

**Annual Report
2014-2015**





Vision

RMCRC will assist the Australian rail manufacturing sector to develop industry-led R&D solutions to industry-identified challenges, encourage innovation and foster increased engagement in the global supply chain.

Mission

RMCRC will assist the rail manufacturing supply chain to develop new technologies and products to increase productivity in the coming decades and to play a key part in attracting and supporting the next generation of highly qualified engineers and scientists to bring their skills and talent to the rail industry.

Strategic Intent

RMCRC will foster, sponsor and direct, collaborative research and commercialisation partnerships between key stakeholders in the rail manufacturing sector..



Business
Cooperative Research
Centres Programme

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Welcome to Rail Manufacturing CRC

As the Chair of Rail Manufacturing CRC since October 2014, it has been my pleasure to support RMCRC in its early stages of development from an industry-led concept to a fully functioning operation actively engaged within the rail manufacturing business and leading research organisations.

RMCRC supports the rail sector by developing new technologies and knowledge to enhance Australia's rail manufacturing capacity and competitiveness. Formed in 2014, RMCRC's members include innovative rail manufacturing leaders from Australia, Canada and China, innovative SMEs and key research providers.

I would like to recognize the work carried out in the formative stages of the CRC by the interim board led by my predecessor Mr Bruce Griffiths and the interim CEO, Dr Mark Trigg and his Research Manager, Mr Barrie Finnin. The current RMCRC board and management team are indebted to their vision and hard work.

We also equally acknowledge the vision of the Commonwealth Department of Industry, Innovation and Science and the former Minister for Industry, the Hon Ian Macfarlane in establishing the RMCRC. Funding for the CRC program is provided by the Commonwealth Government through the Business.gov.au Cooperative Research Centres Programme and matched with funding by its member participants.

Our vision for RMCRC is that it plays a leading role to assist industry to transform the global rail manufacturing supply chain through the use of innovation. To do this, RMCRC will foster, sponsor and direct, collaborative research and commercialisation partnerships between key stakeholders in the sector. We are also supported by and collaborate with industry peak bodies, and federal and state governments.

RMCRC's key focus is to provide research and development programs to support the ongoing growth of the Australian industry in three key technology areas: power and propulsion; materials and manufacturing; and design, modelling and simulation.

Additional RMCRC goals are to assist the rail manufacturing supply chain to develop new technologies and products to increase productivity in the coming decades, and to expand the roles of Australian industry in the global rail market.

In doing so, we will also contribute greatly to providing the next generation of highly qualified engineers and scientists to support the industry.

Globalisation

The Australian rail industry has always been exposed to the forces of globalisation. The sector has relied on international investment in developing and managing the rail infrastructure as a key pillar in Australia's transport, logistics and supply chain management.

Companies like Bombardier, Faiveley, GE, Siemens and others are leaders in transport innovation and offer opportunities for Australian industry to benefit from global supply chain integration and technological development and commercialization.

The sector's future in Australia heavily depends on the extent to which it can profitably integrate into global supply chains and international markets.

The signing of free trade agreements with the world's economic power houses such as China, Japan, South Korea and the USA offers new and exciting opportunities for capturing economic and strategic benefits and opportunities for Australia's rail industry and its key stakeholders.

The RMCRC therefore welcomes the involvement of a number of global companies as partners in the development of world class projects.

Productivity

Most would agree that the biggest risk to a country's growth prospects is low or declining productivity.

The Australian rail industry clearly understands that productivity improvements are an important source of economic growth and rising living standards and is actively looking for ways to fast-track improved productivity outcomes in what is a rapidly expanding global market.

“Most would agree that the biggest risk to a country's growth prospects is low or declining productivity.”

The fastest improving sectors of the British economy have been the manufacturing of planes, trains and automobiles. These sectors have benefited from investment in new technology, improved supply chain efficiency and better management.

Put simply, technological advances aided by collaboration between firms, universities and government in the UK have made manufacturing more efficient. Other countries such as Germany, the Netherlands and the US have exhibited the same benefits of such collaboration.

If Australia is to become a leading rail manufacturing exporter to this market then it must increase its productivity and competitiveness. The Rail Manufacturing CRC will work with industry to improve productivity through innovation which can lead to higher wages and more local jobs.

Innovation

One of the most pressing challenges facing the rail manufacturing industry has been our ability to translate great ideas into market innovations. That is, all the bright ideas in the world will not matter if we cannot transform those ideas into market driven innovations in a timely manner.

It is true to say that the rail industry in Australia has had mixed success in meeting the innovation challenges in domestic and international markets. However, we expect initiatives such as the Rail Manufacturing CRC to make a significant contribution to accelerating the process of capturing intellectual property developed in the CRC's collaborative environment and translating this as quickly as possible to the marketplace.

In our view, these innovations must be industry driven but also must be strongly underpinned by the best research and development institutions available in Australia.

Competitiveness

Australia's rail industry has been exposed to the forces of competition from road, sea and air transport operators over many decades. The industry's market share in urban and

regional infrastructure budgets has been declining as a result of under-investment and other factors that drive decision-making in transport and logistics policy.

The Australasian Railway Association (ARA) has been a major force behind gaining greater support for rail solutions in federal and state budgets. It has clearly articulated the importance of creating jobs and economic growth from continued investment in critical rail infrastructure and services throughout Australia by strengthening our freight networks, delivering major urban rail passenger projects and supporting local manufacturers, suppliers and contractors in the sector.

The Rail Manufacturing CRC will work closely with the ARA on increasing the competitiveness of the sector through innovation and productivity enhancement solutions.

As Chair, I look forward to working with all participants and stakeholders in the rail manufacturing sector to ensure RMCRC achieve our goal of making a significant contribution to the competitiveness, productivity and driver of innovation for the great Australian rail industry.



Paul Johnson
Chair – Rail Manufacturing CRC



About Rail Manufacturing CRC

Introduction

Rail Manufacturing CRC (RMCRC) supports Australia's rail sector by driving the development of new products, technologies and supply chain networks to enhance Australia's rail manufacturing capacity and competitiveness.

RMCRC's goals are to assist the rail manufacturing supply chain to develop new technologies and products to increase productivity in the coming decades, and to play a key part in attracting and supporting the next generation of highly qualified engineers and scientists to bring their skills and talent to the rail industry.

With a strong industry focus, RMCRC is committed to developing industry-led solutions to industry-identified challenges. Importantly, these innovations must not only be industry driven – but they must also be underpinned by the best research and development available in Australia.

The industry development strategy for rail manufacturing in Australia is set out in the roadmap for the sector outlined in *On Track to 2040*¹.

On Track to 2040 identified the need for a collaborative research entity dedicated to an innovation agenda for rail manufacturing. The bid for RMCRC was a direct consequence of this industry consensus.

RMCRC aims to assist industry to transform the global rail manufacturing supply chain through the use of innovation. To do this, RMCRC will foster, sponsor and direct, collaborative research and commercialisation partnerships between key stakeholders in the rail manufacturing sector.

RMCRC's formation

RMCRC came into existence on 20 June 2014 and has been funded by the Cooperative Research Centres (CRC) program of the Australian Government Department of Industry, Innovation and Science, to operate for 6 years.

Commonwealth funding of \$31 million is complemented by \$21 million in industry participant funding and 'in kind' contributions from both industry and Australia's leading research institutions. In total, RMCRC activities will result in investment of around \$100 million in total over the life of the CRC.

RMCRC is part of the Commonwealth CRC Programme which supports industry-led collaborations between researchers, industry and the community that puts science at the centre of industry policy.

RMCRC's members include rail manufacturing multinationals, innovative SMEs and key research providers. Our stakeholders include members from the rail manufacturing sector, leading research and development participants, industry peak bodies, and federal and state governments.

The formation of the Rail Manufacturing Cooperative Research Centre (RMCRC) comes at a critical time for both the rail manufacturing sector and the manufacturing sector as a whole. Global conditions are improving: the decline in the Australian dollar and the global economic conditions are providing greater opportunities for Australian manufacturers.

Within the rail industry sector, the need for both efficient utilisation of existing rail infrastructure and the need for new rail investment for both passenger and freight, provides a once-in-a-generation opportunity for the rail community to invest in new and emerging technologies to ensure Australia develops a world class rail system and maintains this capacity for the decades ahead.

These issues pertaining to the Australian rail supply industry have been given detailed consideration by the rail industry through the industry-led *On Track to 2040* forums that identified the opportunities and challenges facing the rail supply chain, and the need for ongoing innovation and collaboration. It is from this forums that the need for the RMCRC was identified, and the resulting, successful CRC bid was formed.

“The industry development strategy for rail manufacturing in Australia is set out in the roadmap for the sector outlined in *On Track to 2040*.”



¹ Department of Industry, Innovation & Science, *On Track to 2040 – Preparing the Australian Rail Supply Industry for Challenges and Growth*, 2012, downloaded at <http://industry.gov.au/industry/IndustryInitiatives/AustralianIndustryParticipation/SupplierAdvocates/Documents/OnTrackTo2040-Roadmap.pdf>

On Track to 2040 – the vision

“In 2040, the Australian Rail Supply Sector will be innovative and cohesive, having developed a strong sense of industry. This united industry will be capable of embracing change, enabling it to respond to international trends and achieve profitable growth on a local and global scale.”



On Track to 2040 – the Rail Supply Industry Roadmap

RMCR’s goals and R&D program themes are derived directly from the detailed work done in *On Track to 2040 – Preparing the Australian Rail Supply Industry for Challenges and Growth*, a project to map the future needs of the rail manufacturing sector in Australia, launched in 2012.

On Track to 2040 is a project commissioned by the former Department of Innovation Industry Science and Research (DIISR), through the Rail Supplier Advocate. The project was funded by the Commonwealth government; the state governments of New South Wales, Victoria and Queensland; and the Australasian Railways Association (ARA) on behalf of industry.

The *On Track to 2040* roadmap for rail manufacturing was developed through intensive collaboration between industry stakeholders, government and the higher education/ research sectors. It represents the consensus view of 210 industry participants from 110 organisations on the strategic pathway towards industry growth and sustainability.

With a sophisticated understanding of the challenges and opportunities for the sector, this strategic plan identifies the building blocks required to ensure rail manufacturing continues to play a key role in Australia’s economic future.

RMCR will pursue many of the actions identified in the Roadmap and build on the work done in *On Track to 2040* as a means to guide strategic investment in the industry and support knowledge transfer across industry and science-based disciplines.

On Track to 2040 identified 80 opportunities for technological development in the rail manufacturing sector. The list of 80 was then organised into broad themes and ranked into priorities by the industry.

RMCR’s three research themes are Power and Propulsion; Materials and Manufacturing; and Design, Modelling and Simulation.

Collaboration is at the heart of the CRC program and is an essential element in building innovation. Existing technological barriers will require smart, technology-based solutions to enable the rail sector to move forward and compete on in a global industry sector.

“The industry development strategy for rail manufacturing in Australia is set out in the roadmap for the sector outlined in *On Track to 2040*.”

Rail Manufacturing in Australia

The recently released Infrastructure Australia (IA) Audit Report outlines the importance of rail in responding to growing congestion in Australia’s cities which is estimated to cost \$53 billion by 2030.

The last four decades have seen significant challenges for the Australian rail manufacturing industry including the flow on effects of the decline of end-to-end locomotive and wagon production and the loss of accompanying skills and expertise associated with these industries.

However, while many traditional manufacturing processes have been off-shored, Australia has been able to maintain key R&D capabilities and know-how, which cover a vast majority of rail manufacturing processes. These are capabilities that continue to serve the industry well, ensuring it remains internationally relevant and sustainable.

As well as challenges, we have also seen many opportunities, with a number of Australian businesses developing niche product and service offerings, many through the use of innovation, for both domestic and international consumption.

A number of Australian businesses have also been able to thrive through the adoption of innovative and flexible business models. This represents a move to both the niche and smart manufacturing paradigm that accords with Australia’s strengths in high value, highly transformed manufacturing.

Advanced manufacturing includes the full suite of production – from concept, research and development and design – all the way through to post-production activities such as after-sales maintenance.

This paradigm shift signals significant opportunities for the local rail manufacturing industry to build capacity and sustainability domestically and to use this base demand as a means to develop export opportunities in the future.

One of the key drivers to unlocking this potential will be the implementation of innovation developed through ongoing research and development efforts.

While financial constraints are omnipresent, there are numerous examples from all market sectors that show the adoption of ongoing innovation programs separates market leaders from followers.

Without engaging in innovation, Australian rail manufacturing businesses will be restricted to competing in the global market on a price basis alone, while their smart competitors move forward into the advanced manufacturing future.

Although not impossible, competing primarily on price is much tougher and there is extensive evidence that participating in a price-based competition would lead to further reductions in Australia’s domestic rail manufacturing capacity.

RAIL MANUFACTURING SNAPSHOT

- » Australia’s rail network is the sixth largest in the world at around 33,000 route-kilometres
- » Passenger trips on heavy and light rail of 2.3 million per day or 16.4 million per week in 2013
- » Australia’s freight network carried around 1 billion tonnes of freight in 2013-14, an increase of 57% in four years, mainly in agriculture and resources
- » Rail Manufacturing and supporting infrastructure generate annual revenue of around \$4.2 billion per year and adding \$1.6 billion to the Australian economy
- » Rail Manufacturing employs 15,000 workers in 330 rail sector suppliers, of which, 90 per cent are small and medium-sized firms
- » Melbourne has the largest light rail network in the world

ACIL Tasman, *Railway Manufacturing Industry: A profile of the Railway Manufacturing Industry*, prepared for the Department of Innovation, Industry, Science and Research, July 2011.

While the past history of the rail manufacturing industry demonstrates the resilience of the sector, the immediate future requires unique choices to be made by rail procurers (government and operators), rail manufacturers, suppliers and research and development organisations.

These organisations represent the supply chain (and value chain) in Australia and choices made over the coming decade will essentially determine the long term future of the industry.

Advanced Manufacturing falls within the domain of the fourth industrial revolution, also known as Industry 4.0. Automation is driving radical change in the manufacturing sector, with claims that in 15 years' time the way products are manufactured will be altered by the widespread use of automation.

Australia's success in Industry 4.0 will depend on increased collaboration between research and industry and also within each of these sectors.

Australia currently ranks 81 out of the 143 OECD economies for innovation efficiency so there is great room for improvement. With our advantages of top-class research, great design, well-educated citizens, a strong small-to-medium enterprise community, and a terrific services industry – Australia is well placed to tackle the challenges of Industry 4.0.

Rail Infrastructure Investment outlook

The end-user environment for the rail manufacturing sector is largely positive, with continuing investment in the rail sector in Australia, both in passenger transport and freight.

Sector growth over the next five years will largely be driven by investment in passenger rail transport by state governments and maintenance services for rolling stock purchased during the mining boom.

Rail Manufacturing has received strong support from federal and state governments over many years through investments in new rail projects and upgrades to existing rolling stock across the country.

According to the Australasian Railway Association (ARA), the coming decades represent a 'golden age' for rail, with a number of significant investments due to be made by Australian state governments and increased optimism about federal funding for projects.

This forecast investment, as outlined in the report commissioned by the ARA and undertaken by Deloitte Access Economics, *Opportunities for Greater Passenger Rolling Stock Procurement Efficiency*² is likely to result in \$30 billion being spent by state governments on the procurement of rail passenger rolling stock to meet the ongoing demands of public transport and to replace ageing fleets over the next 30 years.

This creates significant opportunities for the local rail manufacturing industry to build capacity and sustainability domestically and to use this base demand as a means to develop export opportunities in the future.

The most recent *Australian Infrastructure Audit*³ conducted by Infrastructure Australia, found that the demand for national rail infrastructure is projected to grow, particularly in WA, Qld and NSW. WA accounts for 50 per cent of national rail freight value-add, due to mining in the Pilbara.

According to the IBISWorld *Industry Report into Railway Equipment Manufacturing and Repair in Australia*,⁴ the outlook for the rail manufacturing sector is positive, with industry revenue forecast to grow at an annualised 2.9% over the next five years to reach \$3.1 billion.

The Australian rail industry has always been exposed to the forces of globalization and there are currently a number of multinational companies based in Australia. For example, Bombardier Transportation, Downer EDI, China Rail Rolling Stock Corporation (CRRC), Siemens, UGL, Alstom, Faiverley, Knorr-Bremse are global leaders in transport innovation, including rail.

The presence of these global manufacturers in this country offers opportunities for Australian industry to benefit from participation in local supply chain integration, access to technological development and commercialisation opportunities.

With a number of key multinationals and SMEs participating in the RMCRC, there exists a developing network of rail transport suppliers that will likely result in new partnerships and Australian based, co-sponsored innovation.



² Deloitte Access Economics, *Opportunities for Greater Passenger Rolling Stock Procurement Efficiency*, 27 September 2013, <http://www.ara.net.au/UserFiles/file/Publications/130927%20ARA%20Rollingstock%20Final%20Report%20Rev%20F.pdf>

³ Infrastructure Australia, *Australian Infrastructure Audit*, 22 May 2015, <http://infrastructureaustralia.gov.au/policy-publications/publications/Australian-Infrastructure-Audit.aspx>

⁴ IBISWorld Industry Report C2393, *Railway Equipment Manufacturing and Repair in Australia*, May 2015, downloaded at: <http://www.ibisworld.com.au/industry/default.aspx?ind=257>

Executive Summary

CEO Report

It is my great pleasure to report on the Rail Manufacturing CRC and our achievements in 2014-15, our inaugural year of operation. Since being appointed as the CEO in April 2015, I have worked with the RMCRC Board and the interim management team to finalise the establishment of the CRC, implement the initial participant projects, and engage with our participants and the broader rail industry and research provider network.

Our Value

With outstanding research providers, our universities and government research organisations provide Australia with a stream of potential new technologies, capabilities and ideas, which offers our locally-based manufacturing businesses opportunities to embrace advanced manufacturing.

RMCRC will assist this process by fostering collaboration between industry and research providers. Furthermore, by providing a platform from which industry can participate in research projects, companies will have direct access to relevant R&D skills, R&D infrastructure, and resultant project intellectual property.

At the most fundamental level, RMCRC provides an interface between industry and our research providers, understanding the capabilities of both, matching industry needs with research capacity, and aligning expectations between all parties.

At a more sophisticated level, we provide an environment where industry can come together to discuss long term strategic issues and seek to pool resources to address key technology challenges, thereby reducing the risk to individual participants and providing industry with access to a pool of scientific and engineering experts.

RMCRC will ultimately play its part in developing and growing a more integrated rail manufacturing supply chain and assist in the identification of core expertise within both research organizations and rail manufacturing businesses.

As RMCRC progressively establishes itself, I look forward to working towards a more integrated manufacturing sector through interaction with our Business CRC community and the recently formed Commonwealth Government initiative, the Advanced Manufacturing Industry Growth Centre.

2014-15 - Our Inaugural year

The 2014-15 year was focused on embedding the key structures, governance models, and implementing RMCRC's strategic R&D plan, which will guide the RMCRC through its first years of operation.

The RMCRC's research strategy is defined through three key research program themes, identified as industry priorities which our projects are divided into:

- **Program 1:** Power and Propulsion
- **Program 2:** Materials and Manufacturing
- **Program 3:** Design, Modelling and Simulation

A number of key projects have been instigated and a second round of projects is expected early in the 2015-16 financial year.

Key milestones

The complexities of setting up a new organisation led to a delay in RMCRC meeting some of its early objectives as well as under spending against the budget. Despite these challenges the RMCRC continues to engage industry to identify research priorities and needs.

Ongoing negotiations are expected to result in a number of new participants joining RMCRC in 2015-16. RMCRC continues to work with its current and prospective participants to develop projects that will have significant impact for the organisations involved and the rail manufacturing industry in general.

To the future

Looking to the future, the manufacturing sector is about to undergo a significant revolution. With the advent of technologies like additive manufacturing techniques, automation, robotics, 3D virtual design and training

“RMCRC will assist this process by fostering collaboration between industry and research providers.”

platforms, vision systems, alternate energy production and storage, and new propulsion paradigms, the business of making complex components will significantly change the way we think about manufacturing.

In more traditional areas of manufacturing, the ongoing development of new materials, production automation, and asset condition monitoring, will create opportunities for providers to lower the future costs of manufacturing and servicing rail infrastructure. New materials are also likely to increase the lifetime and reduce the weight of rail vehicles and components, thereby creating a more sustainable and efficient rail system.

Last but by no means least, providing rail customers with new and innovative experiences through intelligent design and the introduction of new technologies will ultimately attract more people to use rail. By focusing on a better customer experience, smart technologies can ultimately assist the process of enticing commuters onto public transport.

With an array of developing technologies and widgets at our fingertips, Australian manufacturers have the opportunity to become early adopters of these new technologies, providing them with a first adopter market advantage and therefore, future export opportunities.

With so much potential in rail manufacturing, I look forward to working with industry, associated niche manufacturers and our highly capable research providers over the next five years.

Acknowledgements

I would like to acknowledge the efforts of a number of key individuals who devoted their time and energy in establishing the Rail Manufacturing CRC. These include past and present Board members, interim management and past employees. I would also like to thank the many rail companies and research organisations that supported the Rail Manufacturing CRC bid and continue to support the RMCRC, whether formally or informally linked to RMCRC.

During the initial start-up period, RMCRC appointed Dr Mark Trigg as interim CEO and Mr Barrie Finnin as interim Research Director to steer the RMCRC through its formation. Both left the centre during 2015 and I would like to thank both Mark and Barrie for their assistance in establishing RMCRC.

The interim management team was complemented by Ms Shelley Bresick as the interim Financial Controller, Mr Tony Carney as Business Development Director, and Mr Ordan Andreevski as Interim Communications Manager. All continued in these roles for the 2014-15 period of this report.

Finally, I would like to personally thank Mr Paul Johnson, RMCRC Chair, and Ms Bronwyn Constance, Chair of the Audit and Risk Board Committee, for their ongoing support and guidance.



Dr Stuart Thomson
CEO – Rail Manufacturing CRC



Achievements 2014-15

Research and collaboration

Rail Manufacturing CRC has achieved an industry sector mix of both global and domestic businesses and both multi-national and SMEs as industry participants.

In terms of global rail participants, RMCRC has secured the participation of a number of rail manufacturing businesses as industry sector participants. These include both Downer EDI and Bombardier Transportation who have market shares in the Australian Railway Equipment Manufacturing and Repair sub sector of 23.4% and 25.5% respectively.⁵ Furthermore, the newly formed CRRC (China Railway Rolling Stock Corporation) has also become an industry sector participant of RMCRC. CRRC is the world's largest rail manufacturing firm and their participation in RMCRC activities, along with Downer EDI and Bombardier, provides significant opportunities for our domestic participants to engage and collaborate with these global entities.

In addition, key global component suppliers such as Faiverley Transport and Sigma Air Conditioning (part of the Knorr Bremse group) have joined as centre participants, ensuring RMCRC has a broad range of manufacturing expertise to contribute to advanced technological research projects that can be commercialised and then taken to a global market.

The participation of global rail manufacturing companies also provides the potential for collaboration with Australian based SMEs, enabling companies like Simplex and Airlinx to be supported in developing new technologies while also having access to networks which can assist to provide partnering, collaboration and market opportunities.

RMCRC is playing an important role in communicating the importance of innovation through advanced manufacturing to the broader rail and transport sectors.

Partnering with organisations like the Department of Industry, Innovation and Science, the Innovation Capability Network (ICN), the Australasian Railway Association (ARA), Austrade, and various state government departments, RMCRC has been actively promoting innovation, education, research and development through a number of forums.

⁵ IBISWorld, ibid

These include:

- ARA & ICN 2015 Rail Suppliers Industry Briefings;
- Victorian Government Transport Discussion Roundtables;
- Australasian Railway Association networking events; and
- Meetings with SMEs and major rail sector companies.

RMCRC will also partner with the new Advanced Manufacturing Industry Growth Centre and through our joint efforts, will seek to further strengthen the rail manufacturing sector for the benefit of our industry sponsors.

All of these activities help to highlight the benefits both research and education can bring to the rail manufacturing sector specifically, but also the rail and transport sectors more broadly.

Commercialisation and utilisation

RMCRC's model for commercialization and utilization was developed in close consultation with its industry and research participants. The overarching principle is to support and facilitate industry led research outcomes in an independent manner.

As this annual report covers the results of RMCRC's inaugural year (2014-15), all projects currently being undertaken are in the initial phases of R&D. However, as noted above, all current projects have defined commercial outcomes and commercial and intellectual property terms and conditions have been determined prior to the projects starting.

Education and training

RMCRC will ensure that as the organisation grows and establishes itself that its education and training outcomes remain a key focus.

The CRC Program seeks to stimulate a broader education and training experience for postgraduate students to enhance their employment prospects, providing them with the skills needed to utilise research outputs and produce innovative end-user centric solutions.

Rail Manufacturing CRC is already supporting three PhD students and one undergraduate student in 2014-15. These numbers are expected to grow in 2015-16 as projects become established and new projects commence.

“RMCRC will assist this process by fostering collaboration between industry and research providers.”

Participants Forum

On 18 June 2015 RMCRC held its inaugural Participants forum. The objective of the day was to assemble a number of industry representatives and researchers to discuss RMCRC activities. The format adopted was to ensure the session was industry led. Industry attendees were provided with 30-45 minutes to present an overview of their companies and their key innovation needs during the morning sessions. As a follow up to the initial presentations, research providers presented responses to the industry presentations, outlining their individual capabilities in a 15 minute timeslot.

The objective of the forum was to exchange information pertaining to industry participant needs and provide research organisations with better insight into potential new projects and research themes.

To gauge participant feedback, RMCRC distributed a survey to participants. The outcomes of this survey showed that;

- 90% of respondents rated the forum very good
- All participants thought the forum was organised, with 80% indicating it was very well organized;
- 90% of respondents were Very likely or Extremely likely to attend the next forum; and
- 90% agreed the forum helped build closer ties between stakeholders.

RMCRC Official Launch

In an event marking the establishment of the new Rail Manufacturing CRC, an official launch for RMCRC was held on 21 July 2015 at the Bombardier Transportation site in Dandenong, Victoria, a flagship location of Australia's robust rail manufacturing industry.

RMCRC was pleased to have Hon Karen Andrews MP, the then Parliamentary Secretary to the Federal Minister for Industry and Science attend and give the keynote address. Ms Andrews spoke about the role of CRCs in facilitating industry sector relationships, both nationally and internationally, and in providing platforms for wider collaborations that integrate and strengthen the supply chain.



Managing Director of Bombardier Transportation, Mr René Lalande; Parliamentary Secretary to the Minister for Industry, Hon Karen Andrews MP; CSIRO Director of Manufacturing Flagship, Dr Keith McLean; RMCRC Chair, Mr Paul Johnson; Victorian Minister for Industry, Ms Lily D'Ambrosio; and RMCRC CEO, Dr Stuart Thomson at the official launch at Bombardier Transportation in Dandenong on 21 July 2015



Risks and impediments

Since commencing operations in mid-2014, RMCRC has progressively signed project agreements with research and industry participants but this has taken longer than anticipated. In addition, RMCRC has experienced the risks and impediments that any 'start up' organisation would experience in moving from funding announcement to full operation. Despite being in operation for a relatively short time frame RMCRC has been active in establishing projects and networks to achieve its goals.

Since the inception of RMCRC, a number of Essential Participant companies have undergone corporate restructures and mergers which has affected the start-up of planned projects. For example, CRRC (China Railway Rolling Stock Corporation) was formed on 1 June 2015 with the merger of China CNR Corporation and CSR Corporation Limited, which occurred after RMCRC had signed an agreement with China CNR. In addition, in July 2015, Wabtec Corporation announced an irrevocable offer to acquire RMCRC Participant, Faiveley Transport.

There have been some delays to completing Commonwealth output milestones with a project involving Rhombert Rail Australia and Getzner Werkstoffe GmbH being renegotiated with new participants following the original industry participants not proceeding with the project. A project with CRRC involving mechanical design of wagons has been delayed. The recruitment of PhD students in **Program 2** is also behind schedule with one PhD still being recruited.

In **Program 3** there is a delay to starting a project in software for evaluating wagon design which has delayed achievement of a milestone. Overall, three of the six Commonwealth Outputs due during the reporting period have been delayed due to the late start of projects as the CRC ramps up activities.

Ongoing negotiations are expected to result in a number of new participants joining RMCRC in 2015-16. RMCRC continues to work with its current and prospective participants to develop projects that will have significant impact for the organisations involved and the rail manufacturing industry in general.

End-user environment

According to the Australasian Railway Association (ARA), the coming decades represent a 'golden age' for rail, with a number of significant investments due to be made by Australian state governments and increased optimism about federal funding for projects.

This forecast investment, as outlined in the report commissioned by the ARA and undertaken by Deloitte Access Economics, *Opportunities for Greater Passenger Rolling Stock Procurement Efficiency*⁶ is likely to result in \$30 billion being spent by state governments on the procurement of heavy rail passenger rolling stock to meet the ongoing demands of public transport and to replace ageing fleets over the next 30 years.

This creates significant opportunities for the local rail manufacturing industry to build capacity and sustainability domestically and to use this base demand as a means to develop export opportunities in the future.

RMCRC's goals are strongly aligned with industry priorities which were identified in a detailed analysis outlined in *On Track to 2040 – Preparing the Australian Rail Supply Industry for Challenges and Growth*,⁷ a project to map the future needs of the rail manufacturing sector in Australia, launched in 2012.

The *On Track to 2040* roadmap for rail manufacturing was developed through intensive collaboration between industry stakeholders, government and the higher education/research sectors. It represents the consensus view of 210 industry participants from 110 organisations on the strategic pathway towards industry growth and sustainability.

RMCRC is confident that by pursuing the priorities identified in *On Track to 2040* that its strategic direction is aligned to the rail manufacturing industry sector and that projects undertaken will be of direct benefit to end-users.

⁶ Deloitte Access Economics, *Opportunities for Greater Passenger Rolling Stock Procurement Efficiency*, 27 September 2013, *ibid.*

⁷ Department of Industry, Innovation & Science, 2012, *ibid.*

“According to the Australasian Railway Association (ARA), the coming decades represent a ‘golden age’ for rail...”

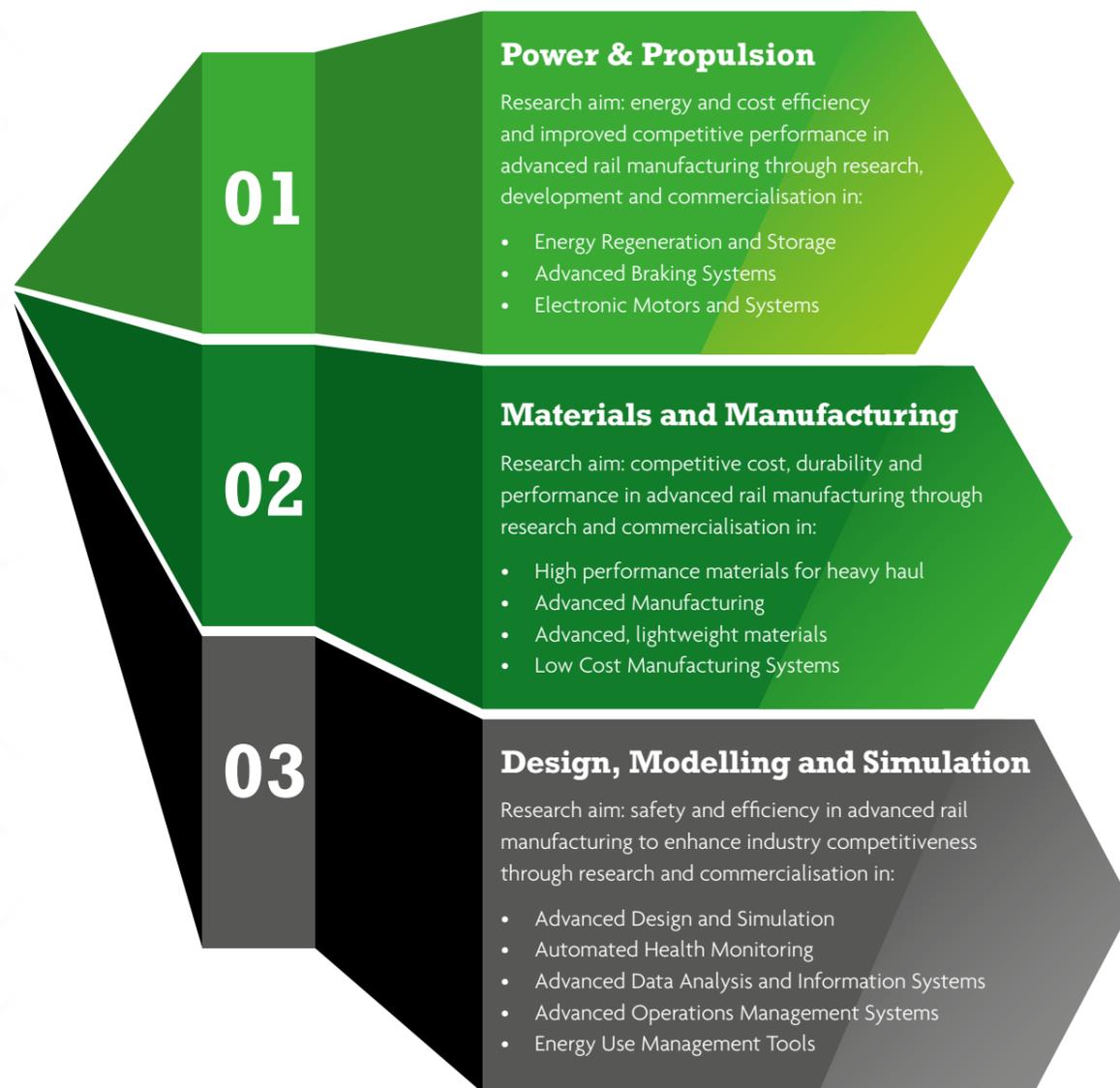
Impacts

Achievement of monetary impacts is largely dependent on increasing the number of projects conducted within the CRC in a timely manner. There have been some delays to project starts due to restructuring within a number of companies in the rail manufacturing sector, largely as a result of the winding down of the mining investment cycle.

However, RMCRC is well advanced in addressing the delays through engagement with rail manufacturing companies and a focus on the future opportunities that innovation delivers. The non-monetary impact of achieving the number of PhD graduates proposed is also tied to increasing the number of projects conducted within the CRC.



Research



Performance against activities

Summary

RMCR's research program launched during the reporting period with nine projects commencing across all three of RMCR's research themes.

The research objective of the **Power and Propulsion** program theme is to deliver energy and cost efficiency and improved competitive performance in advanced rail manufacturing. This will be achieved through research, development and commercialisation and commercialisation in energy regeneration and storage; advanced braking systems; and electronic motors and systems. In this program, four projects in energy storage and propulsion, related to catenary-free electric transport systems, commenced in the reporting period.

For the second program theme, **Materials and Manufacturing**, the research objective is to deliver competitive cost, durability and performance in advanced rail manufacturing. This will be achieved through research and commercialisation in high performance materials for heavy haul; advanced manufacturing; advanced, lightweight materials; and low cost manufacturing systems. Three projects in this research theme commenced during the reporting period. All three projects involve the durability analysis of critical rail componentry. The measurement and analysis of performance of materials in these projects enables performance under rail industry operating conditions to be better understood and for maintenance programs to more effectively match the durability properties of materials.

Finally, the third program theme, **Design, Modelling and Simulation** has the research aim of delivering safety and efficiency in advanced rail manufacturing as a means to enhance competitiveness within the rail industry. The projects will focus on research and commercialisation in advanced design and simulation; automated health monitoring; advanced data analysis and information systems; advanced operations management systems; and energy use management tools. Two projects commenced during the reporting period in which computer modelling and simulation is being used to improve the design of rail components and rail transport systems.

Program 1: Power and Propulsion

The development of robust and safe high-performance energy capture and delivery devices has progressed during the reporting period with projects commenced investigating the development and manufacture of high power density energy storage devices. Such devices will be used in conjunction with new generation batteries for passenger transport vehicles and are critical in commercialisation of new innovations such as high efficiency regenerative braking systems, 'catenary free' power systems and new electric propulsion systems.

A project to develop a prototype energy management system (EMS) using commercially available capacitors or batteries for a catenary-free electric tram system commenced and is complementary to the development of energy storage devices. The energy management system is required to enable the application of supercapacitors for catenary free trams that is safe and reliable and has many potential advantages, the most significant of which is the elimination of overhead wires to power the tram. The overhead wiring is expensive to install, increasingly considered to be unsightly, and is a maintenance item.

A propulsion project involving electric linear motors and magnetically levitated carriages in catenary-free systems research has also commenced.

Program 2: Materials and Manufacturing

The objective of the Materials and Manufacturing research program is to deliver competitive cost, durability and performance in advanced rail manufacturing.

In this Program the next generation of rail vehicles and structures will benefit from the development of low cost, lightweight materials with superior durability to improve the capacity of track, increase productivity and extend service life. Reducing the mass and increasing the load bearing capacity of the rolling stock will lead to an increase in the freight that can be carried, corresponding to a gain in productivity.

In this program three projects commenced during the reporting period. All three projects involve the durability analysis of critical rail componentry. The development of model based optimised maintenance techniques is a novel research contribution but also represents a showcase for the Australian rail manufacturing and maintenance industry. Development of improved rail steel grades and sleepers will improve the economic viability of the current rail product manufacturing facilities.

Program 3: Design, Modelling and Simulation

The objective of the Design, Modelling and Simulation research program theme is to deliver safety and efficiency in advanced rail manufacturing as a means to enhance the competitiveness of the industry.

This Program focuses on the use of design and simulation techniques to model operations to develop more efficient processes and equipment solutions to reduce

use of resources, increase efficiency and extend asset life of rail systems. This program covers automated health monitoring, advanced data analysis and information systems, advanced operations management systems, and energy use management tools

Two projects commenced during the reporting period. In the first project, using computer modelling, the airflow field and the temperature field in a high-speed train cabin will be precisely predicted. In addition, particulate contaminant concentration fields will be able to be visualized. Computer simulation could ease the cabin design tasks and give a reliable assessment of the exposure risk in a high-speed train cabin, thereby improving train air quality and thermal comfort.

In the second project, computer simulation will result in a set of recommendations for train dwell time analysis methods to improve passenger experience, boarding times, and thus operations as a whole.



“The objective of the Power and Propulsion research program is to deliver energy efficiency and improved competitiveness.”

Rail Manufacturing CRC Projects commenced during reporting period

	Program	Project number	Project	Participants
1	Program 1	R 1.1.2	Propulsion of Intelligent Magnetically Levitated Track-Vehicle	Simplex/Deakin
2	Program 1	R 1.3.1	Supercapacitor Energy Management System	CRRC/CSIRO
3	Program 1	R 1.3.2	Supercapacitor Development and Scale up for Manufacture	CRRC/CSIRO
4	Program 1	R 1.3.3	High Energy Supercapacitor Development	CRRC/CSIRO
5	Program 2	R 2.3.2	Axel-bearing Maintenance Optimisation	Bombardier/UQ
6	Program 2	R 2.4.1	Advanced Steel Development for Rail and Sleepers	OneSteel/Monash
7	Program 2	R 2.3.1	Accelerated Life Testing and Characterisation of Critical Components	Sigma/CSIRO
8	Program 3	R 3.1.2	Integrated Passenger Behaviour, Train Operations Diagnostics and Vehicle Condition Monitoring System	Downer/UTS
9	Program 3	R 3.6.1	Experimental and computational study on the key ventilation issues affecting air quality and thermal comfort in train cabins	Airlinx/RMIT

Commonwealth Milestone status at 30 June 2015

Project	Milestone	Due Date	Status
R 2.5.1	Report approved for feasibility study for Substructures for reduced vibration and enhanced stability including patent and literature landscape, performance benchmark and confirm approach in terms of technical and economic feasibility	30 Jun 2015	In progress. Industry partner not proceeding with contract. Under negotiation with new industry partners
R 2.7.1	Commencement of two PhD students	30 Jun 2015	In progress. One PhD student commenced. UQ advertising for second.
R 3.1.2	Report approved for feasibility study for advanced detection technologies for rail applications.	30 Jun 2015	Achieved
R 3.4.1	Report approved for feasibility study for Advanced software tool for evaluating mechanical design of wagons including patent and literature landscape, performance benchmark and confirm approach in terms of technical and economic feasibility	30 Jun 2015	In progress
R 3.6.1	Report approved for feasibility study for airflow simulation for light rail passenger vehicles including patent and literature landscape, performance benchmark and confirm approach in terms of technical and economic feasibility	30 Jun 2015	Achieved
R 3.7.1	Commencement of one PhD student	30 Jun 2015	Achieved

Education and Training

Rail Manufacturing CRC will ensure that as the organisation grows and establishes itself that its education and training outcomes remain a key focus.

The CRC Program seeks to stimulate a broader education and training experience for postgraduate students to enhance their employment prospects, providing them with the skills needed to utilise research outputs and produce innovative end-user centric solutions.

RMCR is already supporting three PhD students in 2014-15. These numbers are expected to grow in 2015-16 as projects become established and new projects commence.

Project 2.3.2: Axle-bearing Maintenance Optimisation

Cameron Milne is one of RMCR's PhD students enrolled at University of Queensland (UQ) and collaborating with Bombardier Transportation on a project in RMCR Program 1 to develop the materials used and the design of traction motor bearings on the Queensland New Generation Rolling Stock (QNGR) project.



Using mechanics-based modelling, UQ researchers – including Cameron – and led by Associate Professor Paul Meehan will undertake the research project to develop and test a new optimised predictive maintenance system for axle bearings.

Cameron commenced his PhD in January 2015 and he sees the industry-supported project as a great opportunity for him to extend his talent and experience in rail research, as well as an opportunity to contribute to the knowledge-base in the area of railway engineering.

During Cameron's undergraduate studies, he worked as a UQ Summer Research Scholar in 2010 and 2011 and contributed to the Rail Innovation CRC project on railway squeal, co-authoring two conference papers.

For his undergraduate thesis, Cameron developed a LabVIEW program to improve the instrumentation on the two-disk rolling contact test rig, used for the CRC rail corrugation and squeal projects. Cameron brings valuable field experience to his research project from his period working in the mining industry as a materials handling engineer and a project engineer following graduation with a Bachelor's degree in Mechanical Engineering from UQ in 2011.

UQ's research projects to tackle practical rail engineering problems through the application of advanced dynamical measurement and modelling systems neatly complements one of RMCR's three research themes namely, Design, Modelling and Simulation.

Research Participant University of Queensland has built a solid reputation as a research leader in the field of mechanical engineering – including detailed expertise in railway engineering – which is a valuable resource for RMCR's industry and SME partners.

The UQ-Bombardier collaboration is consistent with RMCR's goals of supporting innovation that has a direct impact on improving industry operational efficiency and reducing costs in the rail manufacturing industry.

Cameron Milne, UQ PhD student, (left)

Project 3.1.2: Integrated Passenger Behaviour, Train Operations Diagnostics and Vehicle Condition Monitoring System

Introducing UTS PhD students Alex Virgona (below, left) and Julien Collart (below, right)



University of Technology Sydney (UTS) PhD students Alexander Virgona and Julien Collart are currently working on an RMCR project under the supervision of UTS Faculty of Engineering and Information Technology Dr Nathan Kirchner and championed by Downer Rail. The project concerns passenger behaviour, train operations diagnostics and a vehicle condition monitoring system.

This project aims to model and monitor trains in real-time. This project is about improving service reliability at key stations and assist in increasing service numbers per hour. The project also aims to provide information to passengers through smartphone passenger information systems to assist them in managing train journeys.

Alex Virgona commenced his PhD with UTS Faculty of Engineering and Information Technology in September 2014 and Julien Collart commenced his PhD in February 2015.

Julien Collart is a PhD candidate at the UTS Centre for Autonomous Systems with keen interest in Robotics. He received his master's degree in 'Interactive systems and Robotics' from University Paul Sabatier (Toulouse, France). Through his studies he has built technical expertise in: software development; speech/image processing; micro-controllers; modelling tools; dynamic control; computer graphics; path planning; simultaneous localisation and mapping; and robotics control (arms, humanoids and mobile).



Currently Julien's research involves the development of an autonomous system capable of sensing and interpreting passenger behaviour and train events to infer the intentions of passengers in the urban rail environment. His research interests include machine vision, machine learning and prediction models

RMCR's second PhD student at UTS, Alex Virgona is interested in improving the quality and efficacy of interactions between humans and autonomous systems through the development of human sensing and perception technology.

Alex completed his Bachelor of Mechanical and Mechatronic Engineering at UTS in 2012, and for his final year capstone project worked with the RobotAssist group at the Centre for Autonomous Systems (CAS) at UTS to develop person recognition technology for their home-assistance robot. This work culminated in travelling with the team to compete in RoboCup 2011, in the home assistance stream of the competition. Following graduation he worked for a number of years as an automation engineer for Kalmar Automation, on their AutoStrad® vehicle control systems team, before returning to CAS to pursue a career in research.

Alex's current research focus is integrated passenger and vehicle awareness in transport environments. This research has its roots in human-robot-interaction and aims to apply concepts from machine vision, machine learning and behavioural science to develop human-aware transport infrastructure.

SME Engagement

In the rail transport sector, SMEs comprise 90% of rail manufacturing and maintenance companies and in the context of a devolved manufacturing supply chain, are an important element of the industry sector.

RMCR will foster engagement with SMEs through alliances, partnerships and joint ventures.

Recognising the importance of SMEs to rail manufacturing, RMCR has SMEs as industry participants.

Engagement with SMEs by RMCR is achieved by strategies including the following:

- Participation in one of RMCR's three program themes that were devised as a result of extensive industry consultation as part of the *On Track to 2040* project;
- Direct engagement with RMCR's CEO and key staff through participation in rail industry events and forums including AusIndustry and Austrade events; Australasian Railway Association and state government forums;
- Regular contact with RMCR's activities and progress through the RMCR Communications Strategy including monthly email newsletters; website updates and social media posts of relevant content.

During the reporting period RMCR had two SMEs participating in RMCR projects. These companies were Simplex Factory Automation Pty Ltd and Airlinx Heating and Cooling Pty Ltd. Simplex is an RMCR Essential Participant and is undertaking research in **Program 1**. RMCR is supporting a project entitled *Propulsion of Intelligent Magnetically Levitated Track-Vehicle*. The research seeks to develop new vehicle paradigms for rail applications.

Airlinx is currently undertaking research in **Program 3** with a project entitled *Experimental and computational study on the key ventilation issues affecting air quality and thermal comfort in train cabins*. The research seeks to model and understand key ventilation issues affecting quality and passenger comfort in rail cabins.

During the reporting period RMCR has been in direct contact with a number of SMEs and is currently working with these entities to develop potential programs with the centre. Furthermore, during our R&D consultations, RMCR has also been able to identify and match business to business opportunities for a number of SMEs through our understanding of participant's needs and SME capabilities. This latter example highlights an additional benefit of the networks RMCR is creating and highlights the additional capacity of RMCR to assist in integrating the broader rail manufacturing supply chain.



Results

Utilisation and commercialisation

RMCR's model for commercialisation and utilisation was developed in close consultation with its industry and research participants. The overarching principle is to support and facilitate industry led research outcomes in an independent manner.

RMCR's commercialisation and utilisation model is tailored to each project and is dependent on factors such as; the capacity of the participants to use and commercialise project outcomes, research and commercial inputs to the project, the benefit to Australia, the contributions of parties to intellectual property, and the commercial viability of the research outcomes.

The RMCR model creates several benefits. Firstly, it limits the number of organisations seeking input into commercial decisions, it ensures that the RMCR participants who invest in the project receive benefit from any commercial returns, it ensures RMCR has an independent role in project decision making, it ensures commercial and intellectual property matters are determined through transparent, upfront contractual negotiations, and it limits potential IP legacy issues that may exist once the RMCR is wound up.

As this report covers the results of RMCR's inaugural year (2014-15), all projects currently being undertaken are in the initial phases of R&D. However, all current projects have defined commercial outcomes and commercial and intellectual property terms and conditions have been determined prior to the projects starting.



Intellectual property management

RMCR Ltd is a company limited by guarantee. Hence, it has members rather than shareholders. RMCR's strategy is to transfer its technologies in the most efficient and effective manner to the rail industry and in particular, to its rail company members. RMCR does not seek to own intellectual property nor seek royalties from the technology it develops. What RMCR seeks to ensure is that the technologies its projects deliver provide maximum benefit to the project partners.

Upon completion of the projects, RMCR does not take a stake in project intellectual property. Ownership and use of the project intellectual property is defined during the development of individual project agreements between the respective project participants, ensuring that the process is transparent and beneficial to all participants.

“The overarching principle is to support and facilitate industry led research outcomes in an independent manner.”

Communications Strategy

Rail Manufacturing-CRC seeks to engage with both internal and external stakeholders through a range of tools to communicate RMCRC's goals, objectives, activities and outcomes to key stakeholders. To assist with this task, RMCRC has appointed a Communications Manager.

In accordance with RMCRC's Communications Policy and Social Media Policy [OPSI], and in accordance with the Commonwealth Agreement, the RMCRC Communications Manager will undertake communications activities to promote the work of the CRC.

As RMCRC is in the 'start-up' phase of operations, communications will have an emphasis on introducing the RMCRC and its research and industry participants, as well as communicating the goals and objectives of the CRC.

RMCRC also has a role to play in communicating the successes of the rail manufacturing sector and promoting the achievements of industry and research partners.

For the purposes of the Communications Plan, internal communication includes communication with Industry & Research Participants and external communication includes not only these stakeholders but also the manufacturing, industry, research, transport and government sector more broadly, as well as the general public.

Internal communications objective

- Ensure effective interaction within RMCRC industry and research participants to enable collaboration between researchers, stakeholders and across projects and staff;
- Ensure staff, students and industry participants are aware of programs, activities, results and outcomes;
- Building a culture of collaboration to ensure objectives and goals are achieved.

External communications objective

- In conjunction with industry and research participants, promote a positive outlook for the rail manufacturing sector in Australia;
- Enhance collaboration and application of research to benefit the rail manufacturing sector;
- Raise awareness of the benefits of collaboration between industry and research participants for the rail manufacturing sector;
- Engage with leading research and engineering students to encourage them to apply their skills to rail manufacturing challenges;
- Promote the successes of the Rail Manufacturing CRC.

Strategy

- Effective communication of RMCRC's objectives;
- Maintain strong personal relationships with research and industry participants and stakeholders with a commitment to the future of the rail industry in Australia;
- Provide industry, research and government stakeholders with regular, comprehensive updates about the progress of RMCRC's towards its goals and objectives.



Resources

Rail Manufacturing CRC Board

Chair - Mr Paul Johnson MBE, (Dip. Aircraft Design, MSc. Aircraft Design, MAICD) Independent director and Board Chair since 31 October 2014.



Experience and expertise: Paul has skills in executive management, R&D, engineering, business administration, transport industry expertise and experience as a non-executive director.

Mr Paul Johnson graduated Master of Science in Aircraft Design from Cranfield Institute of Technology (UK) in 1974. He was an Aircraft Artificer and then an Engineering Officer in the Royal Australian Navy for 22 years. Paul then joined the private sector and worked for General Electric (USA) including from 1994 as regional President for South Asia and Australasia. In 2003, Paul became Managing Director and CEO of Lockheed Martin Australia. From 2007 to 2011, Paul was also the Chair of the Australian Industry Group's Defence Industry Executive Council. Paul retired from Lockheed Martin in July 2011 and is currently a director on the Air Force Board, the South Australian Government Defence Advisory Board and the Board of Aerospace Australia Ltd (Avalon Airshow). Paul served as the Supplier Advocate for the Energy Resources sector and as Chairman of the Resource Sector Supplier Forum from 2012 to 2014.

Paul was awarded the MBE in 1980 in recognition of his contribution to the advancement of Naval Aircraft Engineering and is a Member of the Australian Institute of Company Directors.

Ms Bronwyn Constance (FCPA, FAICD, FCIS) Independent director since 31 October 2014. Chair of RMCRC Audit & Risk Board Committee.



Experience and expertise: Bronwyn has skills in financial management, business administration, manufacturing industry administration and expertise as a non-executive director.

Ms Bronwyn Constance has held many senior executive positions including finance director of Kraft Foods Limited Australia and New Zealand, Vice President Finance of Kraft Foods Asia, Executive General Manager Finance and Administration of Pasmenco Limited and finance director of Nylex Limited. She spent her early career with the ACI Group of companies. Ms Constance is an independent director and chairs the Audit and Risk Committee of the Defence Materials Technology Centre (DMTC) and CRC CARE Pty Ltd. Ms Constance is a former independent director of the Melbourne Market Authority, Plantic Technologies Limited, The Just Group Limited and the CRC for Advanced Automotive Technology.

Dr Stuart Thomson (BSc, BSc(Hons), PhD, GCTMLP, GAICD) Executive director since 20 March 2015. Chief Executive Officer since 1 April 2015.



Experience and expertise: Stuart has skills in business administration, executive management, IP, commercialisation, R&D and as an executive director.

Dr Stuart Thomson received his PhD in Physical Chemistry from the University of New South Wales, and subsequently worked in various research roles at UNSW, the Max-Planck-Institut für Kohlenforschung and the Australian Nuclear Science and Technology Organisations (ANSTO). Dr Thomson went on to be appointed Program Leader of an international safeguards research program at ANSTO and then was appointed Technical Development Manager at Note Printing Australia where he led NPA's development and design efforts for the next generation Australian banknote for the Reserve Bank of Australia. Dr Thomson has served as Chief Operating Officer at CRC Mining and Executive Director and Board member of the Grape and Wine Research and Development Corporation. He was recently appointed to the role of CEO and Managing Director of RMCRC. He holds qualifications in Science and Trademark Law and Practice, and is a graduate of the Australian Institute of Company Directors.

Mr Theuns Victor (BEng) Director since 31 October 2014. Member of Audit & Risk Board Committee.



Experience and expertise: Theuns has skills in engineering, executive business administration and expertise in manufacturing sector management.

Theuns has over 25 years' experience in the Australian and international manufacturing industry. A qualified Metallurgy engineer, specialising in Steel Manufacturing, he has held several senior management positions in Integrated Steelworks in South Africa and is currently the General Manager (GM) of the OneSteel Whyalla Steelworks, which is the only local producer of rails, steel sleepers and rail wheels. As GM, Theuns is responsible for approximately 1,600 employees and contractors producing 1.2 million tonnes of steel for the Australian domestic market, which generates sales of around \$1 billion per annum.

Dr Bruce Whan (BEng, PhD, FAICD) Director since 31 October 2014. Member of Audit & Risk Board Committee.



Experience and expertise: Bruce has skills in R&D, commercialisation, higher education sector expertise and as a non-executive director.

Bruce has in-depth knowledge and working experience of the importance of developing and planning research programs, the challenges of the innovation process, and of bringing the outputs of R&D through to successful commercialisation. Bruce's early career covered research, operations and management and was followed by a long career in the management and commercialisation of R&D. In his current role of Associate Director – Partnerships with Swinburne Knowledge, Bruce is responsible for all of the university's CRC involvements. He is also a director of CAST CRC Ltd.

Mr David Wynd (BEng, MEng) Director since 26 June 2014.



Experience and expertise: David has skills in executive business administration and expertise in engineering and manufacturing sectors.

David is the National Operations and Engineering Manager at Faveley Transport Australia and has over 15 years' experience in product development and industrialisation of technology for manufacture, including more than 8 years working with R&D suppliers on commercial projects. He also brings more than 6 years of rail industry project experience.

Mr Timothy Bentley Director from 31 October 2014 to 4 August 2015.



Experience and expertise: Timothy has skills in executive business administration and expertise in engineering and manufacturing sectors.

Tim is the Group Commercial Director at Downer Rail and has 30 years' experience in the rail industry including worldwide railway experience.

He served as an Independent Director of RMCRC from 31 October 2014 until 4 August 2015.

Governance

Directors' Meetings

The Board has met four times in the year as follows: 30 October 2014; 10 December 2014; 12 February 2015 and 9 April 2015.

During the reporting period ended 30 June 2015, the number of meetings of Directors held while each Director was in office, and the number attended by each Director, was as follows:

Name	Role	Appointed/Resigned	Number of meetings held while Director was in office	Number of meetings Director attended
Paul Johnson (Chair)	Independent	31/10/2014 – current	3	3
Bronwyn Constance	Independent	31/10/2014 – current	3	3
Theunis Victor	Onesteel Manufacturing (Industry Participant)	31/10/2014 – current	3	3
Bruce Whan	Swinburne University (Research Participant)	31/10/2014 – current	3	2
David Wynd	Faiveley Transport (Industry Participant)	26/06/2014 – current	4	3
Stuart Thomson (CEO)	RMCRC CEO	20/03/2015 – current	1	1
Timothy Bentley	Downer EDI (Industry Participant)	31/10/2014 – 4/08/2015	3	1
Andrew Spink	Bombardier Transportation (Industry Participant)	31/10/2014 – 27/03/2015	2	1
Bruce Griffiths	Interim Chair	20/06/2014 – 31/10/2014	1	1
Kong Hun Gan	CSIRO (Research Participant)	20/06/2014 – 31/10/2014	1	0
Amanda Bywater	OneSteel (Industry Participant)	26/06/2014 – 31/10/2014	1	0

RMCRC's Board is responsible to its Members and participants for the company's performance. The Board's election, composition, function and responsibilities are set out in the RMCRC Constitution and Participants Agreement. The Board sets RMCRC's company strategy and performance targets and it reviews and approves the policies and oversees the implementation of procedures to ensure RMCRC management meet the Board's objectives. The board meets at least quarterly for scheduled meetings.

The Company's Constitution requires that the Board include:

- up to four persons elected by a vote of the Industry Essential Participants;
- one person elected by a vote of the Research Essential Participants;
- up to three independent non-executive directors elected by a vote of Essential Participants; and
- the CEO.

The Chair is an independent director.

Key Staff to 30 June 2015

Name	Organisation	Position title	Time committed
Stuart Thomson	RMCRC	CEO (1/4/15 – current)	100%
Mark Trigg	RMCRC	Interim CEO (1/7/2014–31/3/2014)	100%
Shelley Bresick	RMCRC	Financial Controller	80%
Colin Cole	RMCRC	Program Leader	51%
Gary Savage	RMCRC	Program Leader	51%
Barrie Finnin	RMCRC	Interim Research Director	70%
Tony Carney	RMCRC	Business Development Director	50%

Committees

Audit and Risk Board Committee

The Audit and Risk Board Committee (ARBC) is a subcommittee of the Board which reviews and provides recommendations to the Board on financial reporting, statutory audit functions, internal control functions, risk management and compliance and governance. The ARBC is chaired by an independent non-executive director and its membership includes an industry representative director and a research provider representative director. The Committee met twice in the reporting period. The Committee members are; Bronwyn Constance (Chair and independent), Bruce Whan (research representative member), and Theunis Victor (industry representative member).

Remuneration and Nomination Board Committee

The Remuneration and Nomination Board Committee (RNBC) is Chaired by an independent non-executive director and its membership includes an industry representative director and a research provider representative director. The RNBC did not meet in 2014-15. The Committee members are; Paul Johnson (Chair and independent), Bruce Whan (research representative member), and Tim Bentley (industry representative member).

Research and Development Management Committee

The Research and Development Management Committee (MRDC) provides advice to the CEO on technical research areas and meets quarterly to discuss RMCRC's project portfolio with the appropriate research provider and industry representatives. The Committee met once in 2014-15. The Committee members are as follows; Larry Jordan (Chair and RMCRC Research and Development Director), Colin Cole (CQU and Program Leader RMCRC), Gary Savage (CSIRO and Program Leader RMCRC), Stuart Thomson (CEO).

Essential Participants



Collaboration

RMCRC continues to promote collaboration both within its R&D and education programs and through broader activities pertaining to the rail manufacturing sector. The inaugural research programs undertaken by RMCRC involve a number of collaborations between industry and researchers. Furthermore, a number of RMCRC projects are consulting or collaborating directly with rail industry operators to provide feedback or undertake trials using operator facilities.

Financial Management

RMCRC spent the majority of the period under review upon foundation issues, in terms of establishing its corporate structure and governance processes, securing funding agreements with the Commonwealth and industry participants, and commencing initial projects within each of its three key research programs. Being the first year of operation, comparatives to prior years are not applicable.

Taxation Status

RMCRC is in the process of preparing an application for recognition as a charitable organisation under Subdivision 50-B of the Income Tax Assessment Act 1998 and section 123E of the Fringe Benefits Tax Assessment Act 1986. The Directors expect the application to be successful, meaning the Company would be exempt from income tax, hence no provision for income tax has been made in RMCRC's accounts.

Financial Performance

Income earned during the period ended 30 June 2015 totalled \$2.6 million, consisting of \$2.0 million of CRC Program Funding from the Commonwealth and \$0.6 million from participants.

Expenditure of \$2.6 million during the period included \$1.3 million on research costs, \$1.3 million on administrative costs (inclusive of \$0.7 million of salaries and on-costs) and \$0.003 million of depreciation expense.

Cash Flows (inclusive of GST)

During the period RMCRC received \$3.9 million of operating cash inflows, consisting of \$3.6 million from the Commonwealth CRC Program and \$0.3 million from participants. Operating cash outflows of \$1.4 million related solely to payments to suppliers and employees. Payments to research providers did not commence until the quarter commenced 1 July 2015.

Investing cash outflows totalling \$0.02 million (excluding GST) were for the purchase of computer equipment for RMCRC staff.

In Kind Contributions

In-kind contributions of \$2.0 million to 30 June 2015 are non-cash contributions to RMCRC's research programs by research and industry participants and represent contributions of people, equipment and facilities.

Financial Position

As at 30 June 2015 Total Assets were \$3.0 million and Total Liabilities were \$3.0 million. Assets comprised Trade and Other Receivables of \$0.6 million and Cash and Cash Equivalents of \$2.4 million.

Liabilities largely comprised Trade Payables of \$1.6 million and Deferred Income of \$1.4 million.

Financial Issues

The key financial challenges from the current reporting period, which carry through to the next reporting period, are to:

- (i) secure \$5.45 million of research contributions from new participants in order to match the Commonwealth's CRC research funding; and
- (ii) agree and finalise research projects to the value of approximately \$8.25 million with existing participants.

Appendices

Essential Participants

Participant name	Participant type	ABN	Organisation type
Bombardier Transportation Australia Pty Ltd	Essential	73 010 699 804	Industry
Central Queensland University	R&D	39 181 103 288	Research
CRRC (China Railway Rolling Stock Corporation)	Essential	(Chinese company)	Industry
CSIRO	R&D	41 687 119 230	Government
Deakin University	R&D	56 721 584 203	Research
Downer EDI Rail Pty Ltd	Essential	92 000 002 031	Industry
Faiveley Transport Australia	Essential	41 000 611 898	Industry
Monash University	R&D	12 377 614 012	Research
OneSteel Manufacturing Pty Ltd	Essential	42 004 651 325	Industry
Queensland University of Technology	R&D	83 791 724 622	Research
Sigma Air Conditioning Pty Ltd	Essential	31 000 900 970	Industry
Simplex Factory Automation Pty Ltd	Essential	81 094 159 896	Industry
Swinburne University of Technology	R&D	13 628 586 699	Research
The University of Queensland	R&D	63 942 912 684	Research
University of Technology, Sydney	R&D	77 257 686 961	Research
University of Wollongong	R&D	61 060 567 686	Research

Other participants

Participant name	Participant type	ABN	Organisation type
Airlinx Heating and Cooling Pty Ltd	Other Industry	28 094 691 791	Industry
Australasian Railway Association	Other Industry	64 217 302 489	Industry Association
Australasian Centre for Rail Innovation	Other Industry	52 164 764 167	Research
RMIT	Other R&D	49 781 030 034	Research

Third Parties

Participant name	Participant type	ABN	Organisation type
Queensland Rail Ltd	Third Party	47 564 947 264	Industry
Industry Capability Network Ltd	Third Party	85 068 571 513	Government
Austrade	Third Party	11 764 698 227	Government

PhD Students

Name	Commencement date	Research Programme	Project theme	Project title	Degree	Research Organisation	Expected Completion Date
Cameron Milne	12/01/2015	RMCRC Project R 2.3.2 Axle-bearing Maintenance Optimisation	Materials and Manufacturing	UQ/Bombardier Project	PhD	UQ	12/01/2018
Alexander Virgona	29/08/2014	RMCRC Project 3.1.2: Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system.	Design Modelling and Simulation	UTS/Downer EDI	PhD	UTS	29/08/2018
Julien Collart	5/02/2015	RMCRC Project 3.1.2: Integrated passenger behaviour, train operations diagnostics and vehicle condition monitoring system.	Design Modelling and Simulation	UTS/Downer EDI	PhD	UTS	5/02/2019

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