

2017–18 SNAPSHOT  
**Rail Manufacturing CRC**



# Message from the Chair and MD

This snapshot report covers the fourth year of operation for the Rail Manufacturing Cooperative Research Centre (CRC). To access the full report, visit [www.rmccr.com.au](http://www.rmccr.com.au)

During the past year, the Rail Manufacturing CRC has continued to deliver excellence in research, technology and capability improvements for the rail industry in collaboration with our research institutions and industry partners.

## Australia's commitment to rail

Since commencing in 2014, the Rail Manufacturing CRC has witnessed many changes to the Australian rail sector. The plateauing of the heavy haul mining sector, the exceptional growth of passenger rail projects and the ongoing global restructuring of traditional and large rail manufacturing organisations (through mergers and acquisitions) have all influenced the demand for research and development (R&D) activities within Australia and subsequently within the Rail Manufacturing CRC's program of work.

## Project highlights this year

The 2017–18 Financial Year has again been one of continued growth for our Centre and the Australian rail manufacturing sector as a whole, resulting in strong progress for many of the Rail Manufacturing CRC's inaugural projects, as well as the commencement of seven new projects in the last year.

A number of the Centre's projects starting to yield commercial outcomes include:

- » the development of a prototype energy management system to power supercapacitors, designed by CSIRO for industry organisation CRRC
- » the launch of DwellTrack, a passenger tracking system, delivered by the University of Technology Sydney and Downer
- » the ongoing development of bearing monitoring systems for Bombardier, undertaken by the University of Queensland
- » the expansion of our heating, ventilation, and air conditioning (HVAC) project portfolio with industry leader Knorr-Bremse Australia
- » the extension of our train cabin airflow modelling project with Airlinx and RMIT University.

We are especially fortunate to have the ongoing support and commitment from some of Australia's best research institutions. Throughout the rail industry's recent difficulties, our research institutions have provided unwavering support, first class performance and regular proposals for new R&D initiatives that have helped our Centre to continue to meet its commitments.

## Education is the future

The Rail Manufacturing CRC has continued to foster and grow our education program, with the Centre supporting 34 PhD students, through industry projects, scholarships and internships, since establishing in 2014.

Our PhD candidates are working on a wide variety of industry-leading rail research projects, including real-time condition monitoring, using drones for assessment, laser cladding technologies, augmented and virtual reality for training, big data analytics and automated assembly of rolling stock fabrications.



## Fourth year of operation

These students are committed, keen and excited to engage with the rail industry during their studies, and many have expressed intent to join Australia's rail industry post-graduation. Our PhD scholarship program would not be possible without the continued support of our university participants, who we thank for their commitment and joint funding.

### Recognition of our team and supporters

The Rail Manufacturing CRC also acknowledges the ongoing support of our industry participants who continue to engage and support the Centre and our activities. The last six months have seen extensive growth in the approval of new projects and the development of new research proposals by a number of our major industry participants – it is heartening to see the increasing levels of collaboration between researchers, academia and industry.



Paul Johnson MBE - Chair    Dr Stuart Thomson - CEO



### About the Rail Manufacturing CRC

The Rail Manufacturing Cooperative Research Centre (CRC) drives the development of new products, technologies and supply chain networks to enhance the competitiveness, capacity and productivity of Australia's rail manufacturing industry.

The Rail Manufacturing CRC currently has 41 active projects underway, and five projects completed. These projects focus on work in areas such as battery and supercapacitor development, new braking technologies, bearing maintenance optimisation, the use of new manufacturing materials, integrated passenger tracking, train operations diagnostics and improvements to train cabin ventilation.

Funded jointly by participating rail organisations and the Australian Federal Government's Department of Industry, Innovation and Science under its Business Cooperative Research Centres Programme, the Rail Manufacturing CRC has a six year lifespan, finishing up at the end of the 2019–20 Financial Year.



Australian Government  
Department of Industry,  
Innovation and Science

**Business**  
Cooperative Research  
Centres Programme

## Achievements

In its fourth year of operations, the Rail Manufacturing CRC's research program has started to see commercial success across its projects, with a number of outputs now starting to be investigated or implemented by the rail industry.

The high degree of end-user collaboration within projects this year has been particularly pleasing, clearly highlighted in Project R1.3.4 - **Supercapacitor energy management system stage 2** (CRRC / CSIRO). For this project, CSIRO has developed and transported a full-sized prototype energy management system unit to China for the CRRC project team to replicate the design and test in their purpose-built facility.

Another key success is shown in Project R3.1.2 - **Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system** (Downer / University of Technology Sydney), where the commercialisation of the project's outputs has resulted in the development of a technology prototype for a responsive passenger information system called DwellTrack.

Seven new project agreements were executed in 2017–18:

- » Project R1.1.2 - **Hybrid supercapacitors with high energy and power densities for rail industry applications** (HEC Group / University of Technology Sydney)
- » Project R1.5.1 - **Aluminium matrix composite brake discs** (CRRC / CSIRO)
- » Project R2.1.1 - **Platform gap** (Downer / Monash University)

- » Project R2.1.2 - **Protection of cast steel coupler from corrosion by cold spray** (CRRC / CSIRO)
- » Project R3.3.2 - **Development of a smart rail route map** (Australasian Railway Association / Deakin University)
- » Project R3.4.1 - **Arc welding modelling** (CRRC / CSIRO)
- » Project R3.5.1 - **Battery HVAC feasibility study** (Knorr-Bremse / CSIRO).

As of June 2018, two Rail Manufacturing CRC projects were completed during the year:

- » Project R3.2.1 - **Development of a responsive passenger information system for the Sydney Trains network** (Sydney Trains / University of Technology Sydney)
- » Project R3.3.1 - **Detection and monitoring on trains - feasibility study** (Knorr-Bremse / University of Technology Sydney).

To assist with potential commercialisation activities, Project R2.3.2 - **Axle bearing maintenance optimisation** (Bombardier / University of Queensland) was also extended during the year to broaden the scope of work and bearings being assessed.



**25 essential  
and Other Participant**  
organisations committed

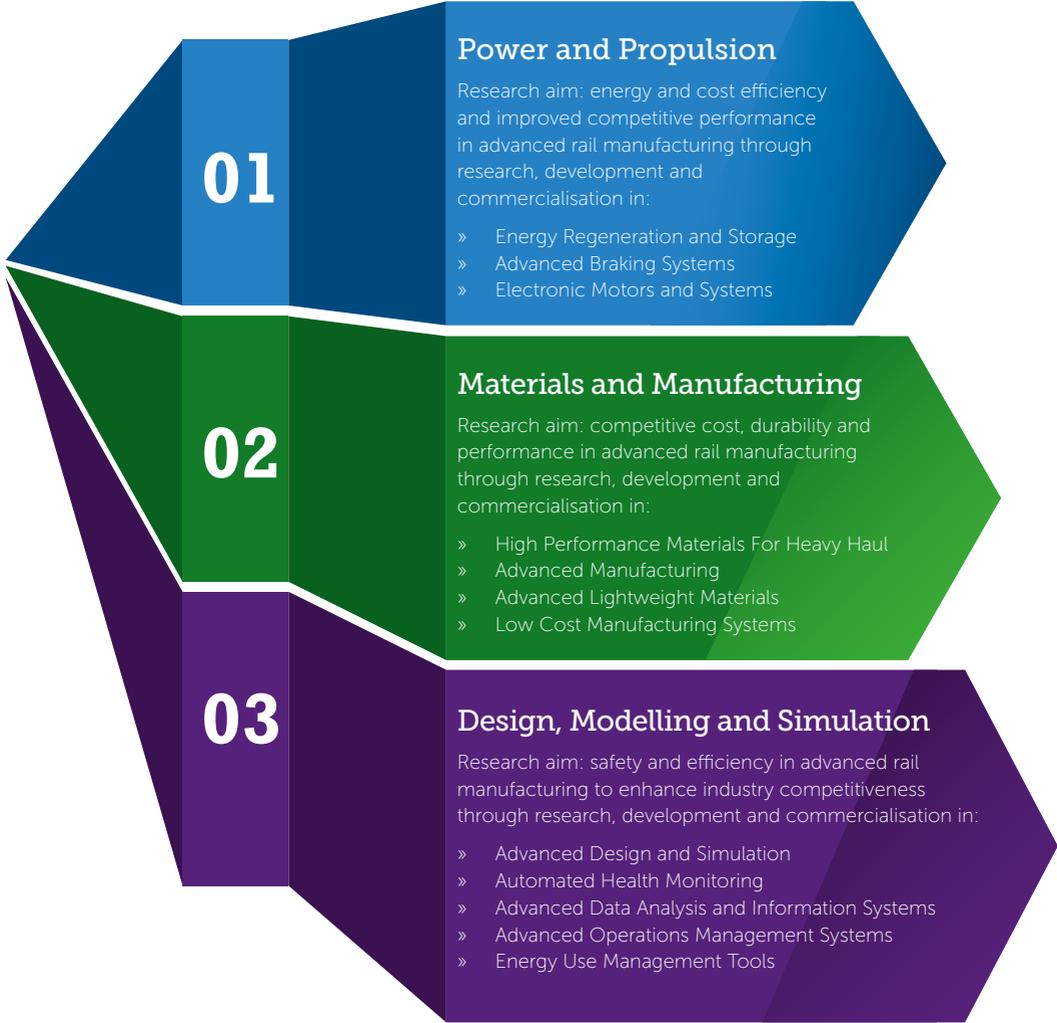
## Current Projects as at 30 June, 2018

Project #	Project	Participants
<b>Research program area: 1 – Power and Propulsion</b>		
R1.1.1	New generation lithium-ion batteries with high energy and long service life for rail industry applications	HEC Group / University of Technology Sydney
R1.1.2	Hybrid supercapacitors with high energy and power densities for rail industry applications	HEC Group / University of Technology Sydney
R1.3.3	High energy supercapacitor development	CRRC / CSIRO
R1.3.4	Supercapacitor energy management system stage 2	CRRC / CSIRO
R1.5.1	Aluminium matrix composite brake discs	CRRC / CSIRO
<b>Research program area: 2 – Materials and Manufacturing</b>		
R2.1.2	Protection of cast steel coupler from corrosion by cold spray	CRRC / CSIRO
R2.3.1	Accelerated life testing and characterisation of critical components	Knorr-Bremse / CSIRO
R2.3.2	Axle bearing maintenance optimisation	Bombardier / University of Queensland
R2.3.4	Monitoring and control of false brinelling	Bombardier / University of Queensland
R2.4.1	Advanced steel development for rail and sleepers	OneSteel / Monash University
R2.5.1	Performance of recycled rubber inclusions for improved stability of railways	Tyre Stewardship / Australasian Centre for Rail Innovation / University of Wollongong
R2.5.2	Application of geogrids for minimising track deformation and degradation under high frequency cyclic and heavy haul loading	Global Synthetics / Foundation QA / University of Wollongong
<b>Research program area: 3 – Design, Modelling and Simulation</b>		
R3.1.2	Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system	Downer / University of Technology Sydney
R3.3.2	Development of a smart rail route map	Australasian Railway Association / Deakin University
R3.4.1	Arc welding modelling	CRRC / CSIRO
R3.5.1	Battery HVAC feasibility study	Knorr-Bremse / CSIRO
R3.6.1	Experimental and computational study on the key ventilation issues affecting air quality and thermal comfort in train cabins	Airlinx / RMIT University



# Research theme areas

All projects conducted by the Rail Manufacturing CRC align to one of the following three key research themes, which also relate to initial recommendations defined in the On Track to 2040 roadmap<sup>1</sup> developed in 2012.



<sup>1</sup>Department of Industry, Innovation and Science, On Track to 2040 – Preparing the Australian Supply Industry for Challenges and Growth, 2012, downloaded at: <https://rmcrc.com.au/wp-content/uploads/2015/05/OnTrackTo2040-Roadmap.pdf>

## Progress in Program 1 – Power and Propulsion

With an increasing focus on electrification and energy efficiency, this first research theme has the potential to significantly change the rail industry through energy storage solution development and implementation. The Rail Manufacturing CRC has a number of related projects that are looking to address the challenge of increasing the performance of energy storage devices for use in rail applications.

There is a variety of applications for energy storage in rail, including backup power and regenerative braking, but the largest application exists for catenary-free light rail systems where the overhead lines are replaced by charging stations at tram stop platforms.

During the year, the excellent collaboration between China Railway Rolling Stock Corporation (CRRC) and CSIRO continued in the following rail supercapacitor energy storage systems projects:

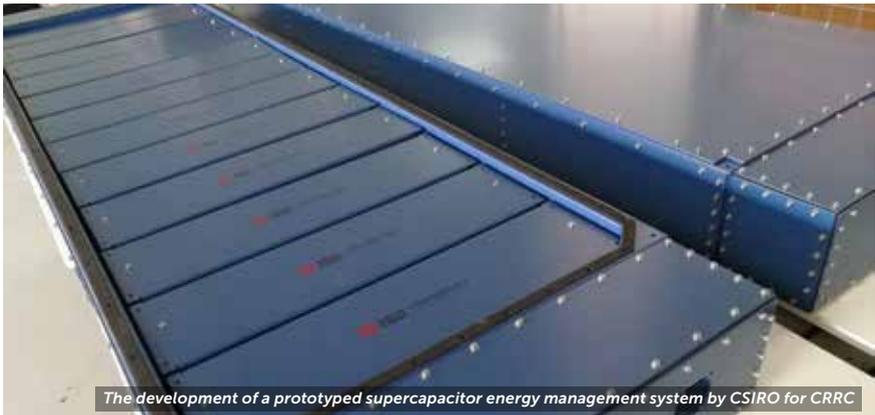
- » Project R1.3.3 - **High energy supercapacitor development** (CRRC / CSIRO)
- » Project R1.3.4 - **Supercapacitor energy management system stage 2** (CRRC / CSIRO).

In a similar theme, the material-focused activities in partnership between the HEC Group and University of Technology Sydney have also delivered promising laboratory results for:

- » Project R1.1.1 - **New generation lithium ion batteries with high energy density and long service life for rail industry application** (HEC Group / University of Technology Sydney)
- » Project R1.1.2 - **Hybrid supercapacitors with high energy and power densities for rail industry applications** (HEC Group / University of Technology Sydney).

One final project that addresses advanced braking research component also commenced during this Financial Year: Project R1.5.1 - **Aluminium matrix composite brake discs** (CRRC / CSIRO).

This project aims to develop novel materials and processing to fabricate high-performance aluminium matrix composite brake discs.



The development of a prototyped supercapacitor energy management system by CSIRO for CRRC

## Progress in Program 2 – Materials and Manufacturing

This theme incorporates a variety of projects relating to maintenance and durability of rail track and rolling stock, which has emerged as a key focus for industry.

In Project R2.3.1 - **Accelerated life testing and characterisation of critical components** (Knorr-Bremse / CSIRO), Knorr-Bremse is working with CSIRO to test the performance of air conditioning units in different atmospheric conditions.

Two projects underway in partnership between Bombardier and the University of Queensland could significantly reduce the rail industry's maintenance and overhaul requirements:

- » Project R2.3.2 - **Axle bearing maintenance optimisation** (Bombardier / University of Queensland)
- » Project R2.3.4 - **Monitoring and control of false brinelling** (Bombardier / University of Queensland).

Project R2.3.2 involves the development and testing of a new optimised predictive maintenance system for bearings, while Project R2.3.4 is investigating wear that occurs during the transportation of bearings due to vibration and/or load on the bearing.

Another two projects are focused on researching materials used to enable rail ballast stability:

- » Project R2.5.1 - **Performance of recycled rubber inclusions for improved stability of railway** (Tyre Stewardship Australia / Australasian Centre for Rail Innovation / University of Wollongong)
- » Project R2.5.2 - **Application of geogrids for minimising track deformation and degradation under high frequency cyclic and heavy haul loading** (Global Synthetics / Foundation QA / University of Wollongong).

Two new projects have also just commenced at the end of 2017–18:

- » Project R2.1.1 - **Platform gap** (Downer / Monash University):  
The manufacture and testing of a dynamically adjustable polymer-based gap bridging device that fills the space between the station platform and the train door.
- » Project R2.1.2 - **Protection of cast steel coupler from corrosion by cold spray** (CRRC / CSIRO):

The use of cold spray to maintain and prolong coupler lifetime.



Assessing the lubrication of axle bearings

## Progress in Program 3 – Design, Modelling and Simulation

With Industry 4.0, automation, the Internet of Things and Virtual Reality beginning to take prominence in Australia's rail industry, the suite of projects underway are focused on the use of design and simulation techniques to model operations, develop more efficient processes and equipment solutions, increase efficiencies and extend rail systems' asset life.

Project R3.1.2 - **Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system** (Downer / University of Technology Sydney) involves the development of an autonomous system capable of sensing and interpreting passenger behaviour and train events to monitor the movement of passengers on and off trains. In the last 12 months, a commercial prototype called DwellTrack has been delivered and a provisional patent and trademark has been lodged.

Another long-term project underway in Program 3 is Project R3.6.1 - **Experimental and computational study on the key ventilation issues affecting air quality and thermal comfort in train cabins** (Airlinx / RMIT University). This project involves modelling airflow from the air vents within

a train environment to determine optimum flow based on different passenger numbers.

A focused six-month project also delivered in the past 12 months was Project R3.5.1 - **Battery HVAC feasibility study** (Knorr-Bremse / CSIRO).

An additional two new projects also began towards the end of 2017–18:

» Project R3.3.2 - **Development of a smart rail route map** (Australasian Railway Association / Deakin University)

This project is working to establish a common view of priorities, themes, timelines and actions for Australia's rail industry, which will be used to identify and deliver the most applicable technologies and services to the sector.

» Project R3.4.1 - **Arc welding modelling** (CRRC / CSIRO)

This project will develop a software module specifically for CRRC to use for welding rail components.



DwellTrack camera hardware used to track passenger movements

## Education and training

The Rail Manufacturing CRC is working to support the next generation of research-trained employees to join Australia's rail industry.



*Students Fukun Xia, Tianyi Wang, Calvin Vong and Sundar Shrestha practicing their PhD pitches*

The past year has seen another large increase in the number of PhD students supported by the Rail Manufacturing CRC. Since the Centre commenced in 2014, 34 PhD students have now been supported across three student programs – industry-led projects, rail PhD scholarships and internship placements.

As of the end of 2017–18, there are now seven<sup>2</sup> PhD students participating in industry-led projects, 23<sup>3</sup> PhD scholarship students currently working on a wide variety of rail research projects and two PhD students who participated in a paid 12-week work placement at Queensland Rail and Aurizon in 2016–17 and 2017–18.

To encourage the Centre's PhD students to consider a career in rail after graduation, a variety of supporting initiatives have been delivered to provide information sharing, relationship building and induction into Australia's rail industry. This support includes:

- » hosting the inaugural Rail Manufacturing CRC PhD students' forum in January/February 2018
- » scheduling student tours of industry headquarters in Sydney and Brisbane
- » inviting PhD students to attend and present at Rail Manufacturing CRC Participants Forums
- » the identification of training opportunities to strengthen job readiness
- » the rollout of a trial mentoring program to match students with rail industry representatives for support and guidance.

<sup>2</sup> This total does not include one industry PhD student who withdrew from a project

<sup>3</sup> This total does not include one scholarship PhD student who withdrew from a project

## Industry PhD students

In 2017–18, there are now seven PhD students participating in industry-led projects:

- » Tianyi Wang, working on Project R1.1.1 - **New generation lithium-ion batteries with high energy and long service life for rail industry applications** (HEC Group / University of Technology Sydney)
- » Zhang Yin, working on Project R1.3.3 - **High energy supercapacitor development** (CRRC / CSIRO), studying at Queensland University of Technology
- » Matthew Pozzebon, working on Project R2.3.2 - **Axle bearing maintenance optimisation** (Bombardier / University of Queensland)
- » Osama Brinji, working on Project R2.3.4 - **Monitoring and control of false brinelling** (Bombardier / University of Queensland)
- » Chamindi Jayasuriya, working on Project R2.5.1 - **Performance of recycled rubber inclusions for improved stability of railways** (Tyre Stewardship Australia / Australasian Centre for Rail Innovation / University of Wollongong)
- » Alexander Virgona and Julien Collart, both working on Project R3.1.2 - **Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system** (Downer / University of Technology Sydney).

## Scholarship PhD students

Following the establishment of a scholarship program in 2016–17, the Rail Manufacturing CRC has continued to commit to funding a cohort of new scholarship students in the past 12 months. These scholarships are co-funded by the Rail Manufacturing CRC and participating universities, which include CQ University, Swinburne University of Technology, RMIT University, Monash University and University of Technology Sydney.

As of 30 June 2018, there are 23 PhD Scholarship students currently working on a wide variety of industry-leading rail research projects, including real-time condition monitoring, using drones for assessment, laser cladding technologies, augmented and virtual reality for training, big data analytics and automated assembly of rolling stock fabrications.

## Industry internships

Across 2016–17 and 2017–18, the Rail Manufacturing CRC worked with Australian not-for-profit organisation TrackSAFE Foundation to establish a PhD internship program, where two PhD students from Queensland University of Technology were selected to participate in a 12-week paid level crossing-related internship with rail organisations Queensland Rail and Aurizon. At the end of the work placement, the students were invited to present on their research and internship experiences to the National Level Crossing Steering Committee in Brisbane in November 2017.



**41** Rail Manufacturing CRC projects currently underway – 18 industry projects and 23 scholarships

## Commenced PhD students as at 30 June, 2018

Student name	Project title	Research institute
<b>Research program area: 1 – Power and Propulsion</b>		
Tianyi Wang	New generation lithium-ion batteries with high energy and long service life	University of Technology Sydney
Zhang Yin	High energy supercapacitor development	Queensland University of Technology
Sundar Shrestha	Estimation of adhesion conditions between wheels and rails for the development of advanced braking control systems	Central Queensland University
Esteban Bernal Arango	Smart axle transducer transmitter for freight wagon condition monitoring systems	Central Queensland University
<b>Research program area: 2 – Materials and Manufacturing</b>		
Cameron Milne <sup>4</sup>	Axle-bearing maintenance optimisation	University of Queensland
Matthew Pozzebon	Axle-bearing maintenance optimisation	University of Queensland
Osama Brinji	Monitoring and control of false brinelling	University of Queensland
Chamindi Jayasuriya	Performance of recycled rubber inclusions for improved stability of railways	University of Wollongong
Chuhao Liu	The performance of stabilised ballast in rail tracks	University of Wollongong
Mahsa Taherimandarjani	Laboratory evaluation of laser cladding on rail wheel steels	Swinburne University of Technology
Meng Wang	Manufacturing of lightweight panels	Swinburne University of Technology
Fukun Xia	Evaluation of hybrid structures for impact performance in rail applications	Swinburne University of Technology
Vu Trong Thien (Terence)	Automated assembly for rolling stock fabrication in rail industry	University of Wollongong
Hang Su	Optimisation of rail welding process parameters to mitigate rolling contact damage	Monash University
Pravin Urudra <sup>5</sup>	Evaluating the suitability of laser clad rail steel in heavy haul application	Monash University
Simon Wagner	Heavy haul train force control product	Central Queensland University
Elias Salloum	Optimising friction-stir welding and alloy design to ensure the durability of light weight carriages in the rail fleet	RMIT University
Anthony Micheletto	Improvement of flashbutt welds in premium rails	Monash University
Don Kushlani Ranmal Ranasinghe	Optimal design of raised rail - road crossing structure	Queensland University of Technology
Zheshuo Zhang	Effect of raised rail - road crossing to the safety of road vehicles	Queensland University of Technology

<sup>4</sup> This student withdrew from the project as of 30 April 2017

<sup>5</sup> This student withdrew from the project as of 21 February 2018

Student name	Project title	Research institute
<b>Research program area: 3 – Design, Modelling and Simulation</b>		
Alexander Virgona	Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system	University of Technology Sydney
Julien Collart	Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system	University of Technology Sydney
Mahdi Saki	Ultra-reliable and cost effective communication infrastructure for future IoT-based railway applications	University of Technology Sydney
Zhibin Li	Big data analytics for condition based monitoring and maintenance	University of Technology Sydney
Huaxi Huang	Rail infrastructure defect detection through video analytics	University of Technology Sydney
Amir Eslami	Drive-by bridge inspection: the use of instrumented revenue wagons for structural health monitoring of rail bridges	Monash University
Yu Fung Lee (Joseph)	Nonlinear vibro-acousto-ultrasonic waves for fatigue cracking detection in key rail components	Monash University
Chi Hei Yong (Calvin)	Control and navigation of micro UAV in small railway culverts and tunnels	Monash University
Yong Pang	System for real-time monitoring and sensing railway conditions by laser light	Monash University
Dongyu Zhang	Hybrid unmanned aerial system for railway inspection	Monash University
Nalin Randeniya	Augmented reality manufacturing and maintenance modules in High Capacity Metro Train for enabling effective engagement and faster learning curves	Swinburne University
Andrew Danylec	Develop and establish augmented reality tools in High Capacity Metro Train for productivity and quality enhancements	Swinburne University
Wenhua Jiang	Short-term rail passenger flow forecasting application	Monash University
Jie Yang (Joanne)	Optimising railway carriage design for improved dispersion, capacity and safety	RMIT University



**34 students**  
supported in the Centre's lifetime

# Collaboration

The Rail Manufacturing CRC's participation in multiple industry forums during the last 12 months has enabled the development of stronger relationships with rail manufacturers, rail operators and Government groups across the world, while also working closely with local rail peak bodies such as the Australasian Railway Association (ARA).

In 2017–18, the Rail Manufacturing CRC participated in and promoted rail innovation at:

- » leading technical presentations at the AusRAIL conference held at Brisbane in November 2017
- » demonstrating DwellTrack technology at CeBIT Australia in May 2018
- » presenting at the Spain – Australia Rail Technology Cooperation Forum held at Melbourne's RMIT University in November 2017
- » participating in the Infrastructure Transport 2056 forum organised by Engineers Australia at CORE 2018
- » involvement in the Public Transport Authority Western Australia - METRONET Rolling Stock Procurement forum held in October 2017
- » chairing the Strategic Transport Asset Management conference held at Sydney in August 2017
- » participating in recurring ARA Rail Industry Group meetings, a forum with senior rail representatives aimed at supporting rail suppliers
- » participating in numerous State Government briefings and forums
- » attendance at the ARA Telecommunications & Technology Forum, the CRC Association annual conference, the Rail Manufacturing CRC's Participant Forums, and other academic and industry forums.

In 2017–18, the Centre initiated a third call for Rail Innovation Gateway proposals, where all interested businesses working in rail, or with the potential to do so, were invited to apply with rail R&D project proposals for funding. In response, four project proposals were received, three of which were selected to proceed and are now undergoing late stage contractual negotiations.

## Collaborative project examples

The Rail Manufacturing CRC's current suite of projects are providing considerable benefit to its participants, with the following projects showing commercial potential:

- » Project R1.1.1 - ***New generation lithium-ion batteries with high energy and long service life for rail industry application*** (HEC Group / University of Technology Sydney):

This research seeks to develop new battery technologies for rail applications by utilising new lithium-based chemistries. Developing better battery materials have far-reaching applications in rail, with the potential for use in the development of hybrid trains.

- » Project R1.3.3 - ***High energy supercapacitor development*** (CRRC / CSIRO)
- » Project R1.3.4 - ***Supercapacitor energy management system stage 2*** (CRRC / CSIRO):

Energy storage control systems being developed jointly by CRRC and the CSIRO hold significant opportunities for the domestic and global rail sector. This suite of projects includes the development of high energy supercapacitors with new design and chemistry, and the prototyping of an energy management system which is currently being tested by CRRC in China.



*Rail Manufacturing CRC's Larry Jordan and Paul Johnson attending the CRC Association conference in May 2018*

- » Project R2.3.2 - **Axle bearing maintenance optimisation** (Bombardier / University of Queensland)

This project could potentially reduce maintenance and overhaul requirements for rolling stock by examining methods to model and predict lubrication needs for the maintenance of the axle bearings.

- » Project R3.1.2 - **Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system** (Downer / University of Technology Sydney):

This project has developed a prototype passenger monitoring system, which continues to undergo trials with rail operators. It enables rail operators to better understand passenger movement within stations, assists them to operate more efficiently and effectively, and to potentially reduce railway operation costs.

- » Project R3.2.1 - **Development of a responsive passenger information system for the Sydney Trains network** (Sydney Trains / University of Technology Sydney):

This work sought to study and identify key passenger information systems technologies for the rail sector. The outputs of this project will enable Sydney Trains to undertake future activities with in-depth insights into the background technology involved.

- » Project R2.3.1 - **Accelerated life testing and characterisation of critical components** (Knorr-Bremse / CSIRO)
- » Project R3.3.1 - **Detection and monitoring on trains - feasibility study** (Knorr-Bremse / University of Technology Sydney)
- » Project R3.5.1 - **Battery HVAC feasibility study** (Knorr-Bremse / CSIRO)

These three Knorr-Bremse projects focus on the key topics of real time heating, ventilation and air conditioning (HVAC) monitoring, battery technologies and HVAC accelerated lifecycle modelling, all of which seek to better understand and provide pertinent data for Knorr-Bremse's commercial benefit.

# Communications

The Rail Manufacturing CRC’s Communications Strategy is to:

- » provide internal and external stakeholders with timely, consistent and informative communications about the Rail Manufacturing CRC’s direction and activities
- » maintain strong and collaborative relationships with the Centre’s industry and research institute participants and key external stakeholders
- » evaluate the communication channels used via surveys, feedback, website analytics, social media engagement and newsletter readership.

## Monthly newsletter

In 2017–18, a key communication channel was the Centre’s monthly email newsletter, sent to over 500 subscribers. The newsletter’s average open rate of 32.7 per cent during the last 12 months compares positively against the MailChimp manufacturing industry benchmark open rate of 16.6 per cent.

## Participants forums

Another key communications channel during the year was hosting regular Participants Forum events. An informal Christmas celebration forum was held in Melbourne in December, with 17 businesses represented. This was followed up with a full Participants Forum in Sydney at the beginning of May, with 30 attendees across the rail industry and universities.

## Online and social media

Alongside the Rail Manufacturing CRC website, which is regularly updated with latest news, participants information and project listings, the Centre also manages LinkedIn and Twitter social media channels to share latest news, key successes and rail updates.

## Rating the Centre’s effectiveness

Following the establishment of an inaugural Participants Survey in 2016–17, this survey was again conducted at the end of 2017–18 to rate the effectiveness of the Rail Manufacturing CRC.

The 2017–18 Participants Survey received 18 responses in total – with 11 industry responses and 7 research institution responses (against a total of 25 organisations requested to respond).

In summary:

Questions (where 1= very unsatisfied, 3 = neutral, 5 = very satisfied)	2017–18 weighted average	2016–17 weighted average
... the Centre’s Board is effective	4.33	3.67
... the Centre’s Senior Leadership is effective	4.61	4.00
... administration is effectively managed	4.39	4.21
... research programs are effectively managed	4.44	4.08
... project outcomes meet the expectations of participants	4.06	3.71
... communications program is effectively managed	4.44	4.07
... education and training program is effectively managed	4.36	3.64
... level of satisfaction with the Centre’s Intellectual Property Model	4.11	4.00
<b>Overall level of satisfaction with the collaboration between your organisation and the Rail Manufacturing CRC in 2017–18</b>	<b>4.33</b>	<b>4.07</b>

# Financial management

For the year ended 30 June 2018, the Rail Manufacturing CRC expended its financial resources on:

- » contracting new research projects
- » managing and supporting existing research projects
- » awarding and managing student PhD scholarships
- » developing its pipeline of potential new research projects with both existing, and potentially new, participants.

## Financial performance

For the year ended 30 June 2018, the Rail Manufacturing CRC earned revenue of \$5.44 million and other income of \$0.17 million, and incurred expenses of \$5.61 million, resulting in a \$nil operating profit. Revenue of \$5.44 million comprised \$3.26 million of CRC Programme Funding from the Department of Industry, Innovation and Science and \$2.18 million from participants. Expenditure of \$5.61 million included \$4.21 million of research costs, \$1.01 million of employee benefits costs and \$0.39 million of administration and depreciation expenses.

Research expenditure has increased by \$935,000 or 29 per cent compared to last year, but was \$4 million lower than budgeted reflecting the loss of Faiveley and Simplex as Essential Participants and delays in some existing and anticipated projects.

## Cash flows

During the year, the Rail Manufacturing CRC received \$5.68 million of operating cash inflows (inclusive of GST), consisting of \$3.39 million from the Commonwealth CRC Programme, \$2.13 million from participants and \$0.16 million in interest receipts. Operating cash outflows totalled \$4.59 million (inclusive of GST), consisting of \$2.98 million of research payments and \$1.61 million of administration payments. There were no investing cash flows this year.



## In-kind contributions

Total in-kind contributions of \$8.18 million for the year ended 30 June 2018 comprised \$7.71 million of staff in-kind and \$0.47 million of non-staff in-kind contributions, being non-cash contributions to the Rail Manufacturing CRC's research programs by research and industry participants, representing contributions of people, equipment and facilities.

## Financial position

As at 30 June 2018, total assets were \$13.67 million and total liabilities were \$13.67 million. Total assets are comprised predominantly of cash and cash equivalents of \$12.89 million, trade and other receivables of \$0.31 million, prepayments of \$0.45 million and non-current assets of \$0.02 million. Total liabilities comprised of deferred revenue of \$10.06 million, trade and other payables of \$3.54 million and provisions of \$0.07 million.

## Financial issues

The key financial challenges, for the next and subsequent years, in order to meet the Centre's current obligations to the Commonwealth, are to:

- » source and secure additional funding to offset shortfalls due to Essential Participant changes
- » agree and finalise research projects to the value of approximately \$1 million with existing participants
- » source additional funding and projects to the value of approximately \$1.6 million.

## Board



CHAIR - PAUL  
JOHNSON MBE



BRONWYN  
CONSTANCE



CEO - DR STUART  
THOMSON



MICHAEL  
MILLER



PROF GRANT  
STANLEY



MICHAEL  
MCLELLAN



ALAN BEACHAM

## Management team



CEO - DR STUART  
THOMSON



DR LARRY  
JORDAN



SHARON  
SALPIGHIDIS



KATIE RIZZO



MIATALI PANDIT



PROF COLIN  
COLE



PROF PAUL  
MEEHAN

# Participants

**BOMBARDIER**





**Rail Manufacturing CRC Ltd.**

ABN – 14 600 249 518

PO Box 273  
Flemington Victoria 3031  
Australia

Ph: +61 3 8589 7112  
[www.rmcr.com.au](http://www.rmcr.com.au)

