WA. 2. 30 postgraduate students from 6 mining and energy CRCs visit Hls melt iron plant during the 5-day Student-Industry-CRC Symposium. 3. Teaching teachers about extractive metallurgy: making a tin ingot and 4. gold plating a chemist's spatula to show students.

AJ Parker CRC for Hydrometallurgy*

CRC category Mining and Energy

Core participants

Industry: Alcan International Ltd, Alcoa World Alumina Australia, AMIRA International Ltd, AngloGold Ashanti Ltd, BHP Billiton Innovation Pty Ltd, Billiton Aluminium Australia Pty Ltd, Comalco Ltd, Newmont Australia Ltd, Queensland Alumina Ltd, Rio Tinto Research and Technology Development, WMC Resources Ltd, Zinifex Ltd.

University: Curtin University of Technology, Murdoch University, The University of Queensland

Australian Government: CSIRO

State Government: WA Department of Industry and Resources

*Now the Parker CRC for Integrated Hydrometallurgy Solutions



Training research managers

EDUCATION, TRAINING AND PUBLIC OUTREACH



PhD graduates of Australian universities have many talents, but they rarely include the highly employable skills of meeting timelines, managing staff, and understanding the management and commercialisation of intellectual property.

Research by the Grain Foods CRC found that its industry partners were dissatisfied with the graduates' broader management skills, and highlighted the need for PhD students to gain these skills while still candidates. However, the students themselves were reluctant to take the necessary time out of their research unless they received formal recognition for the work.

The CRC's solution was a new Graduate Certificate in Management designed for researchers, the only accredited program of its kind in Australia. Designed with major input from CRC Sugar Industry Innovation through Biotechnology, the program is run by external delivery through NSW's Southern Cross University. It is supported by five CRCs.

The quality of the program, the need for it, and the benefits to the CRCs taking part in it, were demonstrated by the swift response to its launch in December 2004. By January 2005 there were 50 enrolments. While the course focuses on professional development for CRC PhD students, it has also proved very popular with both CRC industry partners and non-partners. Two new CRCs have made the graduate certificate compulsory for all their PhD students.

Although Southern Cross University had long been aware of the need for such a program, it lacked the resources to mount one until the CRCs became involved. The program can be extended to a Graduate Diploma, and plans are afoot to make the Graduate Certificate available to all PhD students throughout Australia. Those who complete the Graduate Certificate receive credits for further postgraduate study at Southern Cross University.

Graduates of the program can look forward to advanced career options. In turn, CRCs and their industry partners are already reaping the benefits of employing PhD graduates with advanced skills in the management of research.

Left: The Graduate Certificate in Management is proving popular with large numbers of PhD students, CRCs, their industry partners, and others.

CRC for Innovative Grain Foods

CRC category Agriculture and Rural Based Manufacturing

Core participants

Industry: Danisco, George Weston Foods Ltd

University: Southern Cross University

Other: BRI Australia Ltd, Council of Grain Grower Organisations Ltd, Export Grains Centre Ltd, Grains Research Development Corporation, Puragrain



GenEd for schools

EDUCATION, TRAINING AND PUBLIC OUTREACH



Australia's dairy industry is big business — it is the third-largest rural industry in Australia, with a total value of \$8.5 billion, accounting for 17% of worldwide dairy product exports, and employing around 40,000 people. Australia is the world's third largest dairy exporter.

The new gene technologies offer the Australian dairy industry many opportunities to remain internationally competitive through improvements in herd productivity and creation of new high-value dairy products for the global market. These technologies range from improvements to conventional breeding (e.g genetic fingerprinting), to new genetic technologies such as genetic modification and cloning.

The potential impact of different aspects of biotechnology on agriculture has generated considerable community interest, and in the case of genetic modification (GM), some controversy. The subject has infiltrated school curricula beyond science into areas such as business studies, geography and philosophy. To create better understanding of biotechnology and how it might impact on the dairy industry, the CRC for Innovative Dairy Products identified a need for sound, easily accessible information for use by teachers, students, farmers and the general community.

Enter GenEd Web for Schools, an innovative web-based resource created by the CRC to help students and others to learn about biotechnology, and the related benefits and issues. It uses some aspects of the CRC's past and present research for the dairy industry as working examples. It encourages users to canvas the range of opinions on the new technologies and to develop their own point of view

GenEd is relevant in schools across curricula by subject and state. GenEd Web, designed for secondary students, went live in September 2004. The activity-based primary GenEd project, developed by primary teachers working with the CRC's education team, was uploaded in 2005.

Creating GenEd has been a unifying exercise for the CRC's six partner institutions. Already, GenEd is proving of considerable use to the general public, including farmers, and undergraduate students, both in Australia and overseas.

Visit GenEd Web at <<http://www.dairycrc.com>>.

From top: 1. Australia's dairy industry is big business. 2. The dairy industry provides the context for GenEd. Kylie Cane, Dairy CRC's first PhD graduate. 3. Vanessa Hall, one of Dairy CRC's first completing PhD students and a GenEd writer. 4. GenEd targets Years 5 and 6 students, and includes a primary project.

CRC for Innovative Dairy Products

CRC category Agriculture and Rural Based Manufacturing

Core participants

Industry: Australian Dairy Farmers Ltd, Dairy Australia, Genetics Australia Co-operative Ltd, ProBio Inc, Tatura Milk Industries Ltd

University: Monash University, The University of Sydney

Australian Government: CSIRO

Other: Garvan Institute of Medical Research



Industry placement program

EDUCATION, TRAINING AND PUBLIC OUTREACH



Chronic inflammatory diseases (CIDs) affect millions of people across the world, leading to untold suffering, economic loss and premature death. CIDs include rheumatoid arthritis, osteoarthritis, inflammatory lung and bowel disease, atherosclerosis and psoriasis.

CIDs are a substantial social and economic burden for the Australian community. Arthritis alone afflicts 3.4 million Australians and in 2004, cost the nation more than \$19 billion.

Despite the prevalence of these highly debilitating diseases, and intensive global research, there have been relatively few innovative breakthroughs into their cause, treatment or cure.

The CRC for Chronic Inflammatory Diseases is working with its two commercial partners—AstraZeneca, the world's fourth-largest pharmaceutical company, and Zimmer, the world leader in orthopaedics—to find novel treatments for these diseases.

However, discovering and developing drugs is a long and risky venture, taking an average of 12 to 15 years. The extremely competitive and expensive process involves multiple stages of research and development, with high rates of attrition at each stage.

To introduce its staff and students to the commercial risks and realities inherent in the business of finding new drugs, the CRC has established an industry placement program. Successful applicants spend up to three months at partner research centres in the United Kingdom, Sweden or the United States.

With greater scientific freedom, the CRC participants are able to share new ideas and innovative approaches to the discovery of novel treatments for CIDs.

In turn, with the industry experience, CRC participants return with a more strategic viewpoint that allows them to focus on results that will bring real benefits to, and new treatments for, inflammatory disease sufferers.

The sharing of knowledge through the personal relationships that develop in the industry placement program greatly facilitates the ability of the CRC's researchers to find novel treatments for diseases that impose substantial social and economic burdens on Australia.

Left: Sharing knowledge and building relationships helps program participants in their search for novel treatments for chronic inflammatory diseases.



CRC for Chronic Inflammatory Diseases

CRC category Medical Science and Technology

Core participants

Industry: AstraZeneca Australia Pty Ltd

University: The University of Melbourne, The University of Queensland, Monash University

Learn to assess river health—online

EDUCATION, TRAINING AND PUBLIC OUTREACH



Innovative online training packages are providing readily-usable technology-transfer for CRC research products.

AUSRIVAS Online, and its offshoot Watercourses Online, are giving water managers flexible and convenient access to knowledge generated by research in the CRC for Freshwater Ecology and beyond—a world first for this kind of training. The packages consist of interactive theory modules that are available entirely online and can be taken at the user's own pace. They are often combined with short face-to-face modules to teach practical skills where necessary. Participants may take any or all of the modules, depending on their needs.

AUSRIVAS—the Australian River Assessment System—comprises nationally standardised sampling protocols, prediction models and software. It was developed under the National River Health Program by the CRC for Freshwater Ecology for the Federal Government in 1994 in response to growing concern about the water quality in Australia's rivers. The AUSRIVAS Online training package prepares water agency personnel Australia-wide for accreditation as AUSRIVAS practitioners for their own states or territories.

The CRC for Freshwater Ecology has made a substantial investment in AUSRIVAS models and protocols for the analysis and reporting of river health. These are now used by state and territory water agencies and others as a fast, cost-effective way of assessing the health of rivers. The accuracy and precision of these assessments relies on the ability of field and laboratory staff to perform to a satisfactory level.

AUSRIVAS Online and Watercourses Online are the CRC's response to an identified need for flexible and efficient training in river assessment, as well as in natural resources management and ecological education.

The CRC's state and territory government partner agencies were among those involved in identifying training needs and devising training and accreditation criteria. The packages themselves were developed, and are delivered via the University of Canberra, with funding from the Natural Heritage Trust. They will continue to be offered through the eWater CRC.

Left from top: 1. Collecting macroinvertebrates using standardised AUSRIVAS sampling methods (Photo: Andrew Tatnell). 2. Accurate assessments rely on the ability of field and laboratory staff (Photo: Andrew Tatnell). 3. A variety of macroinvertebrates (these are insect larvae) found in a 'healthy' river (Photo: Frank Coffa). 4. The Watercourses homepage <<http://freshwater.canberra.edu.au/WatercoursesOnline.nsf>> (Artwork: Bullseye Graphics). 5. Course participants learn online, at their own computer.

CRC for Freshwater Ecology*

CRC category Environment

Core participants

Industry: Melbourne Water, Goulburn-Murray Water, Lower Murray Urban and Rural Water Authority, ACTEW Corporation Ltd

University: University of Canberra, Monash University, Griffith University, La Trobe University, The University of Adelaide

Australian Government: Murray-Darling Basin Commission, CSIRO Land and Water

State Government: QLD Department of Natural Resources and Mines, VIC Department of Sustainability and Environment, NSW Department of Infrastructure Planning and Natural Resources, Environment ACT, Environment Protection Authority (VIC), Sydney Catchment Authority, NSW Department of Environment and Conservation, SA Department of Water, Land and Biodiversity Conservation

* Now eWater CRC



WormBoss CD and website

EDUCATION, TRAINING AND PUBLIC OUTREACH



Parasitic worms cost Australia's sheep graziers hundreds of millions of dollars every year. Farmers fight the parasites with drenches, but the worms fight back by evolving resistance. The next generation of super-effective agents might be five years away, so we have to use existing drenches with precision to get the maximum effect.

Until now, farmers have had to rely on fragmented and scattered sources of information. After fifty years of field tests and local experiments, no-one had pulled all the information together in a form that working graziers could use. Choosing the right drench, the right time and the right schedule for dosing remained work for specialists.

The Australian Sheep Industry CRC mustered the experts from state agricultural departments (all CRC members) and from Australia's leading stock and station agents and agricultural chemical suppliers. Drawing on a national network of scientists and other consultants, the CRC developed WormBoss, a CD–website combination that organises the data and allows the farmer to generate a tailored report. The website <<http://www.wormboss.com.au/>> can be updated to keep the product up to date, but not all areas or all farmers have broadband internet access, so the CD was essential.

Users don't even need to type in information—every possible choice is covered in drop-down menus. Select the state, region, class of sheep, level of worm burden, drench resistance status and the climate outlook, and the 'Ask the boss' interactive feature of WormBoss produces not only a recommended plan, but alternatives. Sometimes it would be a mistake to drench, so WormBoss flags unexpected observations and directs the user to expert advice.

Australia's drench merchandisers are on board, and are also distributing the product. If a sheep grazer lacks a computer, the local agent can enter the information and generate a plan of action suitable for any region and any type of sheep.

Left: WormBoss is designed to help Australian sheep farmers select the best worm management options for their situation. The product is available both as a web site and a CD.

Australian Sheep Industry CRC

CRC category Agriculture and Rural Based Manufacturing

Core participants

Industry: Australian Meat Processor Corporation Pty Ltd

University: The University of New England

Australian Government: CSIRO

State Government: WA Department of Agriculture, NSW Department of Primary Industries, QLD Department of Primary Industries and Fisheries



The right recipe for property management

EDUCATION, TRAINING AND PUBLIC OUTREACH

Few areas are as sensitive to poor farming practices as the coastal zone, where catchment run-off meets the sea, and no other Australian coast is as delicate as Queensland's.

In their quest to make agriculture not only profitable but sustainable, Queensland farmers undertake planning for land and water management, vegetation management, soil conservation and pest control, along with industry sector programs. The Queensland Government has worked to reduce this complexity, but planning at the property level to meet the often conflicting requirements of various catchment stakeholders and still make a profit can be a bewildering task.

The Coastal Zone CRC has stepped in to broker a new framework for management at property level. The centre's Property Level Management System (PLMS) has drawn together the state's major government, industry, natural resource management, environmental and community players to work out an outcomes-based framework that farmers can use. Previous attempts, based on single industries, regions or agencies, have not worked for many farmers.

The PLMS has a large outreach component that includes not just workshops and education, but also pilot studies at the property level. The program's hallmarks are flexibility and interactivity.

Natural resource management bodies have gained a better understanding of the importance of property level management planning, and are now incorporating PLMS principles in regional plans. The work also ties in with the work of the Queensland Farmers' Federation, one of the main participants in the project. State and national agencies, through partnerships with the CRC, have also contributed, allowing the Centre to head off potential conflicts.

The CRC's role has been that of an honest broker, backed by substantial previous research and a reputation for bringing consensus out of conflict. The potential benefits of the work reach from the top of catchments to the Great Barrier Reef.

Left: Queensland farmers are being encouraged to diversify their land uses using PLMS. (Photo acknowledgements from top: 1&2. Tweed River estuary. 3. NSW Department of Natural Resources. 4. Queensland Department of Natural Resources and Mines.)

CRC for Coastal Zone, Estuary and Waterway

CRC category Environment

Core participants

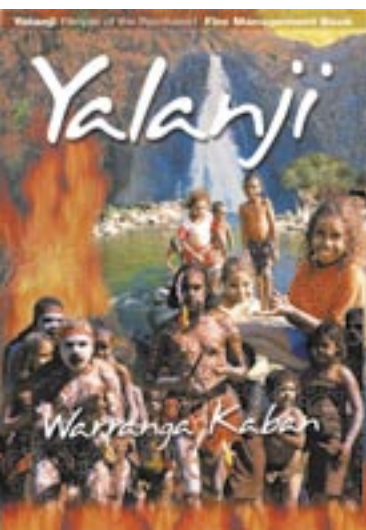
University: The University of Queensland, Central Queensland University, Griffith University, James Cook University, Curtin University of Technology, University of Western Australia

Australian Government: CSIRO, Geoscience Australia, Defence Science and Technology Organisation

State Government: QLD Department of Natural Resources, and Mines, QLD Department of Primary Industries and Fisheries, QLD Environmental Protection Agency



Traditional fire management



EDUCATION, TRAINING AND PUBLIC OUTREACH

Traditional peoples, land managers and scientists will benefit from a unique publication that has evolved from collaborative research between the Rainforest CRC and Yalanji Traditional Owners.

The book, *Yalanji Warranga Kaban: Yalanji People of the Rainforest Fire Management Book*, explores traditional natural resource management in the Wet Tropics World Heritage Area, and transfers oral history into written words, both in English and—for the first time in a major publication—in Yalanji language.

Fire management in the Wet Tropics is a current resource management issue of growing relevance. Yalanji people have provided invaluable insight into their traditional knowledge and approaches that will support sustainable rainforest management and make a significant contribution to future generations.

The knowledge about traditional culture and practices recorded in the book is a testament to cultural survival, and a valuable resource for teaching young people about their language and their country.

Yalanji Warranga Kaban is the first book written together with Aboriginal Traditional Owners on Aboriginal traditional fire management, a long overdue achievement given the comprehensive body of ecological and other literature about this subject.

The project was supported by the Natural Heritage Trust, Cape York Land Council, Wujal Wujal Community Council, Bamanga Bubu Ngadimunku, the Australian Conservation Foundation, James Cook University, and publisher Little Ramsay Press.

One of the key innovations responsible for the successful partnership was the governance of the publishing process by a Yalanji Management Committee established by the Traditional Owners. This ensured that process and content were culturally appropriate. The book was distributed to all Yalanji families and financial gains from its sale are returned to the Yalanji People for language, cultural and land management projects.

Across the world there has been little advance in the 'access and benefit sharing from biodiversity for Indigenous communities' as called for in the Convention on Biological Diversity. This book is a shining example of what can be achieved through collaboration and mutual respect.

Left from top: 1. The Yalanji Fire Management Book. 2. Agnes Burchill sharing stories with the children. 3. Eileen Walker, Leah Talbot and principal researcher Dr Rosemary Hill conduct field work. 4. Management Committee members (from left): Edward Barney, Roy Gibson, Raymond Buchanan, Rosemary Hill, Kathleen Walker, Steven Nowakowski, Leah Talbot, Marilyn Wallace, Francis Walker, Doreen Ball and Eileen Walker. Bottom: Edward Barney and Roy Gibson observe a fire. (All photos and images by Steven Nowakowski)

CRC for Tropical Rainforest Ecology and Management

CRC category Environment

Core participants

Industry: Alliance for Sustainable Tourism, Queensland Tourism Industry Corporation

University: James Cook University, The University of Queensland, Griffith University

Australian Government: Aboriginal and Torres Strait Islander Commission, Environmental Protection Agency, CSIRO Tropical Forest Research Centre

Other: QLD Department of Natural Resources and Mines, QLD Department of Primary Industries (Forestry), Queensland Parks and Wildlife Service, Wet Tropics Management Authority



WINNER





**Carrie
Newbold**

PHD STUDENT PRESENTATION WINNER

More power for 'bionic ears'

People with cochlear implants ('bionic ears') must replace the batteries every day. The high rate of power consumption is caused by tissue growth around the implanted electrodes. This protective sheath, the body's natural defence against the 'foreign object', impedes current flow from the electrodes to the hearing nerves, thus increasing the need for power.

Carrie Newbold has been working to understand how this tissue growth affects power use. She has developed an in vitro model to explore the effects of electrical stimulation on the electrode–cell bio-environment and to test next-generation electrode arrays and stimulus protocols.

Currently, Ms Newbold's research is doubling the battery life of bionic ears. In due course, she hopes that reducing power requirements could make smaller, fully implantable devices possible. This would have a far-reaching effect on device design and market growth.

More than 60,000 people worldwide have bionic ears designed and manufactured in Australia.

CRC: CRC for Cochlear Implant and Hearing Aid Innovation



**Sreeraj
Balachandran**

PHD STUDENT PRESENTATION

'Natural' ginger extraction

Herbal compounds in ginger produce benefits such as pain killers, anti-nausea drugs, and aphrodisiacs. However, extracting the compounds requires the use of environmentally hazardous organic solvents that leave behind a toxic residue.

Working in collaboration with Food Science Australia and The University of Melbourne, Sreeraj Balachandran has developed a new extraction technique. Based on 'green chemistry', it uses less energy, generates less waste as by-products, and leads to products that can be recycled in a natural product chain. By treating the ginger with compressed carbon dioxide—an eco-friendly solvent—there is no residue and the potency of the substances are retained.

Mr Balachandran is investigating whether the technique can be sustained for larger-scale operations, an important question given that Australia is the world's second biggest ginger processor and a US\$40 billion market for ginger.

CRC: CRC for Bioproducts

Renewable hydrogen energy



David Pointing

PHD STUDENT PRESENTATION

Each year, millions of litres of energy-supplying diesel are transported to Antarctica to power stations like Mawson. This is both environmentally risky and expensive—cleaner and cheaper energy systems are needed.

Hydrogen energy technology relies on wind being trapped in turbines and converted and stored as hydrogen, an excellent energy source. David Pointing has successfully designed such a storage facility, and three of these turbines are being installed at Mawson. In operation, they will reduce diesel consumption by approximately 75%—about 450,000 litres of diesel each year. The stored hydrogen will be used when there is insufficient wind to generate energy.

With the cost of diesel increasing by as much as 10% per annum, and the damaging effects of fossil fuels, Mr Pointing's research could also benefit the large percentage of Australians living in other remote areas and beyond. It has generated interest in places as far away as Norway.

CRC: CRC for Antarctic Climate and Ecosystems

Allergy-free grass



Natasha Petrovska

PHD STUDENT PRESENTATION

Genetically modified ryegrass could soon be providing welcome relief for Australia's 1.8 million hay-fever sufferers. The only remedies currently available to them include drugs like antihistamines, or immunotherapy. Avoidance is usually the best treatment.

Scientists from Melbourne's LaTrobe University have genetically modified the ryegrass variety that is the main cause of hay fever in Australia and Europe. Natasha Petrovska's PhD has focused on silencing the genes responsible for producing the grass pollen allergens that cause hay-fever symptoms. Removing the gene altogether was not possible because it could have had an important function in the plant.

The allergy-free ryegrasses have been included in field trials in the USA and so far, the tests have been successful. The plants will be available for commercial sale in about five years, and it is hoped they will be widely used in lawns, parks and pastures to ease the misery of hay-fever sufferers.

CRC: CRC for Molecular Plant Breeding

Keeping trains safe and on time

PHD STUDENT PRESENTATION



Amie Albrecht

The traditional way of creating train timetables and track maintenance schedules can be slow and laborious, involving many hand-written drafts before the results are keyed into a computer. Rescheduling for delays or maintenance can be equally inefficient and costly.

Better use of the rail corridor will allow rail operators to provide more flexible services that can compete with road transport, while allotting time for track maintenance.

A new train scheduling system, Schedulemiser, takes minutes to generate thousands of alternative timetables and track maintenance schedules, which are then evaluated against wide-ranging criteria including cost effectiveness and train lateness. The system incorporates software and mathematical techniques devised by Amie Albrecht, a University of South Australia postgraduate student working for the Rail CRC.

Schedulemiser is being commercialised by TMG International, trialled by Queensland Rail, and is already being used to schedule trains for a mineral ore railway and to plan new routes for the Australian Rail Track Corporation.

CRC: CRC for Railway Engineering and Technologies

Hidden link between asthma and obesity

PHD STUDENT PRESENTATION



Bennett Shum

Asthma is a major burden on our quality of life, costing Australia an estimated at \$600 billion a year.

The discovery of a new asthma gene is providing scientific leads into linkages between asthma and obesity, and has implications for the control and treatment of asthma and its symptoms.

Working at the Garvan Institute of Medical Research, Bennett Shum has discovered that the gene *ap2*, previously thought to be exclusive to fat cells, is highly active in asthma sufferers. In collaboration with Professor Gokhan Hotamisligil of Harvard University School of Public Health, Mr Shum found that genetically modified mice that had no *ap2* gene present were almost totally protected from asthma.

Mr Shum plans to continue working on whether *ap2* is a key molecular link between obesity and asthma. He hopes the research may eventually result in improved asthma treatment. His work is being published in the Journal of Clinical Investigations.

CRC: CRC for Asthma

Rock oysters as water quality barometers



**Russell
Richards**

PHD STUDENT PRESENTATION

Oysters are important barometers of water quality in our coastal ports and waterways. One oyster filters 50 litres of water a day, incidentally accumulating trace metals, particularly copper.

Russell Richards, a Coastal CRC doctoral student at the University of Queensland, has found that rock oysters not only accumulate concentrations of trace metals suspended in seawater, they do so at different rates depending on local conditions.

Modelling the complex relationships between oysters and their environment at the Port of Brisbane, Mr Richards discovered that the presence of algae plays a major role in accelerating the oysters' accumulation of copper, a contaminant often found in estuaries and ports.

His model provides valuable information about managing the effects of high copper concentrations, whether natural or human generated, and highlights the significance of algal blooms in introducing copper to the food chain. This will improve the accuracy and widen the applicability of monitoring processes.

CRC: CRC for Coastal Zone, Estuary and Waterway Management

Choosing the sex of lambs



Simon deGraaf

PHD STUDENT PRESENTATION

Sex-sorted ram sperm currently has a reduced level of fertility that is not commercially acceptable.

Simon de Graaf, working in conjunction with XY Inc., has compared sex-sorted and non sex-sorted ram sperm, shedding light on potential differences in the mechanism of sperm transport, its ability to fertilise the egg, and its overall fertility.

A modified flow cytometer sorts sperm into those bearing an X chromosome and those bearing a Y chromosome, based on their difference in DNA content. This enables the use of X sperm or Y sperm to produce either female or male offspring respectively.

The ability to screen sperm and pre-determine the sex of sheep offspring through artificial insemination or IVF embryo transfer could help sheep breeders to maximise their profits by, for example, increasing the percentage of rams produced from genetically superior flocks, or producing superior female lines faster than previously possible.

CRC: Australian Sheep Industry CRC

CRC Association Members

Manufacturing Technology

CRC Advanced Composite Structures

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CRC for Functional Communication Surfaces

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CRC for Microtechnology

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CRC for Polymers

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CRC for Railway Engineering & Technologies

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CRC for Welded Structures

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CRC for Wood Innovations

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Information & Communication Technology

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CRC for Integrated Engineering Asset Management (CIEAM)

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CRC for Sensor Signal & Information Processing

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CRC for Smart Internet Technologies

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CRC for Spatial Information

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CRC for Technology Enabled Capital Markets

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Mining and Energy

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CRC for Greenhouse Gas Technologies

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CRC Landscape Environments & Mineral Exploration

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CRCMining

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CRC for Predictive Mineral Discovery

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CRC for Sustainable Resource Processing

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Agriculture and Rural Based Manufacturing

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CRC for Australian Sheep Industry

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CRC for Cattle & Beef Quality

(Now CRC for Beef Genetic Technologies)
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CRC for Sustainable Production Forestry

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CRC for Innovative Dairy Products

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CRC for Molecular Plant Breeding

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Agriculture and Rural Based Manufacturing (continued)

CRC for Sugar Industry Innovation through Biotechnology

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CRC for Sustainable Aquaculture of Fin Fish

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CRC for Tropical Plant Protection

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CRC for Viticulture

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CRC for Bushfire

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