

SUBMISSION



Submission to the Review of Australian Higher Education



The CRC Association

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To the Review of Australian Higher Education

Submitted by

THE COOPERATIVE RESEARCH CENTRES ASSOCIATION INC.

16 June 2008

1. INTRODUCTION

The Cooperative Research Centres Association Inc. (CRCA) welcomes the review of Australian Higher Education. This submission is focused on addressing Question 5 of the Discussion Paper, viz:

“Are there particular examples of good practice where you can demonstrate either rapid response to skill shortages or successful initiatives to improve generic skills?”

The CRC Program is an excellent example of a Government initiative that has spun-out serendipitous results, in this case addressing skills shortages in the science and technology arena through the training of “industry ready” PhD graduates, and the development of programs throughout the Australian education system which train, inspire and teach the coming generations of Australian innovators.

2. THE CRC ASSOCIATION

The CRCA is the representative body for the organisations operating within the Australian Government’s Cooperative Research Centres (CRC) Program. The purpose of the CRCA is to promote science in general, with a particular focus on the future growth of the CRC Program.

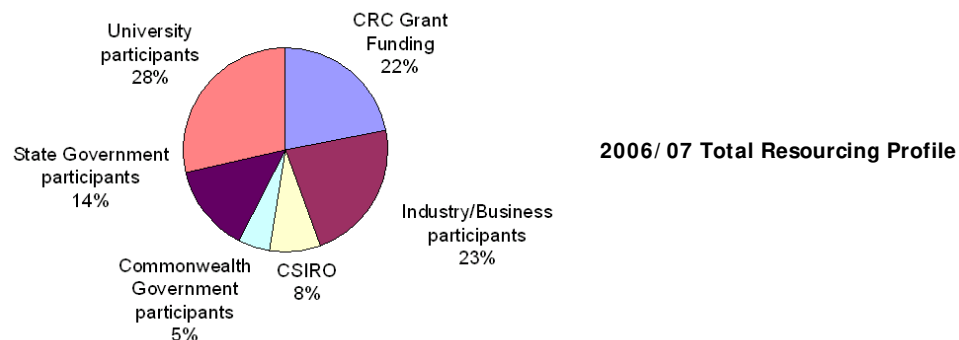
The CRCA is an independent body, funded by fees paid through voluntary membership. The CRCA Constitution states that only bodies classified as “Cooperative Research Centres” by the Australian Government are eligible to be members of the CRCA. The current membership comprises all 58 CRCs.

3. THE CRC PROGRAM

The CRC Program was established in 1990 by the Hawke Government with the aim of changing the culture of industry to shift from looking to specific short term problem solving research, to taking a longer term, strategic approach to investment in research.¹ Over the course of its 18 year existence the CRC Program has met that aim and improved the effectiveness of Australia’s research effort through bringing together researchers in the public and private sectors with the end users. The CRC Program links researchers with industry and government with a focus towards research application. The close interaction between researchers and the end users is the defining characteristic of the Program. Moreover, it allows end users to help plan the direction of the research as well as to monitor its progress.

Since the commencement of the Program, there have been ten CRC selection rounds, resulting in the establishment of 168 CRCs over the life of the Program that have operated across Manufacturing, ICT, Mining & Energy, Agriculture & Rural Based Manufacturing, Environment, and Medical Science & Technology sectors.

Reflecting its broad areas of activity, the CRC Program draws funding and in-kind resources from a wide range of sources. Displayed below is the resourcing profile for CRCs in 2006-07.



¹ Myers, Rupert. *Changing Research Culture, Australia - 1995*. Report of the CRC Programme Evaluation Steering Committee, Aust Gov’t Publishing Service, Jul 1995.

3.1 THE PERFORMANCE OF THE CRC PROGRAM

The conventional definition of a CRC is “a company formed through a collaboration of businesses and researchers. This includes private sector organisations (both large and small enterprises), industry associations, universities and government research agencies such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and other end users. This team of collaborators undertakes research and development leading to utilitarian outcomes for public good that have positive social and economic impacts.”² However this definition only tells a part of the story. As the Program has grown and matured, further benefits have emerged, including:

- CRCs assemble multidisciplinary teams from across research providers to address end user driven research. They collaborate across all sectors (Industry, Academia, State Government, Consumers and Industry Associations) and create a critical mass in their field.
- CRCs provide companies, including multinationals, with the unique and attractive proposition of being able to deal through one organisation (the CRC) that can assemble the best teams in the Australia to develop the technology that the company needs, managing the process professionally to deliverables and gearing it with funds from the Commonwealth and research providers who are sharing the risks, and the returns.
- CRCs are managed to deliver impacts not just papers, and are held to account to deliver.
- The stability of funding provides certainty for the research partners in particular and also for the end-user partners.
- The overall activities are actively managed by the CRC management team and Board to maximise the national benefits. This includes terminating, redirecting or accelerating projects in a way that is not part of the culture of most other programs.
- CRCs provide a mechanism for realising unanticipated commercial opportunities, i.e. in cases where technologies have applications beyond the interests of the commercial partners, the CRC can pursue these through the creation of spin off companies, licenses etc.
- CRCs play an important role in bridging the gap between discovery research funded by NHMRC and ARC grants and the requirements of industry for commercialisation-ready innovations.
- CRCs encourage innovation through their interaction and reach with SMEs (for example, the CRC for Spatial Information interacts directly with over 55 SMEs).
- A CRC is neutral and un-aligned and so can provide a central focus from which grows collaboration.
- CRCs provide research management skills and discipline. This helps ensure the research is managed to a high standard.
- CRCs foster “hands-on” learning. Although they are heavily focused on postgraduate education, and thereby providing training for very highly skilled professionals, CRCs are involved, to differing extents, at all levels of the education and training system.

In the 2006 study on the economic impacts of the CRC Program commissioned by the Australian Government³, fifty examples were included of economically quantifiable beneficial applications of CRC research. In these solid, quantified examples, only the clearly measurable components of the outcomes were included in the calculation of the net economic impact of the Program. Looking only at these clearly quantifiable impacts, the study showed that as a result of each dollar invested in the CRC Program,

² www.crc.gov.au

³ https://www.crc.gov.au/HTMLDocuments/Documents/PDF/CRC_Economic_Impact_Study_Final_121006.pdf

Australian Gross Domestic Product is cumulatively \$1.16 higher than it would otherwise have been (had the money instead been used for tax reductions) and Total Consumption is cumulatively \$1.24 higher than it would otherwise have been (had the money instead been used for tax reductions). It is important to note that Gross Domestic Product and Total Consumption are two critical indicators of the economic welfare of the Australian community rather than being measures of the private returns to CRC participants.

Since its inception the CRC Program has been regularly and meticulously reviewed. The success of the Program has been recognised not only within Australia but also internationally as the CRC Program has been researched, emulated and even copied by a number of other nations.

4. TRAINING INNOVATORS THROUGH CRCs

Innovation is a process rather than an outcome. It is about curiosity and commitment. Innovation requires the freedom to think and explore, and innovation requires a resource of attuned minds; people who are prepared to experiment and take calculated risks (i.e. “innovators”).

4.1 THE INFLUENCE OF THE CRC PROGRAM

CRCs are becoming increasingly recognised as a breeding ground for Australia’s innovators. This recognition is largely attributable to work undertaken by the CRCA which investigated the impact that the CRC Program has had on all levels of the Australian education system. Every CRC is required to be associated with at least one University and incorporate a PhD program within its core activities. However the CRCA research identified that most CRCs have gone beyond that brief and have developed education programs aimed at other levels of the education system, from pre-school through the post-doc and beyond.

The CRCA produced and distributed a factsheet identifying specific examples of CRC activity at each level of the education system, which includes:

- Primary School
- Secondary School
- TAFE / VET
- Undergraduate
- Postgraduate
- Teachers
- Vocational Training
- General community.

The factsheet is presented in Appendix A. The initiatives described are evidence that the CRC Program is a Government Program working toward addressing skills shortages, not only by training workers but also by providing the environment that encourages children to consider a future in science.

Furthermore, Appendix B provides an article from the 25 February 2008 edition of the Australian Financial Review describing some CRC initiatives aimed at the VET sector.

Appendix C provides a media release from the CRC for Sustainable Resource Processing describing its “Science in the Classroom” program aimed at school teachers which was recently awarded the CRCA Award for Excellence in Education.

4.1.1 THE CRC PhD

Currently there are 58 CRCs in existence, and through those CRCs there are around 1500 PhDs at various levels of completion. The major feature of the PhDs undertaken through CRCs is that the candidates undertake their study in liaison with the partners of the CRC. This means that through their study the students are exposed directly to the needs and idiosyncrasies of industry and emerge with the classification of being “industry ready”.

This view is supported by a wealth of anecdotal evidence, not only from industry but also from the students themselves. Appendix D provides an article from the 21 April edition of the Australian Financial Review showcasing a number of past CRC PhD student in a “where are the now” feature. The testimonials therein show that these researchers all view the CRC experience as integral to their successful careers.

Empirical evidence is also being collected to back up these claims. An interdisciplinary group of researchers from The University of Queensland and Griffith University have been funded through a 3 year ARC Linkage Project to examine the impact that the industry and educational opportunities provided through the CRC program have had on the PhD experience and outcomes of candidates. With the assistance of the CRCA, the researchers are in the process of contacting PhD graduates from CRCs who were awarded/submitted/graduated in the years 1996-1999 and 2001-2004 inclusive. Graduates from the same time periods who did not have involvement with a CRC during their candidature will also be included in the study. This study will build upon a smaller project conducted in 2005 which surveyed a much smaller set of past PhD students.

4.1.2 THE eGRAD CERTIFICATE

An important factor differentiating CRC PhDs from non-CRC PhDs is the exposure to and understanding of issues regarding commercialisation and research management. The exposure to industry gives CRC students hands-on experience and understanding of the issues in a “real world” environment. To build on that capacity, the CRCA is now working closely with the Australian Technology Network of Universities to develop and deliver a Graduate Certificate in Research Commercialisation. The Certificate has been developed specifically to meet the career needs of researchers and postgraduate students in CRCs and has been shaped in line with priorities developed by the CRCA.

The course provides skills, knowledge and accreditation in research commercialisation and in the associated areas of research project management, leadership and workplace communication and principles and practice of research management.

The Graduate Certificate is offered jointly by the five course providers (Curtin University of Technology, Queensland University of Technology, RMIT University, University of South Australia, and University of Technology Sydney.) Students enroll through the ATN university of their choice. The first group of students will enter the course in Semester 2, 2008.

Further detail on this course is provided in Appendix E.

CONCLUSION

Innovation occurs when good ideas are allowed to become reality. But innovation does not happen all by itself. To have innovation, we first need to have innovators, i.e. the people who get those good ideas and can transform them into reality

CRCs are recognised as the home of industry-focused innovation and increasingly now are being also recognised as a breeding ground for Australia’s innovators – PhDs who are “industry ready”; school teachers who understand the innovation occurring in industry today; and children who are allowed to be excited by the opportunities that abound within and innovation nation.

CRCs are working examples of good practice where rapid response to skill shortages or successful initiatives to improve generic skills are demonstrated.

LIST OF APPENDICES

Appendix A –

CRCA Factsheet : The Impact of Cooperative Research Centres on the Australian Education System

Appendix B –

Article : Australian Financial Review 25 February 2008

Appendix C –

Media Release : CRC for Sustainable Resource Planning, 22 May 2008

Appendix D –

Article : Australian Financial Review 21 April 2008

Appendix E –

Brochure. Graduate Certificate in Research Commercialisation.

APPENDIX A

The Impact of COOPERATIVE RESEARCH CENTRES *on the* AUSTRALIAN EDUCATION SYSTEM

Innovation occurs when good ideas become reality. But innovation does not happen all by itself. To have innovation, we first need to have innovators, ie: the people who get those good ideas and can transform them into reality.



Cooperative Research Centres (CRCs) are recognised as the home of industry-focussed innovation and there has been a lot of attention given to the great innovations that the CRCs have been responsible for. Yet the role of CRCs in the creation of the all-important innovators is often neglected and unrecognised.



This paper has been compiled by the CRC Association to identify just a few living examples where CRCs are having an impact in the entire Australian education system: not just at the PhD level, but from Primary Schooling right through to university and beyond.

As this paper clearly shows, CRCs are not only the home of Australian innovation; they are also the breeding ground of Australia's innovators.

For further information about Cooperative Research Centres and the CRC Programme please contact:

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The CRC Programme
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Web: www.crc.gov.au

PRIMARY SCHOOL

- In 2008 the *CRC for National Plant Biosecurity* commences an education program for students up to Yr4 and also for students in Yrs 5 to 10, to raise the profile of plant biosecurity in Australia. A pre-primary level activity is also being developed. The program is expected to reach over 1000 students in its first year. www.crplantbiosecurity.com.au
- The *CRC for Innovative Dairy Products* provides an online resource for primary schools that asks and answers the questions “what are genes, why are they important and how can we use our knowledge of them?” www.dairycrc.com
- The *CRC for Australian Weed Management* has produced the “Ghastly Guests” resource for Yr4 to Yr6 students. It is currently used in more than 300 classrooms across Australia. www.weeds.crc.org.au
- The *Cotton Catchment Communities CRC* has partnered with Primary Science Matters and provided science kits and training for teachers in primary schools in Northern NSW. web.cotton.crc.org.au

SECONDARY SCHOOL

- In partnership with the Australian Centre for Plant Functional Genomics, the *Molecular Plant Breeding CRC* has developed “Get into Genes”, an interactive program highlighting the role of gene technology in agriculture. Over 5000 students and teachers in SA and Vic have participated in the program. www.getintogenes.com.au
- Since 2004 the *CRC for Sugar Industry Innovation through Biotechnology*, via its PhD students, has run an annual ‘plant biotechnology for beginners’ workshop. Over 520 Yr10 and Yr11 students have participated in the events to date. www.crcsugar.com
- The *CRC for Australian Weed Management* has designed the “Lord of the Weeds” competition where secondary school students work on a weed project and submit a report for judging. A prize pool of \$4700 is offered. Since 2004 over 700 school classes have participated. www.weeds.crc.org.au

TAFE/VET

- The *CAST CRC* developed the educational content for a TAFE Engineering Production Certificate aimed specifically at the aluminium and magnesium casting industry. CAST also prepared and delivered a Light Metals Technology Course for TAFE teachers. www.cast.org.au
- The *CRC for Advanced Composite Structures*, together with the industry association Composites Australia, has developed a pre-vocational training program to provide a new influx of workers to a local composites industry desperately short of trained staff. Working together with local TAFE’s and Job Networks, to date 31 people from the target group of long-term unemployed have undertaken the training and are being transitioned into the workforce. www.compositesaustralia.com.au
- The *Invasive Animals CRC* is preparing a series of subjects addressing skill sets not currently available for managers of pest animals. These subjects will form the core of a Diploma in Conservation and Land Management to be awarded through the VET system and will be trialled in 2008. www.invasiveanimals.com

UNDERGRADUATE

- The *CRC for the Australian Poultry Industries* has sponsored the establishment of two undergraduate units at the University of New England. These units will soon also be available online. The CRC also has Honours scholarships for students in Australian universities conducting research into poultry related areas. www.poultrycrc.com.au
- The *CRC Wood Innovations* has developed an Advanced Diploma in Wood Products Management, sponsored by the CRC and taught at the University of Melbourne. 15 students will have completed the course by the conclusion of the CRCs term. www.crcwood.unimelb.edu.au
- The *CRC for Biomedical Imaging Development* supports summer cadetship programs through LaTrobe University; provides lecturers for undergraduate courses at RMIT; and supports medical honours projects through the University of Melbourne and Peter MacCallum Cancer Institute.
- The *Bushfire CRC, the Tropical Savannas CRC*, CSIRO and Charles Darwin University collaborated to develop the online university course 'Fire Ecology & Management in Northern Australia'. The course tackles a wide range of complex ecological, social, political and historical aspects of fire management across northern Australia and won the prestigious National ASCILITE Award for Educational Design & Technology in Tertiary Education in 2005. www.edu.edu.au
- The *Parker CRC for Integrated Hydrometallurgy Solutions* runs a Student-Industry Research Program that provides a research experience for local and international undergraduate students for 10 weeks over their summer university vacation. www.parkercentre.com.au

POSTGRADUATE

- Postgraduate training is a key component of the CRC Programme. Each year the CRC Programme supports some 2000 researchers and educates more than 1000 PhD students (over 1600 full-time equivalent PhD students in 2005-06), with over 150 students graduating annually since 1991 (216 students graduated in 2005-06) and this number is set to increase.
- The new *Capital Markets CRC* is supported by industry partners, security exchanges, and regulators in Australia, the UK, Singapore, Hong Kong, Scandinavia, and North America. As a consequence of this international expansion, this CRC's PhD program will more than double from 70 to over 140 students. www.cmrc.com
- *RailCRC* are addressing the world wide shortage of Railway Signal Engineers through the development of Post Graduate Courses in Railway Signal Engineering offered by Central Queensland University. Certificate, Graduate Diploma and Masters Degree courses are also available. The qualification has been recognised by the UK-based Institute of Railway Signal Engineers. www.railcrc.cqu.edu.au
- *Grainfoods CRC* has sponsored an accredited 4 unit Graduate Certificate of Research Management, awarded through Southern Cross University. The course is now in its third year and has proved popular with PhD students and staff of participants of CRCs, as well as external organisations. www.grainfoodscrc.com.au
- The *Cotton Catchment Communities CRC* runs a cotton production course for industry personnel as an external course through The University of New England. The course involves four study units, and takes two years to complete. About 130 people have completed the course to date. web.cotton.crc.org.au

TEACHERS

- The *Centre for Sustainable Resource Processing CRC (CSRP)* provides a Teacher Program that gives school teachers the experience of hands-on activities in the minerals sector and is designed to foster an appreciation for the practical application of real-world problems to school curriculum.
- CSRP has partnered with Murdoch University to offer a series of one-day educational events for secondary science teachers. These events enhance teacher attitudes towards the mineral processing industry. Over 300 school teachers have participated to date. www.csrp.com.au

VOCATIONAL TRAINING

- The *CRC for Cochlear Implant and Hearing Aid Innovation*, in collaboration with staff of The Department of Otolaryngology, University of Melbourne, The Cochlear Implant Clinic, The Royal Victorian Eye and Ear Hospital, The Bionic Ear Institute and Cochlear Limited conducts four and five day cochlear implant professional training workshops for surgeons and clinicians from Australia and Asia Pacific regions. The workshops are run three times per year and since inception have trained over 2800 attendees. www.hearworks.com.au
- The *CRC for Contamination Assessment and Remediation of the Environment*, in collaboration with the Australian Contaminated Land Consultants Association and its industry partners is running a short-term training program about site assessment and remediation for recent graduates and industry managers. In two years CRC CARE has trained 250 industry environmental managers via 7 workshops. www.crccare.com
- *CRC Landscape Environments and Mineral Exploration*, *CRC for Predictive Mineral Discovery*, *Parker CRC for Integrated Hydrometallurgy Solutions*, and *CRC Mining* (in partnership with the Minerals Council of Australia and the Minerals Tertiary Education Council) are all involved in the provision of professional vocational training covering all aspects of the Mining sector 'Value Chain'.
- The *CRC for Spatial Information* has encouraged and supported industry and end user staff engagement on projects and activities. Today, the perceived remote sectors of industry, government and academia in the spatial information community are now much closer as the unique CRC structure has allowed each sector to better understand each others drivers and culture. www.crcsi.com.au
- The *CRC for Plant Based Management of Dryland Salinity* has developed and delivered accredited salinity management training throughout rural NSW, SA and Vic. In three years more than 700 staff in the Landmark agribusiness company, and about 900 landholders, state agency and catchment management organisation staff have attended 67 workshops over 120 training days. www.crcsalinity.com

COMMUNITY

- The *CRC for Advanced Automotive Technology* is supporting a Rovers (Scouting) initiative to convert standard vehicles to electric vehicles to compete at the Victorian Mudbash event. This exercise aims to increase public knowledge and understanding of the environmental impact of transport choices and to raise awareness of new technologies for more sustainable use of energy for transport. www.AutoCRC.com
- *Molecular Plant Breeding CRC*, in partnership with the Australian Centre for Plant Functional Genomics has a range of activities for enabling community decision-making on the role of gene technology in agriculture. More than 30,000 people have extracted DNA from food at community events across Australia. www.acpfg.com.au
- The *CRC for Construction Innovation*, in partnership with the Australian Sustainable Built Environment Council and the Department of the Environment and Water Resources through the Australian Greenhouse Office, will be launching the web portal www.yourbuilding.org, an actively updated knowledge bank about the ownership, design, construction, occupation, and operation of sustainable commercial buildings. This development supplements the already-established www.yourhome.gov.au and www.yourdevelopment.org portals. www.construction-innovation.info
- The "Take Care With Contacts" campaign for safe contact lens use followed the major microbial keratitis study conducted by the *Vision CRC* and the Institute for Eye Research, with excellent media coverage highlighting the importance of lens hygiene and prompt care, and the establishment of a website to provide information for the public and practitioners. www.visioncrc.org

OTHER

- The *Centre for Sustainable Resource Processing CRC* is researching the motivating factors that entice people to choose research careers within the mineral resource sector. A questionnaire has been developed and validated with an initial sample of 240 scientists within the minerals and energy sector. www.csrp.com.au
- The *CRC for Sugar Industry Innovation through Biotechnology* is funding several research projects to understand how to better educate the community, industry and students. www.crcsugar.com

APPENDIX B

FINANCIAL REVIEW
EDUCATION

February 25, 2008

Edited by: rleihan@afrc.com.au

www.afrc.com



CRCs partner VET sector
Erica Cervini Page 33

Michael
Hartmann

The Australian Financial Review
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CRCs expand operations to build skills

Erica Cervini

Co-operative Research Centres are branching out from dealing only with universities to forge links with vocational institutes in a bid to ease skill shortages and to establish career paths for technicians.

The federal government set up the CRC program in 1990 to strengthen research links between industry and educational institutions. Since then a key role for CRCs has been to produce PhD students.

The chief executive officer of the CRC Association, Michael Hartmann, said CRCs offered the vocational education and training sector access to the latest technological developments, for example in metal alloy technology, to ensure industry needs were met.

"They [CRCs] have the technology and skills that your normal VET trainers might not have access to and particularly at the leading edge," Mr Hartmann said.

The manager of technology transfer and education for the Cast CRC, which focuses research on metal technology, Michael Lee, said that having workers with the latest skills was important for manufacturing companies to compete globally.

"There are a lot of skills you need to be good in the industry and we need more people with a lot of skills to be able to compete internationally," Mr Lee said.

"We're actually casting more metal now than we were 10 years ago."

The light metal, die casting, smelting and foundry industries, from which liquid metals are used mainly for car parts, generated more than \$7 billion worth of sales annually. But small firms, in particular, were facing skills shortages, Mr Lee said.

A new production engineering certificate, aimed at the aluminium and magnesium casting industry, and developed by the Cast CRC with the support of Swinburne University's TAFE division and Comalcom, has been successfully trialled.

Mr Lee said the long-term goal was for school leavers to do the

certificate and then perhaps work in smaller companies.

The bulk of companies in the composites industry was also small, and needed trained shop-floor technicians, the education manager of the CRC for Advanced Composite Structures, Michael Bannister, said.

"Their [small companies'] primary need is for trained people who can help grow the company by making more things," he said.

To help achieve this, the CRC and industry body Composites Australia, are co-funding an education and employment officer to tackle the current skills shortage in the industry.

"A lot of what we've been doing with Composites Australia is to identify how to create composite technicians as a career option, so that a person going into TAFE can specifically move into that as a career," Dr Bannister said.

Skills are taught across a range of TAFE certificates, but the aim is to introduce a national qualification

We need more people with a lot of skills to be able to compete.

Michael Lee, Cast CRC

that focuses on the composites industry and has particular application to the aerospace, defence and maritime sectors.

New VET units, developed by the Invasive Animals CRC, also aim to teach skills that are absent from courses, the CRC's education program leader, Stephen Sarre, said.

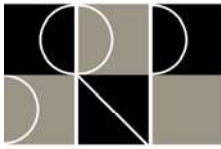
The six units being trialled are part of the diplomas of conservation and land management delivered by the VET-registered University of Canberra College.

Dr Sarre said the units would help managers think strategically about feral animal control.

The units will be offered online so managers around the country have easy access to course materials. There will also be three residential workshops.

There are 56 CRCs in operation.

APPENDIX C



Media Release 22 May 2008

New resource for teachers wins award

Cooperative Research Centre (CRC) Awards

Science in the classroom has traditionally been concerned with textbooks and the periodic table as opposed to the real world of work. However, a new program launched by the **Centre for Sustainable Resource Processing (CSRP)** and **Murdoch University Extractive Metallurgy** is changing that perception with an education outreach program to show physical science teachers employment possibilities for their students.

Currently 600 teachers have elected to be part of the initiative, and it has been so successful that it has been **awarded a major prize for Innovation in Education and Training** by the Cooperative Research Centres Association of Australia (CRCA).

This scheme, known as “Sustainable Researchers: CSRP School Teacher Professional Development Program”, recognises teachers’ influence over their students. Through professional development workshops, after-school programs and technical site tours, it shows where science students might work in the future. There is widespread recognition that fewer young Australians choose careers in the minerals sector despite it being the country’s largest export earner. However, through the CSRP Teacher Program, students, through their teachers, can be shown the relevance of the enabling sciences.

A review of existing programs around Australia reveals that while many universities and companies have education outreach programs, most of these are aimed at students. This new approach is different because it targets teachers, and as it is delivered through a CRC, there is no suspicion of unwanted influences from industry. To date, it is estimated that 100,000 students are benefiting from this improved teacher training program.

The program began in the Perth metropolitan area five years ago with full-day “Chemistry and Physics of Extractive Metallurgy” workshops offered for school science teachers on the Murdoch campus during term breaks. A follow-up “advanced” course was offered. Additionally, a series of one-hour talks for school students were developed and offered along with several 90-minute after school workshops to schools and teachers in regional areas including Geraldton and Bunbury.

In 2005 the program was extended to regional Queensland (Gladstone, Townsville, Cairns, Toowoomba and Charters Towers) and in 2008 to Victoria (Geelong and Ballarat).

An ongoing doctoral study shows this program has led to an increase in teachers’ overall knowledge of the industry and provided a framework in which they can effectively network with scientists. Other results showed teachers’ willingness to provide career information to students and to use the mining and mineral industry as examples in class. It is anticipated that by year end, more than 750 teachers will have attended one or more CSRP Teacher Program events.

CRCA represents 58 Cooperative Research Centres (CRCs) which specialise in a broad range of sciences, technologies and industries. The hub of applied research in Australia, CRCs aim to increase collaboration between researchers and industry and better promote the uptake and use of research. Since its establishment in 1990s the CRC Program has led the world in cooperative innovation.

For information regarding the CSRP Teacher Program contact Dan Churach, Education Manager of the Centre for Sustainable Resource Processing on 08 6436 8735 or dan.churach@csrp.com.au

APPENDIX D

Products of smart applications of intelligence and industry

A key role of the federal government's Co-operative Research Centres is to produce PhD graduates. Rachel Leblhan talks to seven, and an honours student who received CRC funding, about how the centres helped their careers.

Gregg Suaning

Gregg Suaning worked at Cochlear when he had the idea to create a vision prosthesis, or bionic eye, for the blind. He left the company soon after to undertake a PhD in the area, which he even contemplated self-funding.

The CRC for Eye and Research Technology, now the Vision CRC, came to his rescue and funded his work, much of which was carried out at UNSW, where Suaning is now an associate professor.

"It was a little bit speculative, but certainly it's their charter to do that pie-in-the-sky research," Suaning says of the CRC.

His research involved making a nerve stimulator that would sit on the retina and stimulate surviving nerves in the eye, to cure or to treat various forms of blindness. Similar to a Cochlear implant, the device would stimulate nerve cells with tiny electrical impulses.

"I got a career out of it, basically," Suaning says of working with the CRC.

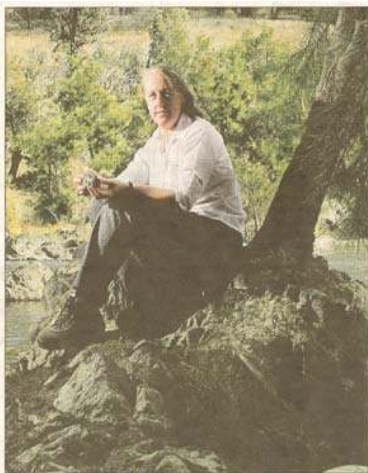
"I established a proof-of-principle that the device would work. I didn't get so far as the human trial I was hoping to have during my PhD, but I established more than anyone else in the country had at that time."

Suaning says one of the major benefits of securing CRC support for his PhD was the resources it gave him access to. "Part of the CRC charter is to become self-funded and this was a potential commercial endeavour so they had resources to pay for patents etc.," he explains.

"But it also provided a wonderful source of experience in one spot you would be unlikely to find elsewhere."

"The ultimate goal is to put it into humans, we're getting closer and closer to that," he says.

"But as far as people walking around with them, that's a few years off."



Networking, links to industry and a sufficiency of resources are among the attractions of CRCs as a route to a PhD cited by (clockwise from main picture) Fiona Dyer, Brendan Cowled, Hannah Hueneke, Cherie van Wensveen and Ashely Roberts-Thomson.



PHOTOS: ANDREW MENZIES, GLEN MACCARTHY, GLEN HUNT, CHRIS JOHNSON

Fiona Dyer

Fiona Dyer received a top-up scholarship from the CRC for Catchment Hydrology to begin her PhD in 1998.

Her work focused on looking at ways of tracing sediment in waterways, and was based on a reservoir in West Gippsland that was experiencing algal blooms to ascertain if it was a consequence of sediment input.

She completed her PhD in 3½ years, and while her plan had always been to stay in academia, after moving to country Victoria and having children she started her own consulting business.

She has been working in Canberra for an international engineering company Earth Tech for the past two years, where she is the business-line leader for the waterways group, which is currently working on a major river restoration

project for the Murrumbidgee catchment management authority. While she doesn't dismiss the idea of returning to academia at some point, for now, "The nature of consulting suits me. I like the problem solving aspect of it."

"It suits my style and the nature of the CRC, having those industry links, means that many of the PhDs and the work that comes out of them are very much directed at helping people solve larger problems," she says.

Dyer fully credits the CRC with getting her to where she is today. For a start it gave her the opportunity to undertake an applied PhD that was expensive to complete.

"It gave me access to the facilities at the CRC that you would struggle to get otherwise," she says.

"It also gave me a range of contacts, by working with CRC researchers as well as university researchers, that you just miss out on when you do a straight university PhD."

Ashely Roberts-Thomson

Ashely Roberts-Thomson is living his dream. Aged 27, he's the living reef manager at Daydream Island Resort and Spa and says he draws on his experience as a PhD student at the Seafood CRC every day.

The basis of his PhD, which he started in 2003, was working out how to manage Velvet disease that causes millions of dollars of damage in aquaculture production. He has just made the final corrections to his thesis.

"It's something I'd always wanted to do, work at a large aquarium, and a PhD gave me a bit of leapfrog over lots of other positions I might have had to do to get to be a manager in one of them," Roberts-Thomson says.

"I'm dealing with fish health problems and that's something my PhD taught me lots about."

He cites the extra training the CRC gave him as a key point.

"I did all sorts of courses with them, media skills, presentation training... that aren't normally on offer for PhD students," he says.

Another benefit of working with a CRC was the networking opportunities that opened up for him, as were the opportunities to travel to overseas and national conferences to present his research.

"Life here is pretty good. It's an opportunity to get out of the lab a bit and use my skills directly, rather than doing background research."

While he doesn't knock the idea of going back to research one day: "For the time being I can't think of anywhere else I'd rather be," he says.

Jennifer Lowe

After a stint unemployed following last year's federal election, prior to which she was an adviser to former



A mix of expertise and collaboration benefited Jennifer Lowe (top left), Gregg Suaning (top right) and Phil Crothers.

environmental minister Julie Bishop, Jennifer Lowe is working in business development for engineering services firm Ausenco, and still draws on the skills she learnt as a CRC PhD student.

Lowe undertook her PhD in chemistry and crystallisation at the AJ Parker CRC for Hydrometallurgy, now known as the Parker CRC for Integrated Hydrometallurgy Solutions.

"The attraction for me was that the centre was spread across a number of universities for one, and also had people with industry involved, so there were lots of opportunities to utilise equipment and harness the expertise of people from other areas," Lowe says.

Being able to draw on the ability she picked up at the CRC to bridge the gap between industry and the academic environment, Lowe says, has helped in her current role, which is a far broader focus than previous jobs.

Hannah Hueneke

"I'm loving living in Alice," Hannah Hueneke says of the

lifestyle change that has taken her to the Red Centre. It's been her home since starting as a research officer at CSIRO Sustainable Ecosystems six months ago.

She is researching how activities in the area can be designed and managed to get health and well-being outcomes, as well as environmental outcomes.

It's not her first working stint in Alice Springs. As part of her honours degree, which focused on why people climb Uluru, the CRC for Desert Knowledge funded a field trip to Uluru so she could complete vital on-ground surveys.

"I'm interested in how Aboriginal land management and Aboriginal ownership of land, particularly in relation to joint management of parks... can work best with tourism and the wider Australian interest in spending time in national parks," she explains.

Her work led to a stint working for Parks Australia, the federal parks management agency that manages Uluru and Kakadu, some tutoring at ANU, and several months in the indigenous policy branch of the Department of Environment and Water Resources.

While Hueneke says her ANU supervisor would have found the money "from somewhere" to fund her field trip, "I wouldn't have had the extra things, like going to a student workshop on methodology and going to the symposium."

The CRC supported her attendance at the 2006 Desert Knowledge Symposium in Alice Springs.

"I met my current boss while I was at that symposium, so that was very valuable," she says. "It helped me to keep a connection with Alice Springs, which is hard to do if you are a student."

Brendan Cowled

Few people can claim their area of speciality to be feral pigs, but Brendan Cowled can.

Cowled is an epidemiologist in the Office of the Chief Veterinary Officer in the Department of Agriculture, Fisheries and Forestry where he's been working for the last six months on equine flu management.

His PhD, which he recently completed through the Invasive Animals CRC, focused on planning for disease outbreaks in feral pigs.

"Feral pigs can spread foot and mouth to livestock," Cowled explains. "It hasn't happened in

Australia, but I'm interested in whether they would be involved, and if they are what the best plan of attack would be."

Cowled, who was a vet for about five years prior to his postgraduate studies, says having a PhD certainly gave him a foot in the door of epidemiology — the management of disease in wildlife and how that interacts with livestock.

Undertaking his PhD at a CRC meant he could conduct his research with good funding in a short space of time. He completed his PhD in three years, the first 2½ of which he undertook full-time.

The centre had crucial links with industry, which provided him with opportunities to take on private consulting work that supplemented his income during his PhD, and allowed him to network with those in his fields of interest.

Cherie van Wensveen

Cherie van Wensveen's career has gone in a different direction than she anticipated it would when she embarked on a PhD with the support of the AJ Parker CRC in 2001.

Van Wensveen was working with the extractive metallurgy group at Murdoch University when she received a top-up scholarship from the centre to help fund her PhD in hydrometallurgy — the extraction of valuable or base metals from ores using water-based processes.

"At that stage I was probably intending to go into the mining industry or academia," she confesses.

What transpired was a role as a patent and trade marks attorney, specialising in chemistry and minerals processing, where she handles lots of intellectual property issues for mining companies.

While it wasn't what she had set out to do with her career, van Wensveen says she had a little exposure to intellectual property through her PhD and her time at the CRC left her well equipped for the role.

Having to maintain contact with the CRC during her PhD and collaborating on biannual reports for companies involved in the centre, meant she picked up many of the skills required to liaise with industry.

She believes her PhD played a "very strong influencing factor" on being offered the job.

"I think a lot of people like the idea of someone having a PhD," she

says. "It's not going to rule you out if you don't have one, but I think people like the fact that you've shown you can work for yourself, but that work also involves collaboration with a team."

While the bulk of her experimental work was completed at the beginning of 2004, she has yet to finish her PhD, which clashed with having to get another qualification for her job.

"It's very close to the end, although I have been saying that for about three years now," she says with a loud laugh.

"It's a lot harder to juggle it than I thought it would be."

Phil Crothers

Phil Crothers says his employment with Boeing is a direct result of the PhD he undertook with RMIT University and the CRC for Advanced Composites in 1997.

"I was selected by RMIT as a prospect. The CRC let me do work experience with them and they then took on my project as a part of their work statement. I drove the project but it was compatible with their aims," he says.

His PhD topic comprised developing techniques of fibre placement to allow for reinforcement along the load directions, or the principal stress directions, in parts or components. "It was directly from my PhD that Hawker de Havilland (owned by Boeing) took me on as one of their first trained researchers."

He was seconded back to the CRC for four years, during which time his major research focus became the automated manufacture of composite structures.

With the success of this research, HfH recruited other trained researchers and an outcome of that research is the control surfaces, which control the direction an aircraft flies, on the wing of the 787 Dreamliner.

He describes the CRC as having "a very rich, friendly, collaborative atmosphere."

"You do something different every day and you are right on the leading edge of developments in this form of technology."

Crothers now heads up the automation division at Boeing's recently launched advanced research and development unit, Phantom Works, where he's working on transforming industrial robotics to aerospace standard.

APPENDIX E



Graduate Certificate in Research Commercialisation



MEMO

to CRC Researchers

Do you want to build advanced skills in applying your research in the workplace and develop leadership capacity? If so, you will be pleased to know that the CRC Association in partnership with the Australian Technology Network's e-Grad School is offering the Graduate Certificate in Research Commercialisation to CRC researchers.

Postgraduate training is a key component of the CRC Program and we encourage you to take a moment to look at what the Graduate Certificate has to offer.

Michael Hartmann
Chief Executive Officer CRC Association

Rod Wissler
Director, e-Grad School (Australia)

The Graduate Certificate in Research Commercialisation meets the career needs of researchers and postgraduate students in Cooperative Research Centres. It has been shaped in line with priorities developed by the Cooperative Research Centres Association.

The course provides skills, knowledge and accreditation in research commercialisation and in the associated areas of research project management, leadership and workplace communication and principles and practice of research management.

Offered jointly by the five course providers:

Curtin University of Technology,
Queensland University of Technology,
RMIT University,
University of South Australia,
University of Technology Sydney.

Enrolment at the ATN university of your choice.



The Graduate Certificate in Research Commercialisation is

- one of a number of e-Grad School resources currently used in 13 Australian universities
- endorsed by the Cooperative Research Centres Association

Key features of the course

- 100 per cent online
- Opportunity to interact with students all around Australia
- Flexible learning
- Moderators actively practising in business and industry
- Face-to-face orientation
- Articulation possible to masters courses

How much does it cost?

Fee per unit in 2008 is

- \$2200 (for domestic students)
- \$3300 (for international students)
- Course fees of students receiving Commercialisation Training Scheme (CTS) scholarships would normally be covered by their CTS scholarship. Your CRC can provide advice regarding funding support mechanisms.

How does it work?

Each unit is online, facilitated by expert moderators for 13 weeks, with discussions, readings, and activities around the topic.

To receive the award of the Graduate Certificate, CRC researchers are required to complete four of the units:

Knowledge Transfer and Research Commercialisation

- Intellectual property protection and commercialisation
- Knowledge transfer through services
- Contractual considerations
- Strategies for advice and funding
- Business planning

Leadership and Workplace Communication

- Models and concepts of leadership
- Managing research teams
- Stakeholder engagement
- Effective communication

Project Management for Research

- Project management processes
- Balancing quality, time and cost
- Project life cycle and scheduling tools
- Financial and risk management
- Reporting

Principles and Practice of Research Management

- Selecting the right research—needs, opportunities and strategy
- Issues in multi-partner research collaboration
- Commercial and public good drivers
- Managing the research funding process

Students may enrol for the full Graduate Certificate or alternatively may undertake single units to complement offerings available to them at their home universities.

What assessment is there?

Summative and formative assessment that includes forum and personal journal contributions, short answer tests at regular intervals and a workplace-related assignment.

Student Feedback

Course

... the Graduate Certificate in Research Commercialisation added a unique dimension to my educational background, which was advantageous when competing for a research position. ...it developed my understanding of research structures, priorities and outcomes ...

QUT graduate, 2007

Knowledge Transfer and Research Commercialisation

Flexibility for sure. I was overseas for four weeks and I could keep up with the unit which was fantastic. Because the material was online I could access everything and read it in my own time.

University of Melbourne student, 2007

Project Management for Research

Teaching was great. So well planned and very clear from the onset. Appropriate and relevant. Structure and weekly announcements that actually appeared as if someone was 'out there'

UTS student, 2007

Additional testimonials available on eGSA website.

For course enquiries please contact:

e-Grad School Coordinator:

Email: egsacoordinator@qut.edu.au

Phone: +61 7 3138 4422

Website: www.egradschool.edu.au