



2017 – 2018 Pre-budget Submission

January 2017

The Cooperative Research Centres Association represents all Australian Cooperative Research Centres (CRCs). In addition, the Association has universities, companies and research groups as Affiliate and Associate Members.

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## Executive Summary

The Cooperative Research Centres (CRC) Programme is a significant part of the government's ambitious innovation agenda. Successive reviews and studies have demonstrated the impact of the CRC Programme, including its positive impact on Australia's Gross Domestic Product.

The government recognises that Australia must lift collaboration between industry and academia to improve our innovation performance and competitiveness. The CRC Programme is acknowledged around the world as one of the most successful means of achieving deep industrial collaboration.

The Turnbull Government has embraced the CRC Programme, expanding it to CRC-Projects (CRC-Ps) in 2016, which have proved exceptionally attractive to industry. Consultations currently underway have invited comment on priorities for the CRC Programme with a view to widening the scope for CRCs to address issues of national benefit.

The expansion of the scope and ambition for the CRC Programme has been widely welcomed by industry. However, this expansion has not been supported with additional funds for the programme, which have reduced in real terms.

The performance of the CRC Programme and the government's increasing reliance on it as a major source of collaboration warrant a substantial boost to the programme's budget.

The CRC Association submits that the total resources to the CRC Programme should be lifted to \$200 million in the 2017-2018 Budget (from the current \$160 million) and maintained in real terms over the forward estimates. The total cost over the next three years is \$108 million. This would partially restore the CRC Programme budget and enable the programme to continue to deliver for Australia.

## Background

In this submission, the CRC Association argues that the 2016 expansion of the CRC Programme, Australia's desperate need for greater industry-research collaboration and a decade-long budget decline, warrant increasing the CRC Programme budget from its current level, to \$200 million per annum and maintaining that level over forward estimates.

The CRC Programme is one of the most successful government innovation programmes in the world. It is also one of the most studied programmes, documenting an extraordinary level of performance. See Appendix A for a list of recent studies and reviews of the programme and Appendix C for a list of some CRC achievements from 2016.

## CRC-Projects take off in 2016

The most significant change in the 25-year history of the CRC Programme occurred in 2016 with the introduction of CRC-Projects (CRC-Ps). CRC-Ps were designed to enable smaller but still significant industry-research collaborations.

CRC-Ps proved extremely popular with industry. Ninety-one applications were received in the first round, with eleven being funded or partially funded, attracting \$51.8 million of collaborator investment to the government's \$22.6 million. At the time of writing, the second CRC-P funding round is underway and during calendar year 2017, a further three rounds are scheduled. Appendix B shows the outcomes for the first round.

The popularity of the CRC-Ps is due to the non-complex design, timelines of funding rounds, and simple application and contracting arrangements.

However, the low funding success rate of CRC-Ps in the first round is a cause of serious concern. Only 11 of the 91 applications were funded - the resulting 12% funding success rate is below the 17% and 18% funding success rates of the National Health and Medical Research Council and the Australian Research Council respectively, in 2016. More importantly, companies applying for CRC-Ps have well under half the funding success rates of the ARC Industry Linkage Programme, which had funding success rates of 35.5% in 2015 and 31.1% in 2016.

Given that the government wishes to encourage more Australian companies to collaborate with public research organisations, it is important that the CRC-Ps remain competitive with other programmes.

CRC-Ps are company/industry-led and research organisations cannot be the lead applicant for a CRC-P. However, research organisations invest in CRC-Ps and if the funding gap continues to open up between the CRC-Ps and others, they will naturally favour programmes that have a higher funding success rate. In other words, industry (which is favouring CRC-Ps) could be denied access to some of Australia's top research talent.

- *The CRC Programme is one of the most successful in the world but funding has declined over 10 years.*
- *CRC-Projects commenced in 2016.*
- *Industry embraced CRC-Ps due to a less complex design and simplified procedures.*
- *The funding success rate for CRC-Ps is below comparable programs.*
- *Research organisations will favour programmes with higher funding rates if CRC-Ps are made too hard to get.*

## Cooperative Research Centres work for Australia

The CRC Programme continues to perform extraordinarily well. The design of CRCs is unique among Australia's R&D programmes in that it provides sufficient time, flexibility, and direction to achieve significant impacts.

The 7-10 year life of CRCs (and longer under previous guidelines) means that an intensity of effort can be placed on achieving an outcome. Many Australian researchers report spending up to 30% of their time seeking grant funding when it is given out in short-term projects. Researchers in CRCs are able to direct that time to actual research.

The large Commonwealth grant confers flexibility to follow successful work with additional investment within a CRC structure. This is a major advantage - CRCs run as companies with a mission to achieve major impacts, rather than a series of stop-and-start projects.

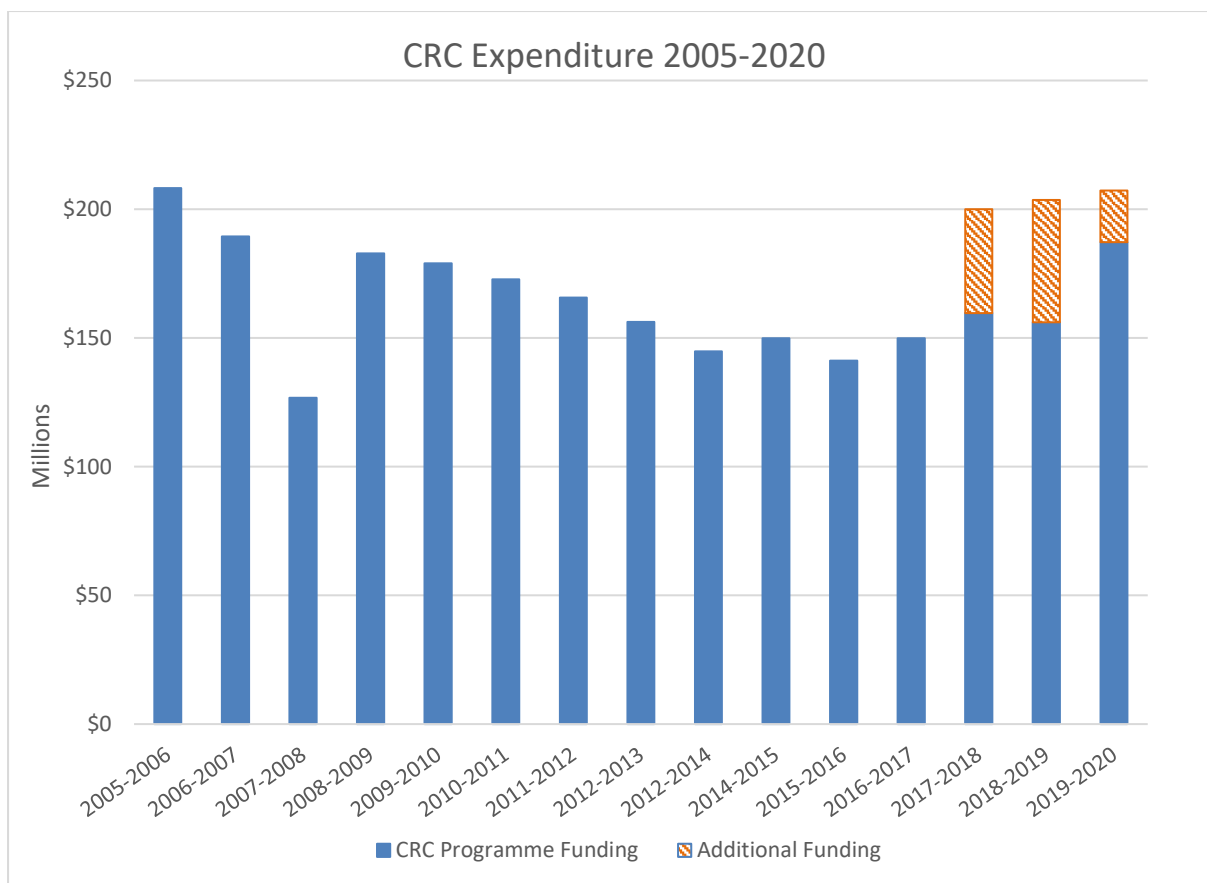
Governance of CRCs is via a skills-based corporate Board. This brings a degree of focus that is a major factor for research success. All developed countries have programmes seeking to bring together public R&D with business needs. The performance of the CRC Programme is considered amongst the very best. Appendix C lists some highlights of CRC performance in 2016.

## Partial restoration of the CRC Programme budget

The CRC Association submits that the government should restore support for the CRC Programme over the course of the forward estimates. The cost to the budget is shown in the table below.

	2017-18 (\$M)	2018-19 (\$M)	2019-20 (\$M)
<b>Current CRC Programme commitment</b>	159,651	156,095	187,217
<b>Suggested CRC Programme commitment</b>	200,000	203,600	207,265
<b>Additional Funding</b>	40.3	47.5	20.0

The total cost over the forward estimates is \$108 million, with the cost in 2017-2018 being \$40.3 million. The partial restoration of the CRC Programme, combined with the other policy measures suggested in this submission, would be sufficient to stimulate renewed interest for major industry-research collaborations.



## Payoff for Australia

The partial restoration of the CRC Programme budget to levels closer to those supported during the Howard Government will encourage industry and research confidence to continue their strong support for the CRC Programme.

The National Innovation and Science Agenda set Australia on a new path. The CRC Programme will continue to make a major contribution but realistically, needs increased budget support. The government can invest in the CRC Programme with great confidence that it delivers for the Australian community. Each dollar the government invests is immediately boosted by more than \$3 of co-investment by CRC participants.

The Allen Consulting group has consistently shown that GDP is significantly higher than it would have been had the CRC funds gone to general government expenditure (Appendix A, 2005 and 2012 study). Few, if any, government programmes are so well documented in fulfilling their mission.

Implementation of the outcomes of the most recent CRC Programme Review (Miles, 2015) began in 2016. The CRC-Projects (CRC-Ps) have captured the attention of industry and proved enormously popular. A boosted CRC Programme budget will ensure a funding success rate that will keep industry engaged.

## References

Australian Research Council, 2016. <http://www.arc.gov.au/selection-report-linkage-projects-2016> accessed 5 January 2017.

## Appendix A: Recent Studies of the CRC Programme

Review/Study	Year	Main finding(s)
Howard Partners	2003	Found that three types of CRC had emerged: (1) those delivering National benefits, generally through repair and replenishment of Australia's natural capital; (2) those delivering collective industry benefits and (3) those delivering commercial benefits through new businesses.
Allen Consulting Group	2005	Modelling over the 1992 to 2010 period suggested that the overall performance of Australia's economy had been considerably enhanced when compared to the performance that would otherwise have occurred in the absence of the Commonwealth Government's investment that was provided for the Round 1-7 CRCs between 1992 and 2005
Allen Consulting Group	2012	<p>Almost \$14.5 billion of direct economic impacts are estimated to have accrued from CRC produced technologies, products and processes. This includes \$8.6 billion of impacts already materialised from 1991 to 2012 and a further \$5.9 billion of imminent impacts estimated to occur over the next five years.</p> <p>It was estimated that the program generated a net benefit to the economy of \$7.5 billion over this period, or around 0.03 percentage points of additional GDP growth. Relative to the funds committed to the CRC program by the Australian Government, the CRC program has generated a net economic benefit to the community that has exceeded its costs by a factor of 3.1.</p>
Miles Review	2015	Four recommendations came out of the Miles Review: (1) Putting greater emphasis on industry "front and centre"; (2) Introduction of a new CRC-Projects model; (3) Focus and alignment of CRCs with Industry Growth Centres; and (4) Improving efficiency and red tape reduction.

## Appendix B

The 11 successful projects (of 91 submitted) in the first round of CRC-Projects in 2016. Applicants will provide \$2.25 of matching investment to each \$1.00 of Government investment.

<b>Project Title</b>	<b>Participants (first organisation is the lead participant)</b>
The future integrated driver monitoring solution for heavy vehicles	Seeing Machines Limited Monash University Ron Finemore Transport Services Pty Ltd
Hydrocarbon fuel technology for hypersonic air-breathing vehicles	DefendTex Pty Ltd Royal Melbourne Institute of Technology The University of Queensland Commonwealth Department of Defence Teakle Composites Universität der Bundeswehr
Printed solar films for value-added building products for Australia	Solafast Pty Ltd Norwood Industries Pty Ltd CSIRO
Translational R&D to accelerate sustainable omega-3 production	Qponics Limited Nutrition Care Pharmaceuticals Pty Ltd The University of Queensland
CRC-P for Innovative Prefabricated Building Systems	Speedpanel Australia Ltd Speedpanel International Ltd The University of Melbourne
An antibody based in vitro diagnostic for metastatic cancer	Chemocopeia Pty Ltd Innoviron Pty Ltd 360 Biolabs Pty Ltd CSIRO
High performance optical telemetry system for ocean monitoring	Zedelef Pty Ltd The University of New South Wales Thales Underwater Systems Pty Ltd
Combined carbon capture from flue gas streams and mineral carbonation	Orica Limited Mineral Carbonation International Pty Ltd The University of Newcastle Greenmag Group Pty Limited
Strengthening Australia's radiopharmaceutical development capabilities	Clarity Pharmaceuticals Pty Ltd Phebra Pty Ltd The University of Queensland



<p>Innovation in advanced multi-storey housing manufacture</p>	<p>Lendlease Development Pty Limited  University of Sydney  Lendlease Timber Solutions Pty Ltd  Keesteel Engineering (Aust) Pty Ltd</p>
<p>Future Oysters CRC-P</p>	<p>Australian Seafood Industries Pty Limited  Select Oyster Company Pty Ltd  Oysters Australia Ltd  South Australian Department of Primary Industries and Regions  Fisheries Research &amp; Development Corp  University of Tasmania  University of the Sunshine Coast  Macquarie University  NSW Department of Industry, Skills and Regional Development  The Flinders University of South Australia  The University of Newcastle  The University of Adelaide  CSIRO  University of Technology Sydney  The Yield Technology Solutions Pty Ltd</p>

## Appendix C – A sample of 2016 CRC outcomes

The following list is a snapshot of CRC achievement from 2016. It is not intended as a comprehensive list of all CRC achievements from 2016.

### Deep Exploration Technology CRC

- Revolutionary coiled tubing drill rig, RoXplorer®, launched. RoXplorer® will drill at 1/6th cost of conventional drilling and address the challenge of falling discovery rates for mineral deposits in Australia and will also deliver safety and environmental benefits.

### Cancer Therapeutics CRC

- In one of the largest Australian preclinical deals the Cancer Therapeutics CRC licensed a program of small molecule drugs, called PRMT5 inhibitors, for the treatment of cancer and blood disorders to USA-headquartered pharmaceutical giant Merck in January 2016. The deal terms included a signature payment of more than \$21 million and potential future payments of more than \$750 million. A minimum of 70% of all payments comes back to the Australian partnership and the partners reinvested more than \$8 million of the initial payment back into the drug discovery and development activities of the CRC.

### Capital Markets CRC

- Using monies from the sale of the technology SMARTS, Capital Markets CRC established the first CRC investment fund (Capital Markets Technologies), and have used the first \$15m in funding to invest in three start-up companies bringing transparency (and ultimately fairness and efficiency) to the mortgage markets ([www.dealmax.com.au](http://www.dealmax.com.au)), café and restaurant markets ([www.ordermentum.com](http://www.ordermentum.com)) and the building management marketplace ([www.cimenviron.com](http://www.cimenviron.com)).
- Set up [www.digi.cash](http://www.digi.cash) which has introduced a new digital currency to the world marketplace. Beyond digitising cash, the technology is able to digitise any asset and enable a financial marketplace (with instantaneous settlement) to be facilitated using a mobile device.
- Through spin-off company Lorichealth ([www.loricahealth.com](http://www.loricahealth.com)) Capital Market CRC introduced Negotiator (a new software tool) to the Australian marketplace. This software which streamlines negotiations between public health payers and hospital provider groups with an acknowledged return on investment (by its first public sector user) of 50:1 based on an initial investment of \$2m.
- Introduced market quality dashboard ([www.mqdashboard.com](http://www.mqdashboard.com)) which brings evidenced based policy making to securities markets and at the same time reduces the time to complete the processing for a PhD by at least 50%, enabling the PhD's to focus more on industry's agenda, thus creating a PhD program that is self-sustaining by industry. At present 3 in every 4 PhD's (out of a total of 100) is fully funded by industry.
- Capital Market CRC CEO won the 2016 PM Prize for Innovation for his work on bringing integrity to financial markets through the SMARTS software ([www.smartsgroup.com](http://www.smartsgroup.com)) and transferring the ideas to the health marketplace ([www.loricahealth.com](http://www.loricahealth.com)).

### **CRC for Water Sensitive Cities**

- The launch of Aquarevo in Lyndhurst — a brand-new water sensitive community — marks a new era in the commercialisation of innovative residential solutions. The first of its kind in Australia, the Aquarevo development showcases research-based, industry-leading water and energy sustainability design that signals a significant reduction in domestic water consumption achieved through urban design. The CRC for Water Sensitive Cities, South East Water, and Villawood properties have worked together to envision and realise this project, whose homes offer the perfect combination of liveability and sustainability. Packed with water-saving features, each home requires approximately 70% less mains water than a regular suburban house.
- CRC Index - How water sensitive is your city? Moonee Valley City Council were keen to understand how they benchmarked against water sensitivity performance and to evaluate potential management actions to make the most impact from future investment. The north-west Melbourne council was aware the CRC for Water Sensitive Cities (CRCWSC) had recently completed the piloting of the Index Tool in Perth and sought Living Rivers funding from Melbourne Water to apply the Index Tool to their municipality.

### **Data to Decisions CRC**

- Delivered the Big Data Reference Architecture to Defence — this provides a standard blueprint for Defence to develop future Big Data systems. It has already been used within Defence for defining future projects and is being adapted to the needs of other sectors such as Agriculture.
- Commenced trials of the Open Source Intelligence applications to support national security's Counter Terrorism needs

### **Young and Well CRC**

- The Young and Well CRC created a smart clinical algorithm through its MHeClinic that has the potential to cut out wait-lists and provide critical care immediately for young people at risk of suicide.

### **CRC for Remote Economic Participation**

- Precision Pastoral Management Tools research project aimed to improve the productivity and profitability of beef production by using advanced technologies to monitor and analyse the performance of individual cattle and pastures remotely without labour input. This led to the development of the Precisions Pastoral Management Systems (PPMS).
- Developed an evidence-based framework tool that provides policymakers and business with an objective measure of the complex interrelationships between health, wellbeing, education and economic participation and the role of culture, community and empowerment in Aboriginal and Torres Strait islander communities.

### **CRC for Living with Autism**

- Pioneered by Autism CRC, Australia's first Autism Biobank was launched by The Hon Sussan Ley, Minister for Health in 2016, developing a highly valuable resource for Australian researchers which will put them at the forefront of biological discoveries related to autism.
- Over 1,500 new families benefitted from further development and commercialisation of the Secret Agent Society social skills training program by Autism CRC in 2016. Social Skills Training Pty Ltd is a wholly owned subsidiary of Autism CRC.

### **Antarctic Climate & Ecosystem CRC**

- ACE CRC researchers have since 1991 observed that the Southern Ocean is steadily warming. In 2016 they confirmed that these warmer waters are reaching the fringes of the Antarctic continent and melting the under-side of the Totten Glacier, south of Australia. The Totten Glacier is thinning rapidly and is the major outlet glacier of the East Antarctic ice sheet, containing the equivalent of 3.5m of global sea level rise.

### **Automotive Australia 2020 CRC (AutoCRC)**

- Development of a prototype electric bus, eBUS, by Gold Coast manufacturer, Bustech. This has been launched at shows in Australia and Malaysia and is now being evaluated by fleet operators in Australia and Asia.
- Plastic injection moulding optimisation tool, MOULD, is a tool that revolutionises that way that manufacturers of plastic products work. It incorporates the specialist knowledge of toolmakers into a system that allows virtual optimisation of the parameters and thus shape being moulded. It has been evaluated by manufacturers in Australia and Malaysia and is currently being refined with an enhanced user interface. The tool will benefit any company using plastic injection moulding techniques and as such has vast potential for use outside of the auto industry.
- A Tool for evaluating ease of entry and exit of vehicles received an Industry Award for the development of a system that allows car manufacturers to quickly assess vehicle designs for difficulties with entry and exit of vehicles, all without the use of costly and time-consuming physical models. Developed for use on any vehicle and for many types of passenger, it will also enable the development of suitable vehicles for people with special needs (ageing / disabled etc). This is currently being deployed throughout Holden and would work for other manufacturers.

### **Plant Biosecurity CRC**

- Pestpoint® uses social media principles combined with mobile devices and low cost microscopes to enable networks of users to identify insect pests. The longer it takes for pests to be identified, the more difficult they are to contain and the more extensive the damage. The problem is that most pests are found on farms a long way from city-based experts in taxonomy, plant pathology and entomology. The global decline in expertise, with increasing trade and people movement, drive up the risks to biosecurity. Pestpoint® allows rapid insect pest identification by non-experts.
- A sensitive, accurate and cost-effective sampling strategy for the detection of Phylloxera (an aphid-like insect that destroys grapevines by feeding on vine roots), will have a significant impact by allowing surveillance to be undertaken by grapevine growers without third party assistance.

### **Bushfire and Natural Hazards CRC**

- The 'Guide to Working with School Communities' is being rolled out to all NSW schools through the NSW Rural Fire Service. The Guide follows the earlier publication of an ebook, available nationally, and based on the same principles that if you educate children on hazards safety, their families and the wider community will also benefit. Collaboration with the NSW Rural Fire Service is continuing, and the team will evaluate the guide over coming fire seasons to gather data to measure its impact on community safety over successive seasons.

- The NSW State Emergency Service has used findings from BNHCRC research for its FloodSafe community campaign and training, while the Queensland Fire and Emergency Services has used it to inform its If It's Flooded, Forget it campaign. Exploring the socio-demographic and environmental factors surrounding 1,859 flood fatalities over 115 years, this research found distinct trends in relation to gender, age, activity and the circumstances of the death. These trends were analysed in the context of changes to emergency management policy and practice over time.

### **Wound Management Innovation CRC**

- The Australian Wound Innovation centre is the research translation centre for the CRC. It will provide clinical services, education, training and clinical trials and its official opening is March 8 2017.
- The CRC launched the national peak body for the management of the Diabetic Foot problems (Diabetic Foot Australia). This peak body supports and works in conjunction with Diabetes Australia and has already developed a clinical trials network and best practice guidelines for the treatment and management of Diabetic Foot Ulcers.

### **Cell Therapy Manufacturing CRC**

- CTMCRC's newly-established translational facility - TekCyte™ - will deliver pilot manufacturing services and skills training for the emerging cell therapies industry, helping customers create more effective and affordable treatments for a range of diseases such as cancer.
- Carina Biotech, has been spun out of the Cell Therapy Manufacturing CRC, to further develop CTM's immunotherapy technologies for the treatment of cancer. A major focus of Carina's work will be with CAR-T cell technology, which harnesses the killing capacity of a patient's own immune system, and has shown unprecedented clinical results with leukaemia clinical trials in the US.

### **CRC for Alertness Safety and Productivity**

- In a first for the Australian heavy vehicle industry, a new partnership between the Alertness CRC and participant the National Transport Commission (NTC) will, through a combination of rigorous field and laboratory-based research, evaluate the impacts of the Heavy Vehicle National Law (HVNL) on heavy vehicle driver fatigue. Making use of increasingly-accurate alertness detection methods and sleep monitoring devices, the research undertaken by the Alertness CRC will support any future reforms of the HVNL fatigue laws – ultimately helping to keep heavy vehicle drivers and those around them safer on our roads.

### **CRC Spatial Information CRC**

- Satellite imaging based pasture monitoring system, NRM Hub, now serving 650 grazing properties covering more than 60 million hectares, processes 30 years of satellite imagery including the latest image in 30 seconds delivered to the grazer through a simple app – a world first. Delivering 30% improvements in pasture productivity. This system is set to go commercial with the strong support Meat and Livestock Australia.
- First ever demonstration in Australia of a driverless robotic tractor being navigated remotely and accurately (to within 5cm of true) by a satellite. The satellite used the communications channel on a positioning satellite without being connected to a mobile phone network. The satellite also operated the tractor's power take off unit. This success puts Australia right at the forefront of developing the capability to control autonomous vehicles safely and reliably by satellite anywhere on the continent, irrespective of access to our existing communications network, a plus in remote areas. The satellite was Japan's Quasi Zenith

Satellite System (QZSS). The research was set up under an MOU between the Australian Minister for Industry and the Japanese Minister for Internal Affairs and Communications. The Japanese are funding the trials.

### **Invasive Animals CRC**

- The Invasive Animals CRC collaborated with industry partners to bring the first new predator bait to market in half a century. The CRC also made great strides in boosting biocontrol of rabbits and began measures for release of a carp biocontrol virus.

### **Oral Health CRC**

- Oral Health CRC scientist validated a world-first vaccine for chronic periodontitis. This major development with industry partner CSL follows 15 years of research. Clinical trials are due to commence in 2018.

### **CRC for Space Environment Management (SERC)**

- The Space Environmental Management CRC set a telecommunications world record when the Japanese Space Agency's satellite Hayabusa 2 received a laser signal from the CRC's Canberra headquarters some 6,700,000 kilometres from earth. The experiment validated the CRC's aim of being able to more accurately track and hopefully eventually manoeuvre space debris. They have proven lasers can have the power and reach required to be useful manipulation of space debris in near earth orbit.

### **Energy Pipelines CRC**

- The National Facility for Pipeline Coatings Assessment (NFPCA), gained its NATA accreditation in 2016. The NFPCA is the only independent NATA accredited coatings testing facility in Australia which allows test samples to be sent quickly and easily to interstate rather than sending them to an overseas facility, reducing the cost of transporting samples as well as offering a better turnaround time on testing results. The facility also supports research as part of the Energy Pipelines CRC's extensive research program that is focused on the life extension of new and existing pipelines.

### **CRC for Polymers**

- More than five million hectares of Australian soils used for cropping are susceptible to water repellence. This water repellence causes rainfall run off, poor furrow efficiencies, patchy seed germination and therefore reduced crop yields. BASF has licensed new soil wetting technologies co-developed with the Cooperative Research Centre for Polymers (CRCP) to help Australian farmers improve water efficiencies and increase yields. The wetting agents are applied in a band to the surface soil directly above the seed, concurrently with the seeding operation, where they significantly improve water infiltration in the soil, reducing run-off losses and increasing the extent of moisture retention in the developing root zone.

### **CRC for Contamination Assessment and Remediation of the Environment**

- CRC CARE's National Demonstration Site for Innovative Acid Sulfate Soil Remediation has gained world recognition for its remarkable achievements and practical solutions in treating extreme acidification caused by land clearing and draining. In partnership with the Queensland Government and Southern Cross University (SCU), a novel *in situ* soil bioremediation strategy has dramatically improved soil health and recovery of the vegetation and aquatic ecology of the East Trinity wetland in far north Queensland. The remediation of the East Trinity site has been so successful that the area now has sufficiently high ecological function to be transferred back to Indigenous ownership and management.

- The National Measurement Institute collaborated with Environment Protection Authority Victoria on a CRC CARE project to conduct Australia's first proficiency study for the contaminants PFOS and PFOA (found in some firefighting foams, non-stick materials and waterproof fabrics, among other uses) in environmental matrices. Both chemicals are highly resistant to degradation, persistent in the environment, known to be toxic to humans and wildlife, accumulate along the food chain, and are regulated by the International Stockholm Convention for Persistent Organic Pollutants. The development of Australian proficiency testing capabilities will help ensure the quality and comparability of PFOS/PFOA measurements, provide end-user confidence in overall data quality and the reliability of results, support Australian environmental policy development, and improve PFOS/PFOA analysis.