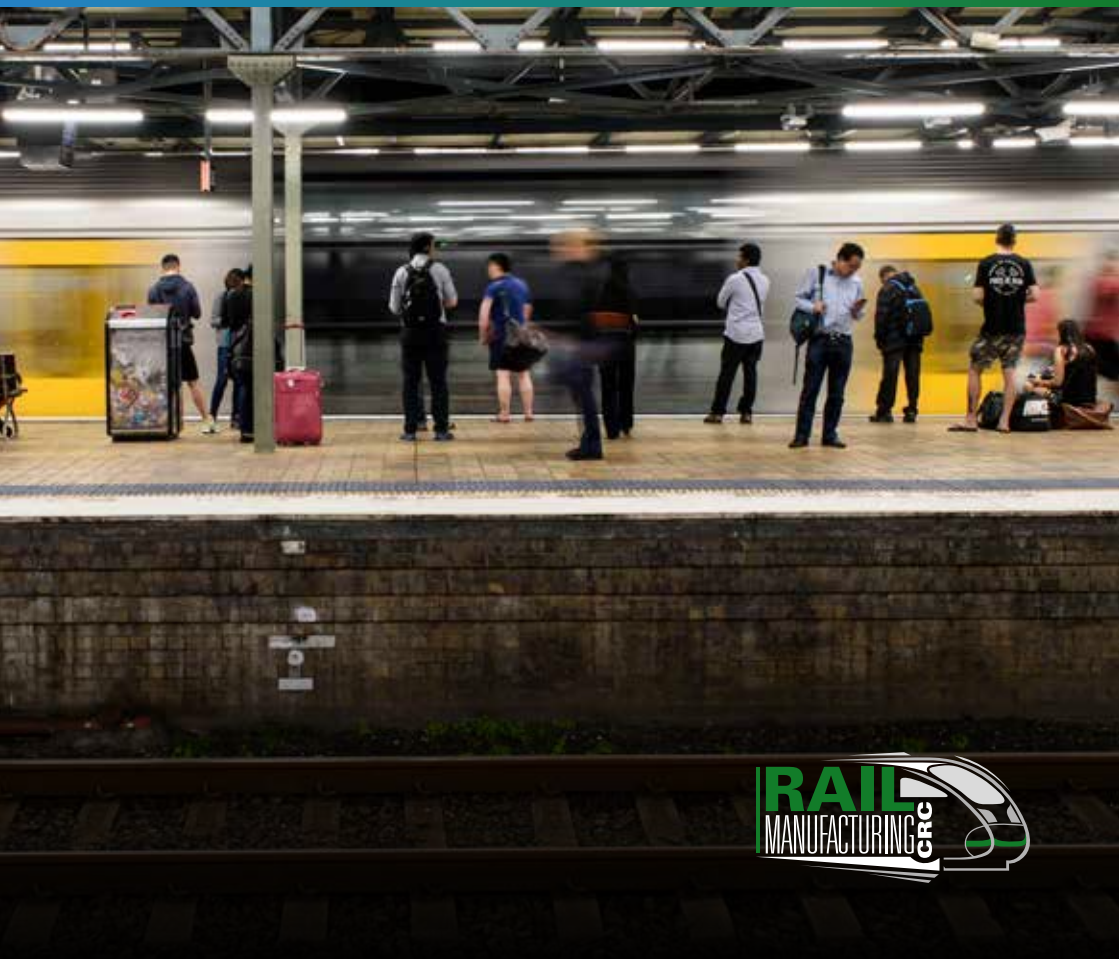
2016–17 SNAPSHOT

RAIL MANUFACTURING CRC



RAIL MANUFACTURING CRC

Message from the Chair and MD

This document provides a summarised snapshot of the third annual report for the Rail Manufacturing CRC, which represents the halfway point of our Centre's six-year lifespan. **To access the full annual report, visit www.rmcrc.com.au**

The past 12 months have seen the maturing and consolidation of a number of the Centre's start-up activities and the development of new projects. We have acquired a number of new participants, including a rail operator, and a range of SME businesses and non-rail entities interested in diversifying into the rail sector.

The Centre has also had to face a number of external challenges due to the continued rationalisation of the global rail industry through mergers and acquisitions, in turn impacting on our industry partners' Australian business operations.

Nevertheless, the Rail Manufacturing CRC's Board and Management teams have actively worked to continue growing the Centre during the 2016–17 Financial Year, with a renewed interest and vigour from our participants in the Centre's operations and projects.

Continued investment in passenger rail

Since the inception of the Rail Manufacturing CRC in 2014, the Australian rail industry has experienced many changes in demand. With the decrease in the heavy haul sector, coupled with a significant increase in the passenger rail sector, the rail industry has restructured to take advantage of these changes as seen through various global mergers and acquisitions occurring in traditional and large rail manufacturing entities.

Many significant rail projects have been committed to in the coming years, with $20 billion allocated in the 2017–18 Federal Budget for investment in rail infrastructure to ease congestion and boost productivity.

Roadmap still on track

In 2012, the rail industry collaborated on the *On Track to 2040 – Preparing the Australian Rail Supply Industry for Challenges and Growth* Roadmap, which defined priority areas and the activities within each, to drive industry innovation.

The three areas originally defined – *Power and Propulsion, Materials and Manufacturing,* and *Monitoring and Management* – were subsequently amended and used as the Rail Manufacturing CRC's three key research theme areas.

Through consultations with the Centre's participants and the broader rail manufacturing sector during events such as the Rail Manufacturing CRC Participants Forums, and participation in key industry events, it is pleasing to note that the priorities and goals set are still seen as highly relevant and valuable to achieve for our industry.

Great achievements this year

The Rail Manufacturing CRC's industry participants have continued to support the Centre, with subsequent growth in projects and participant numbers. New participants to join the Centre in 2016–17 include:

- HEC Group
- Sydney Trains
- Knorr-Bremse
- Global Synthetics
- Foundation QA
- TrackSAFE Foundation
- UGL Rail

3

Years into six
years of operation

The Centre has also been working with inaugural industry participants to develop their commitment to future projects.

In addition to the large increase in new participants and the number of students being supported by the Centre, there has also been a number of project success stories in 2016–17.

None of these successes would be possible without the efforts of our Essential Participants, Other Participants, Third Party Participants and the Federal Government's Business Cooperative Research Centres Programme. Thanks also to industry organisations such as the Australasian Railway Association and the Advanced Manufacturing Growth Centre for supporting our Centre with invaluable information sharing, collaboration and participation throughout the year.

Paul Johnson MBE
Chair

Dr Stuart Thomson
CEO

About the Rail Manufacturing CRC

The Rail Manufacturing CRC began operations in 2014, with a focus to drive the development of new products, technologies and supply chain networks to enhance the competitiveness of Australia's rail manufacturing industry.

The Centre manages collaborative research and commercialisation partnerships between key stakeholders, such as rail manufacturing multinationals, innovative small-to-medium enterprises, leading research and development providers, industry peak bodies, and State and Federal Governments.

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

By turning research-based industry solutions into timely market innovations and products, the Rail Manufacturing CRC will support the development of technologies that will lead to new opportunities for Australian manufacturers.

Australian Government
Department of Industry, Innovation and Science

Business
Cooperative Research Centres Programme

Achievements

In its third year, the Rail Manufacturing CRC's research program has made solid progress across most of its projects, as well as signing up seven new Rail Manufacturing CRC projects and an additional 14 PhD projects under the Rail Innovators PhD Scholarships program in 2016–17.

The high degree of end-user collaboration within these projects is particularly pleasing, with another seven new participant organisations also joining the Centre.

The Rail Manufacturing CRC is also continuing its commitment to engaging with key industry groups to communicate the importance of rail innovation. Participation in numerous rail industry forums has enabled the Centre to develop key relationships with rail manufacturers, rail operators and government organisations. The Centre has participated in a number of joint industry briefings, conferences, forums and advisory groups, while also working closely with rail peak bodies, including the Australasian Railway Association (ARA).

Risks and impediments

The Rail Manufacturing CRC continues to work with its current and prospective participants to develop projects that will have significant positive impact to the organisations involved and the broader rail manufacturing industry as a whole.

Following the guidance of the overarching CRC Committee, the Rail Manufacturing CRC's Board and Management teams have taken steps in 2016–17 to revise the Centre's participant membership, to review and update the project portfolio, to continue consulting with its participants and to instigate new projects with current and new participants.

The Centre has subsequently focused on:

- growing the centre by increasing its number of industry participants
- developing new projects with its current and potential participants
- increasing its focus on passenger rail projects
- increasing its engagement with the postgraduate community via specialised competitive grants
- working with industry peak bodies, such as the Australasian Railway Association, to engage and inform the rail manufacturing industry through forums and industry groups.

28 essential
and Other Participant
organisations committed

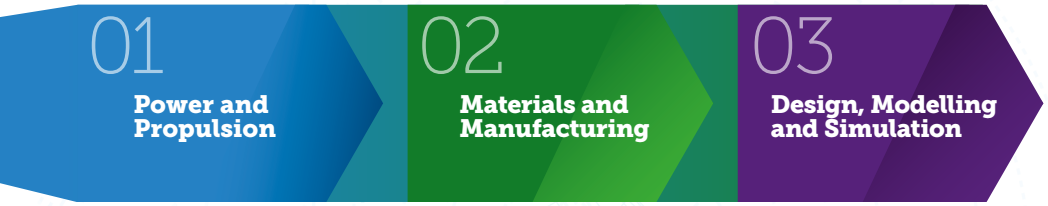
Rail Manufacturing CRC Projects underway during reporting period

Project #	Project	Participants
Research program area: 1 – Power and Propulsion		
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
R1.2.1	Propulsion of intelligent magnetically levitated track-vehicle	Simplex / Deakin University
R1.3.1	Supercapacitor energy management system	CRRC / CSIRO
R1.3.2	Supercapacitor development and scale up for manufacture	CRRC / CSIRO
R1.3.3	High energy supercapacitor development	CRRC / CSIRO
R1.3.4	Supercapacitor energy management system stage 2	CRRC / CSIRO
Research program area: 2 – Materials and Manufacturing		
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
R2.3.3	Manufacturing process for rolling stock fabrication	UGL / University of Wollongong
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
Research program area: 3 – Design, Modelling and Simulation		
R3.1.2	Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system	Downer / University of Technology Sydney
R3.2.1	Development of a responsive passenger information system for the Sydney Trains network	Sydney Trains / University of Technology Sydney
R3.3.1	Detection and monitoring on trains – feasibility study	Knorr-Bremse / University of Technology Sydney
R3.6.1	Experimental and computational study on the key ventilation issues affecting air quality and thermal comfort in train cabins	Airlinx / RMIT

Performance against activities

In the 2016–17 Financial Year, Rail Manufacturing CRC's Research Program has again made solid progress in its portfolio of projects underway and completed during the year.

The Centre's Research Program incorporates three key themes – **Power and Propulsion, Materials and Manufacturing,** and **Design, Modelling and Simulation** – which were originally defined (and tweaked) during the development of the *On Track to 2040 – Preparing the Australian Rail Supply Industry for Challenges and Growth* Roadmap in 2012.



Program 1 – Power and Propulsion

This research theme has the potential to significantly change the rail industry through the development and implementation of energy storage solutions utilising high energy density lithium ion batteries or supercapacitors.

Supercapacitors can charge and discharge very quickly for potentially 100,000 cycles, but don't have the ability to store much energy, so supercapacitor energy storage would traditionally be too bulky. There are a number 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 the tram stop platforms.

The Rail Manufacturing CRC has a number of related projects in this program area that are looking to address the challenge of increasing the performance of energy storage devices for use in rail applications. This includes research to increase cycle life in high energy density lithium ion batteries and to increase the energy density of supercapacitors through changes to cell chemistry.

This research area continued the excellent collaboration between China Railway Rolling Stock Corporation (CRRC) and CSIRO in Projects R1.3.1, R1.3.2, R1.3.3 and R1.3.4 to develop supercapacitor energy storage systems for rail applications. Work has also begun with HEC Group and the University of Technology Sydney in Project R1.1.1 to improve the performance of lithium ion batteries.

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. This is likely due to the integration of build-and-maintain agreements that span the life expectancy of the rolling stock, which support the need to efficiently maintain and service rail assets.

Six of the seven projects underway in this research area involve the durability analysis of critical rail componentry, where the performance of materials and systems in these projects enables maintenance programs to better match durability properties.

The development of accelerated durability testing of rail components at CSIRO in Project R2.3.1 will enable Knorr-Bremse to validate the high reliability requirements of equipment in a range of environments, with a test protocol developed during the reporting period.

Another project R2.3.3 investigated fabrication processes and was completed during the year. It will enable the industry participant UGL to assess processes for potential future builds.

This program area also includes two projects between Bombardier and the University of Queensland, both of which could significantly reduce maintenance and overhaul requirements.

Program 3 – Design, Modelling and Simulation

With Industry 4.0, automation, the internet of things and Virtual Reality gaining headlines over the last year, this theme focuses on the use of design and simulation techniques to model operations, develop more efficient processes and equipment solutions, and increase efficiency and extend asset life of rail systems.

Within this research theme, the University of Technology Sydney and Downer Rail are well advanced on Project R3.1.2 involving 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.

The interest in responsive passenger information systems resulted in project trials at rail operator sites in Sydney and Brisbane during the reporting period and an extension to the project to move the technology closer to commercial adoption in the rail industry.

Sydney Trains embarked on new Project R3.2.1 during the year to scope passenger information system technologies for use on its train network.

In Project R3.6.1, RMIT University and Airlinx are collaborating on the use of computational fluid dynamics to create simulated models to design improved ventilation systems. Based on the project outputs to date, the project parties have agreed to a three year extension which will double the project budget and enable the investigation of diffusor geometries for controlling airflow in rail cabins.

17 **Rail Manufacturing CRC** projects underway

Education and training

The Rail Manufacturing CRC is actively working to help develop the next generation of experienced postgraduate rail students. With less than one per cent of postgraduate students working in rail, it is vital to promote the industry as an attractive employment prospect, while also recognising the value that these highly trained students could bring to the industry.

A real success for the Centre in 2016–17 has been the development of new initiatives to increase the number of PhD students joining the Centre. These initiatives have included:

- ongoing funding of PhD students working on projects in the Rail Manufacturing CRC's project portfolio,
- selection of students to receive a Rail Innovators PhD Scholarship for aligned rail projects
- rollout of a new Internship work placement program for PhD students, initially being trialled in Queensland.

Thanks to these programs, the Rail Manufacturing CRC is currently supporting 22 PhD students in total, with six PhD students working on Rail Manufacturing CRC projects, 14 students receiving a Rail Innovators PhD scholarship during the past year and two students participating in the Queensland industry 12-week work placement internships. The delivery of these three initiatives would not be possible without the continued support of the Centre's university participants, who are driving real change in the rail industry.

With this large increase in students coming on board to the Centre in 2016–17 and 2017–18, the Rail Manufacturing CRC will be working to develop a schedule of professional and personal activities to support the students' development.

22 students

now financially supported

Current list of commenced PhD students – as of 30 June 2017

Student name	Project title	Research institute
Research program area: 1 – Power and Propulsion		
Zhang Yin	High energy supercapacitor development	Queensland University of Technology
Esteban Bernal Arango	Smart axle transducer transmitter for freight wagon condition monitoring systems	Central Queensland University
Research program area: 2 – Materials and Manufacturing		
Cameron Milne*	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
Chuhao Liu	The performance of stabilised ballast in rail tracks	University of Wollongong
Vu Trong Thien	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	Evaluating the suitability of laser cladded rail steel in heavy haul application	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
Research program area: 3 – Design, Modelling and Simulation		
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
Amir Eslami	Drive-by bridge inspection: the use of instrumented revenue wagons for structural health monitoring of rail bridges	Monash University
Yu Fung Lee	Nonlinear vibro-acousto-ultrasonic waves for fatigue cracking detection in key rail components	Monash University
Chi Hei Vong	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

* Student has withdrawn from the project as of 30 April 2017

Communications

The Rail Manufacturing CRC recognises the importance in delivering professional, timely and accurate information to its participants, the broader rail industry and interested parties using a variety of communication channels.

The Centre'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

Participant Forums

In addition to the key communication channel of the Centre's monthly newsletter, another priority channel in 2016–17 was running Participant Forum events, where current and potential participants were invited to hear the latest news and collaborate on key activities and issues impacting the rail industry as a whole. Two Participant Forums were held in the past 12 months – at Sydney in August 2016 and at Melbourne in May 2017.

Social Media

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

Participant Survey

A new evaluation activity beginning in July 2017 was the new annual Participants Survey, where an online survey sent to one key representative per participant organisation asked respondents to rate the performance of the Centre for 2016–17 across a variety of different factors, while also requesting suggestions for improvement in the coming Financial Year.

In the inaugural 2016–17 survey, over 71 per cent of respondents across 17 participant organisations reported they were satisfied or very satisfied with the collaboration between their organisation and the Rail Manufacturing CRC in the past year, while over 64 per cent also agreed or strongly agreed that the Centre's communications program was effectively managed.

Moving forward, the survey will be conducted annually each July as a key measurement of participant engagement.

Financial management

For the year ended 30 June 2017, the Rail Manufacturing CRC expended its financial resources on:

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

$42M
available to fund
rail innovation projects

Financial Performance

For the year ended 30 June 2017, the Rail Manufacturing CRC earned revenue of $4.48 million and other income of $0.13 million, and incurred expenses of $4.61 million, resulting in a $nil operating profit. Revenue of $4.48 million comprised $2.93 million of CRC Programme Funding from the Department of Industry, Innovation and Science and $1.55 million from Participants. Expenditure of $4.61 million included $3.27 million of Research costs, $1.05 million of Employee benefits costs and $0.29 million of Administration and depreciation expenses.

Research expenditure was $5.9 million lower than budgeted for the year, reflecting delays in securing and commencing projects and some timeline adjustments to existing projects.

Cash Flows

During the year, the Rail Manufacturing CRC received $9.04 million of operating cash inflows (inclusive of GST), consisting of $7.28 million from the Commonwealth CRC Programme, $1.65 million from participants and $0.11 million in interest receipts. Operating cash outflows totalled $5.17 million (inclusive of GST), consisting of $3.34 million of Research payments and $1.83 million of Administration payments.

There were no investing cash flows this year.

In-kind Contributions

Total in-kind contributions of $7.2 million for the year ended 30 June 2017 comprised $6.4 million of staff in-kind and $0.8 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 2017, Total Assets were $12.3 million and Total Liabilities were $12.3 million. Total Assets are comprised predominantly of Cash and Cash Equivalents of $11.8 million, Trade and Other Receivables of $0.2 million and Prepayments of $0.3 million. Total Liabilities was comprised of Deferred Revenue of $10.3 million, Trade and Other Payables of $2.0 million and Provisions of $0.04 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:

(i) source and secure $4.7 million of research contributions from new participants in order to match the Commonwealth's CRC research funding

(ii) agree and finalise research projects to the value of approximately $8.5 million with existing participants.

Board

CHAIR - PAUL JOHNSON MBE

DIP, MSC, MAICD.

INDEPENDENT DIRECTOR AND BOARD CHAIR SINCE 31 OCTOBER 2014.

CHAIR OF RMCRC RESEARCH AND DEVELOPMENT, AND REMUNERATION AND NOMINATIONS BOARD COMMITTEES.

BRONWYN CONSTANCE

FCPA, FAICD, FCIS.

INDEPENDENT DIRECTOR SINCE 31 OCTOBER 2014.

CHAIR OF RMCRC AUDIT AND RISK BOARD COMMITTEE.

DR STUART THOMSON

BSC, BSC(HONS), PHD, GCTMLP, GAICD.

EXECUTIVE DIRECTOR SINCE 20 MARCH 2015. CHIEF EXECUTIVE OFFICER SINCE 1 APRIL 2015.

MEMBER OF RMCRC RESEARCH AND DEVELOPMENT BOARD, AND RESEARCH AND DEVELOPMENT MANAGEMENT COMMITTEES.

MICHAEL MILLER

BEC, CA.

DIRECTOR SINCE 14 OCTOBER 2015 (INDUSTRY NOMINEE).

MEMBER OF RMCRC AUDIT AND RISK, AND REMUNERATION AND NOMINATIONS BOARD COMMITTEES.

PROF. GRANT STANLEY

BE(CHEM), PHD.

DIRECTOR SINCE 14 APRIL 2016 (RESEARCH AND DEVELOPMENT NOMINEE).

MEMBER OF AUDIT AND RISK, RESEARCH AND DEVELOPMENT, AND RENUMERATION AND NOMINATIONS BOARD COMMITTEES.

ALAN BEACHAM

B.ENG (HONS) C.ENG MIEE.

DIRECTOR SINCE 26 SEPTEMBER 2016.

MICHAEL MCLELLAN

B.ENG, POST.GRAD.DIP

DIRECTOR SINCE 26 SEPTEMBER 2016.

Management team

DR STUART THOMSON

BSC, BSC(HONS), PHD, GCTMLP, GAICD.

CHIEF EXECUTIVE OFFICER SINCE APRIL 2015.

DR LARRY JORDAN

BSC, MSC, PHD.

RESEARCH DIRECTOR SINCE AUGUST 2015.

SHELLEY BRESICK

ASSOC.DIP.

BUSINESS MANAGER SINCE SEPTEMBER 2015.

SHARON SALPIGHIDIS

BCOM, DIP.ED, CPA.

FINANCIAL CONTROLLER AND COMPANY SECRETARY SINCE SEPTEMBER 2016.

KATIE RIZZO

B. ARTS, GRAD.CERT.

COMMUNICATIONS MANAGER SINCE JUNE 2016.

PROF COLIN COLE

B.ENG, M.ENG, PHD.

PROGRAM LEADER SINCE APRIL 2015.

PROF PAUL MEEHAN

B.ENG(HON1), PHD.

PROGRAM LEADER SINCE MARCH 2017.

Participants

Essential Participants

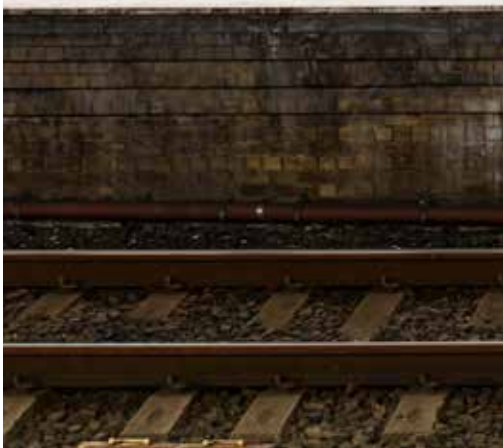
Participant name	Participant type	ABN	Organisation type
Bombardier Transportation Australia Pty Ltd	Essential	73 010 699 804	Large Industry
Central Queensland University	Essential	39 181 103 288	University
China Railway Rolling Stock Corporation (CRRC)	Essential	Not applicable	Large Industry
CSIRO	Essential	41 687 119 230	Australian Government
Deakin University	Essential	56 721 584 203	University
Downer EDI Rail Pty Ltd	Essential	92 000 002 031	Large Industry
Faiveley Transport Australia	Essential	41 000 611 898	Large Industry
Monash University	Essential	12 377 614 012	University
OneSteel Manufacturing Pty Ltd	Essential	42 004 651 325	Large Industry
Queensland University of Technology	Essential	83 791 724 622	University
Sigma Air Conditioning Pty Ltd	Essential	31 000 900 970	Large Industry
Simplex Factory Automation Pty Ltd	Essential	81 094 159 896	Individual SME
Swinburne University of Technology	Essential	13 628 586 699	University
The University of Queensland	Essential	63 942 912 684	University
University of Technology Sydney	Essential	77 257 686 961	University
University of Wollongong	Essential	61 060 567 686	University

Other Participants

Participant name	Participant type	ABN	Organisation type
Airlinx Heating and Cooling Pty Ltd	Other	28 094 691 791	Individual SME
Australasian Centre for Rail Innovation (ACRI) Ltd	Other	52 164 764 167	Other
Australasian Railway Association	Other	64 217 302 489	Other
Foundation QA	Other	78 090 519 289	Individual SME
Global Synthetics	Other	71 120 519 520	Individual SME
HEC Group	Other	18 165 129 260	Large Industry
Knorr-Bremse Australia Pty Ltd	Other	31 092 562 671	Large Industry
Royal Melbourne Institute of Technology	Other	49 781 030 034	University
Sydney Trains	Other	38 284 779 682	State Government
TrackSAFE Foundation	Other	98 155 604 872	Other
Tyre Stewardship Australia Ltd	Other	44 164 971 939	Individual SME
UGL Rail Services Pty Ltd	Other	58 000 003 136	Large Industry

Third Party Participants

Participant name	Participant type	ABN	Organisation type
Aurizon Network Pty Ltd	Third Party	78 132 181 116	Large Industry
Austrade	Third Party	11 764 698 227	Government
Industry Capability Network Ltd	Third Party	85 068 571 513	Government
Queensland Rail Ltd	Third Party	47 564 947 264	Large Industry
The State of Queensland (Department of Transport and Main Roads)	Third Party	39 407 690 291	State Government



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