



ALERTNESS  
SAFETY AND  
PRODUCTIVITY



Australian Government  
Department of Industry,  
Innovation and Science

**Business**  
Cooperative Research  
Centres Programme

# 2019 Annual Report



Alertness CRC Participants as at June 2019

Technology and Development End-Users



Industry and Employment End-Users



Policy, Regulatory and Insurance End-Users



Research, Education and Training



# Contents



<b>Message from the CEO</b>	<b>2</b>	<b>3 Resources</b>	<b>17</b>
<hr/>		<hr/>	
<b>1 Research</b>	<b>3</b>	Governance – Board, Committees and Key Personnel	18
<hr/>		Committees	21
Program One: Alertness Measurement, Testing and Prediction	4	Key Personnel	22
Case Study 1: Aiding alertness in night shift workers	5	Participants	25
Program Two: Safety and Productivity Improvements	6	Case Study 5: Parliamentary inquiry into sleep health awareness in Australia	27
Case Study 2: Lighting for alertness in correctional facilities	7	<b>4 Financial Management</b>	<b>28</b>
Program Three: Sleep Health	8	<hr/>	
Case Study 3: Lifting the lid on better sleep worldwide	9	<b>5 Appendices</b>	<b>31</b>
Education and Training	10	<hr/>	
Alertness CRC PHD Candidate an Award-Winner	10	Appendix 1: Publications	32
PhD, Masters and Industry Based Learning Program	11	Appendix 2: Education	36
Postdoctoral Training	11	Appendix 3: Provisional Patents filed	44
Industry Placement	11	Glossary	45
<b>2 Results</b>	<b>12</b>		
<hr/>			
Commercialisation	13		
Case Study 4: Crucial Road Safety Research	14		
Communications	16		

# Message from the CEO



The penultimate year of this unique consortium saw project teams focus on final stage activities across a portfolio of AlertSafe® technologies and key outputs:

- Delivery of two major product concepts in consumer sleep health management, with a novel insomnia treatment scheduled to follow in early 2020;
- Development of an individual shift work management tool on the back of extensive user testing and a sophisticated sleep wake management model;
- Establishment of an 'Early Adopter Program' and working group to promote best practice fatigue management in healthcare across a network of Australian hospitals, and to encourage the trial and evaluation of the advances in group work scheduling;
- Delivery of a prototype driver (roadside) alertness testing device completed, incorporating a fitness-to-drive algorithm based on eye movements that can measure impairment before, during, and after driving; and
- Discovery of a novel blood-based biomarker of sleep deprivation.

Work with the Sleep Health Foundation to promote sleep health as a national priority culminated in a Parliamentary Inquiry that highlighted the value of the CRC network in the development and translation of alertness management guidelines.

The Alertness CRC continues to leverage data collected during the heavy vehicle driver study to inform model-based scheduling parameters and to support the further validation of current and proposed alertness monitoring approaches.

A unique partnership with Versalux Lighting Systems has seen a range of research activities and feasibility work that has added significantly to the evidence base and facilitated the development of a new range of human-focussed lighting products.

A collaboration agreement with Qantas has the Alertness CRC assessing the impact of proposed long-haul flying routes on the alertness and sleep health of pilots and cabin crew.

Project activities during the reporting period have also been designed to ensure that enduring research infrastructure is created across the research nodes to: support the core data science and modelling capabilities; ensure ongoing access to well-described data sets; and, support the future development of Alertness CRC IP.

**Anthony Williams, CEO, Alertness CRC Ltd**



# 1

## Research

The focus of the research program continued to drive towards key product concepts across priority projects and sustainable transition arrangements that will further support the collaborative work of participant organisations.

The Research Committee provided expert oversight across the three program areas with the assistance of principal investigators, project leaders, industry representatives and research personnel.



## **Program One: Alertness Measurement, Testing and Prediction**

**Professor Shantha Rajaratnam,  
Monash University**

Research Program One continued to focus on the development and verification of tools to measure current alertness levels accurately, to predict the risk of future critical lapses and to intervene before poor alertness impairs productivity and safety.

### **1) Development of a new driver alertness test using ocular biomarkers**

Ocular measures of alertness can be used in developing a test for predicting alertness failure. The Alertness CRC has developed a prototype driver alertness testing device that incorporates a fitness-to-drive algorithm that can predict subsequent driving impairment and retrospectively detect prior driving impairment. This device will be further validated and tested in on-road driving studies in the future.

### **2) Identifying novel metabolomic biomarkers to form the next generation of sleep and alertness tests**

Novel biomarkers that track how long a person has been awake have been identified and are being validated in on-road driving studies to benchmark them against driving performance impairment. By the end of the CRC it is expected that the final set of biomarkers will be available for further validation as a clinical test of sleep-related impairment.

### **3) Building a personalised tool for shift workers to help plan and manage their sleep and improve alertness and wellbeing**

Following a proof-of-concept study in hospital nurses, the Alertness CRC has built a prototype app-based solution that helps shift workers to plan and manage their sleep around work and social commitments. The app includes monitoring, prediction and feedback elements, and was developed based on feedback from in-depth interviews with nurses. Following user testing, the app is currently being modified and a new prototype will be available in the next financial year for deployment and evaluation in healthcare and other occupational sectors.

### **4) Establishing a new framework for occupational shift work management**

A stakeholder working group has been established to facilitate the development of the policy and regulatory framework required to implement new AlertSafe® group rostering tools and personalised sleep management applications.



## CASE STUDY 1: AIDING ALERTNESS IN NIGHT SHIFT WORKERS



In March 2019, a study led by the Alertness CRC unveiled new information that could help night shift workers remain more alert while on duty.

Alertness CRC researchers examined 52 nursing and medical staff in an intensive care unit at Austin Health in Victoria as they worked on a variety of shifts – day, evening, and night. They found that if you can understand the individual timing of a worker’s body clock, you can better help them maintain alertness during night shift.

New knowledge on the impact of different shift types and the sleep-wake behaviour of healthcare shift workers was uncovered, which could inform potential methods of intervention to help people cope better with shift work.

The study also assessed the time course of alertness and performance during day and night shifts, specifically examining whether alertness is most impaired on the first night shift or after working several consecutive nights.

Staff reported their level of sleepiness and completed tests of reaction time and attention during day shift, on the first night shift, and after several consecutive night shifts.

Unlike many other similar studies, this study involved the collection of biological samples to assess the specific timing of individual staff’s circadian phase – the timing of their body clock – to examine the impact of this timing on changes in alertness and performance during a shift. Circadian timing varied considerably between individuals, and this timing was shown to influence sleepiness and performance during night shifts.

“We found that in rotating shift workers, early day shifts could be associated with similar sleep loss to night shifts, particularly when scheduled immediately following an evening shift. This is important to consider when designing shift schedules to optimise the sleep, alertness and the wellbeing of staff in any industry.”

DR TRACEY SLETTEN, PROJECT LEADER, ALERTNESS CRC



## **Program Two: Safety and Productivity Improvements**

Dr Andrew Tucker,  
Alertness CRC

Research Program Two is addressing how alertness can be maximised at the individual, workplace and community level to deliver measurable improvements in safety and productivity.

### **1) Development of a prototype of work/duty scheduling software system and scheduling guidelines for groups of employees**

In partnership with Melbourne-based optimisation software company, Opturion Pty Ltd, the Alertness CRC developed a world-first integrated implementation of AlertSafe® rostering. This software rostering system can assist work schedulers to adjust their rosters according to their constraints and optimisation requirements, which are then automatically classified from a fatigue risk perspective on an individual, team and enterprise basis.

Opturion has integrated model-based alertness calculation methods and best practice rostering rules with successful trials in the health and transport sectors. As a result, fatigue level and risk can be calculated for any sequence of shifts.

This technology has now been encapsulated into a flexible software developer kit (SDK) that enables software providers to offer sophisticated fatigue management in roster building, roster management, human capital management, and time and attendance systems. The SDK creates and integrates a custom module that calculates fatigue levels and warnings/maximum limits based on staff member, shift type(s), start time(s) and length(s). The warnings and maximum limits are configurable (with industry standard defaults available).

### **2) Development of lighting design tools and specifications to maximise alertness, safety and productivity**

#### **a. Lighting design software**

US-based Solemma LLC continues to promote the use of ALFA ('Adaptive Lighting for Alertness'; a world-first circadian lighting design software module) as part of its DIVA-for-Rhino (DIVA) 3-D Modeling Program tool suite. ALFA is helping architects, lighting designers and health professionals predict and control the way lighting works on the human senses, and is allowing lighting design approaches to configure different light combinations that will have predictable impacts on alertness, safety and productivity. ALFA is available directly from the Solemma website for evaluation and/or annual subscription (<https://www.solemma.com/Alfa.html>).

#### **b. Human centric product development guidelines**

In partnership with Versalux Lighting Systems and Monash University, the Alertness CRC is developing a set of human centric lighting guidelines to promote the circadian effects of lighting and inform product design concepts. Extensive feasibility studies and a review of the latest state-of-the-art scientific literature has enabled the development of product specifications for alertness-promoting and sleep-permissive/promoting capability into a single lighting fixture - resulting in a lighting engine with three variants (alerting, sleep-promoting, combination of both). Such capability is fundamental to help improve productivity and safety in indoor environments.

Together with Monash University and Versalux Lighting Systems, the Alertness CRC is planning a national research translation roadshow to educate target markets on the introduction of science-backed circadian lighting solutions to enable improved alertness, safety and productivity in the workplace and at home. Scheduled to begin from November 2019, the roadshow will initially educate audiences in Victoria and New South Wales on lighting for alertness, targeting markets including Aged Care, Hospitals (including mental institutions), Prison Cells/Juvenile Facilities, Drug Rehabilitation Facilities, Mining (including offshore), and Emergency Services.





## CASE STUDY 2: LIGHTING FOR ALERTNESS IN CORRECTIONAL FACILITIES



Considerable research is being undertaken that shows the impact of light on the human brain. While light is largely thought of in terms of vision, it serves powerful non-visual functions as well. For example, light can improve alertness and mood. On the contrary, it can also disrupt the body clock and interfere with sleep, resulting in poor function and mood.

In December 2018, the Alertness CRC in conjunction with participants Versalux Lighting Systems and Monash University ran a Melbourne-based workshop, “Lighting for Alertness in Correctional Facilities”, to explain how lighting requirements within correctional facilities are extremely diverse, and to educate the audience on the lighting parameters that most effectively reflect the latest scientific findings.

The workshop was delivered to around 30 key stakeholders including the Department of Justice, and covered topics such as lighting for alertness and mood enhancement, and sleep-permissive/promoting lighting.

The event was a precursor for a series of Roadshows that will be delivered by the Alertness CRC, Versalux and Monash University across selected Australian states in FY2019-20.



## Program Three: Sleep Health

Professor Ron Grunstein,  
Woolcock Institute of  
Medical Research

Research Program Three continues to develop new systems for phenotyping and managing patients with insomnia and obstructive sleep apnoea (OSA).

### 1) OSA Vulnerability to Alertness Failure (VAF) Phenotyping

Activities have focused on validating the laboratory VAF phenotyping approach against retrospective real-world outcomes of driving performance, safety, productivity, and healthcare costs, with the aim of developing a sleep laboratory alertness failure phenotyping toolkit that is readily deployable in clinical practice.

The toolkit will be able to identify patients who are at high or low risk of alertness failure with a high level of clinical significance. Biomarkers that include neurobehavioral, physiological and electrophysiological signals, as well as biological blood markers, have shown promising results and will be further explored over the next year as potential alertness failure biomarkers in OSA.

The analysis is ongoing and is nearing completion with robust prediction models set to be developed and appropriately validated.

### 2) The Insomnia Research Program

This program of research expanded in two main avenues. Firstly, three studies were completed on the newly-developed SleepFix® smartphone mobile application. The app uses an evidence-based behavioural therapy to treat insomnia, and the studies involved testing the prototype with users to evaluate its features. The evaluation was based on using the app in a small number of individuals with insomnia to determine if it would be acceptable, and using the refined SleepFix® app in a clinical trial evaluating the effectiveness to treat insomnia symptoms. The results were very promising, which led to work commencing on the development of a commercial version.

The second area of research used data science to explore insomnia phenotypes, based on electroencephalographic signals. Three insomnia phenotypes were identified, which have aligned objective and subjective features, thereby strengthening the validity of these classifications.

### 3) 'Sleep Companion' Project

This project has seen the development and testing of a decision support tool for the diagnosis of sleep disorders. Further progress was made in developing a series of focused questions that can tie in to objective diagnosis.

Commercialisation agreements have since been developed with Philips and testing of the 'SmartSleep Analyzer™' tool has commenced in the United States.



### CASE STUDY 3: LIFTING THE LID ON BETTER SLEEP WORLDWIDE



As part of the work with industry and other partners from the Alertness CRC, sleep experts at Flinders University are stepping up their research commitment on efforts to help improve the lives of the millions of people worldwide suffering from common sleep disorders.

A project led by the Alertness CRC has seen the formation of a collaborative team at Flinders University to tackle specific sleep issues. The team includes experts from the revamped Adelaide Institute for Sleep Health (AISH) in Flinders' College of Medicine and Public Health and researchers from the Medical Device Research Institute (MDRI) in Flinders' College of Science and Engineering, together with sleep physicians, specialists and other experts – including Chief Scientific Officer at Philips, Dr David White.

By combining clinical, physiology, psychology and engineering expertise, the AISH and MDRI teams are ideally placed to design and translate novel and practical diagnostic and treatment approaches to address the major burden of sleep problems in the community.

Together, they strive to develop better models of care, and to see GPs, nurses and other health professionals skilled in recognising and dealing with sleep disorders in a constructive way.

“At Philips, we see an opportunity to leverage advanced technology, coupled with scientific and consumer insights, to deliver solutions that improve people’s health and drive differentiated outcomes across the health continuum. In this research partnership with the Alertness CRC, we have a mutual interest in helping consumers all over the world to improve their sleep.”

DR DAVID WHITE, CHIEF SCIENTIFIC OFFICER, PHILIPS

## Education and Training

The Alertness CRC Education Program is designed to include PhD, Masters and Degree students as well as Early Career Researchers (ECRs) in all aspects of the collaborative process, including direct contact with industry partners and providing funding support for their industry

placements. Our Education Committee oversees the selection, training and interaction of students and postdoctoral awardees in the context of their institutional opportunities for training and professional development.



### Alertness CRC PHD Candidate an Award-Winner

In late 2018 Alertness CRC and Monash University PhD Candidate Lauren Bulfin was awarded a Nurses Memorial Centre Scholarship, to support her efforts to improve the management of fatigue in shift working doctors and nurses.

Such scholarships are awarded to nurses and midwives completing postgraduate studies in Australian Universities. They encourage the advancement of the nursing profession through education.

Specifically, Lauren – who is a Critical Care Nurse at Monash Health – was presented with the Betty Jeffrey Award. The award is given to a nurse undertaking research that has the potential to make significant improvement to the community and the nursing profession.

Lauren's project has the potential to make significant improvement to the care provided by medical and nursing staff in Intensive Care Units (ICUs). She is working with her Supervisors from the Monash School of Nursing and Midwifery, as well as from the Alertness CRC and Monash University, to investigate the impact of evidence-based scheduling practices for medical staff on medical errors in the ICU.

“Managing fatigue is critical for shift workers. Our findings could have a real positive impact on the medical and nursing profession, and ultimately the community. I'm honoured to have received this scholarship, which is supporting both my education and driving positive outcomes in the community.”

LAUREN BULFIN, ALERTNESS CRC PHD CANDIDATE

## PhD, Masters and Industry Based Learning Program

PhD student recruitment has increased by three students, with 24 PhD students now active. Eight theses were submitted this year, with eight more being prepared for submission in the following year.

The Alertness CRC also retained its support for the Industry Based Learning (IBL) Program and, working with Swinburne University, has assisted a total of 16 IBL students to date.

## Postdoctoral Training

Twenty-seven postdoctoral fellows remain involved in 22 research projects across the three research programs. Of these postdoctoral fellows, 13 are Alertness CRC Project Leaders facilitating project planning, execution, and the regular review and reporting of project status, playing a critical role in managing the collaboration across project parties.

## Industry Placement

Alertness CRC industry participants who have provided opportunity for our PhD students include Philips Respironics in the US and The Netherlands, Metabolomics Australia (part of the Bioplatforms Australia Network), Cogstate Pty Ltd, Austin Health, and Seeing Machines Ltd.

Students have also worked closely with the Alertness CRC's service providers and other third-party organisations, specifically in the areas of device development and software application design, gaining valuable industry-related knowledge outside their fields of expertise.



# 2 Results

## Commercialisation

The Alertness CRC has developed a portfolio of project outputs that continues to drive the following commercialisation initiatives:

- Circadian Lighting Design Software:**  
 ALFA 'Adaptive Lighting for Alertness' software, which incorporates the 'non-visual' (alerting, circadian) effects within the lighting design process. The product is currently available for free evaluation/annual subscription directly from Solemma.com and the company has conducted two ALFA training courses in New York and San Francisco, primarily for lighting designers, architecture firms, and academia.
- Sleep Health Management Decision Support Tools:** An accurate and evidence-based sleep health assessment algorithm that has been customised for integration into applications that diagnose users' sleep complaints and recommend appropriate treatment options. The algorithm is currently being commercialised by Philips Respironics through a new digital consumer sleep health management approach announced by Philips at the Las Vegas Consumer Electronics Show in January 2019. The Alertness CRC decision support algorithm is driving the sleep health screening process with an initial pilot test of the system being conducted with commercial partner Walgreens in the US. The service connects customers to a range of healthcare providers with whom Walgreens has partnered, including telemedicine companies, digital-enabled house call companies, and more traditional providers. Consumers access the service via a link on a Philips webpage that launches a web-based questionnaire, with results returned to the consumer via the webpage. Philips provides a problem list to the consumer along with personalised sleep tips and solution recommendations.
- Personalised Sleep Health Management:**  
 The Alertness CRC has two major product concepts in development: a novel insomnia treatment approach, and a system that provides personalised and adaptive sleep health advice and feedback for individuals with variable sleep times imposed by shift work. This shift work tool is based on a sophisticated sleep wake management algorithm that draws on the Alertness CRC model of arousal dynamics to provide adaptive recommendations for individual users. The algorithm is linked to a mobile application that presents optimal sleep wake management recommendations and countermeasures in the context of other work and lifestyle constraints.
- AlertSafe® Rostering:** A world-first integrated implementation software to automate and optimise rostering based on constraints/preferences is being commercialised by Australian SME and Alertness CRC participant, Opturion Pty Ltd. The Roster Builder Software & Software Developer Kit (SDK) incorporates work hours reference guidelines and the Alertness CRC model of arousal dynamics. Rostering outcomes are classified from a fatigue risk perspective on an individual, team and enterprise basis. The SDK offers sophisticated fatigue management in roster building, roster management, human capital management, time and attendance systems, and there is an opportunity to package with sleep health management applications for enterprise-based business models. We've also worked through our broader stakeholder network to establish an 'Early Adopter Program' to facilitate access to the new AlertSafe® roster tools for an initial 12-month trial.
- Fatigue Risk Management:** The Alertness CRC has extensively validated an algorithm to measure and predict alertness state, based on measures captured by ocular monitoring devices, for the purposes of determining fitness-to-drive or performing of work duties. Initial prototype development and validation has commenced for an ambulatory driver-operator eye-tracking device for roadside (fatigue management) assessment.

- **Alertness and Circadian Biomarkers:**  
A blood-based test for sleepiness has been developed and extensively validated in the laboratory in collaboration with Metabolomics Australia, with support from other key Alertness CRC stakeholders including the Victorian Transport Accident Commission. This metabolite-based approach is a world-first, with significant implications for future fatigue risk management both at the roadside and in the workplace. The algorithm shows a very high level of accuracy and will now be further validated in the field before being considered for road safety initiatives and accident investigation.
- **Dynamic Lighting Solutions:** In collaboration with Versalux Lighting Systems and Monash University, the Alertness CRC has been working to develop a dynamic lighting solution designed to deliver improved worker health, safety and productivity through better sleep. The work has included extensive feasibility studies to develop evidence-based alerting (blue-enriched) and sleep-promoting (blue-depleted) lighting specifications for optimum workplace lighting solutions and flexible 'smart' lighting systems with user interaction capability. To introduce these new products and evidence-based concepts to the market, the Alertness CRC is sponsoring a series of roadshows in the last quarter of 2019 and early 2020, to educate the market on the importance of lighting and how lighting can be used to promote healthy sleep, general health and wellbeing, and to introduce the new ground-breaking science-backed Versalux BioGen™ Lighting Systems.



## CASE STUDY 4: CRUCIAL ROAD SAFETY RESEARCH

On 15 April 2019, the National Transport Commission (NTC) and the Alertness CRC released the results of a world-first study into heavy vehicle driver fatigue.

The two-year study evaluated alertness monitoring technology and the impacts of work shifts on driver alertness. It analysed shift start time, the number of consecutive shifts, shift length, shift rotation, rest breaks and their likely impact on driver drowsiness and fatigue. The research involved a study of more than 300 heavy vehicle driver shifts both in-vehicle and in a laboratory, as well as 150,000 samples of retrospective data.

It was found that slow eye and eyelid movements, longer blink duration and prolonged eye closure are reliable predictors of drowsiness and fatigue. It also confirmed the scientific link between alertness and drowsiness patterns associated with specific work shifts for heavy vehicle driving.

NTC Chief Executive Officer Dr Gillian Miles said these findings will inform future fatigue policy as part of the NTC-led review of the Heavy Vehicle National Law (HVNL).

The Alertness CRC conducted the research as part of a wider collaboration including the NTC, the Australian Government, Transport for NSW, Austin Health, Monash University, the Institute for Breathing and Sleep and the heavy vehicle industry.

**“This is critical new evidence that will ultimately help to decrease heavy vehicle fatigue risk at a time when the nation’s freight task is expected to double by 2030.”**

DR GILLIAN MILES, CHIEF EXECUTIVE OFFICER, NTC



## Heavy Vehicle Driver Fatigue Research Key Findings

Greatest alertness levels can be achieved under current standard day driving hours for shifts starting between 6am – 8am including all rest breaks.



### Greatest risk of an increase in drowsiness occurs:



**of day driving**  
(when a driver starts a shift before 9am).



**of night driving**  
(when a driver starts a shift in the afternoon or evening).

After **5** consecutive shifts

when driving again for over 13 hours.

When a driver undertakes a **backward shift rotation** (from an evening, back to afternoon, or an afternoon back to a morning start)



During nose-to-tail shifts where a

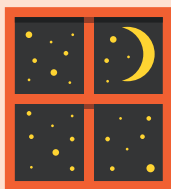
**7** hour break only enables

**5** hours of sleep,

a duration previously associated with a three-fold increased risk for motor vehicle accidents

When driving an early shift that starts **after midnight and before 6am**

After long shift sequences of more than **7** shifts



During the first 1-2 **night shifts** a driver undertakes and during long night shift sequences

## Communications

The Alertness CRC continued to undertake several communications and media activities to promote our progress across the research, translation and commercialisation activities. Consortium representatives presented at national and international conferences and events covering key topics such as lighting for improved health, personalised sleep health, shift work management for improved workforce performance and wellbeing, and fitness for work and roadside testing.

In its first year, the WorkAlert® website received almost 3,000 visitors, with almost 10 per cent of these visitors having navigated to the workplace scheduling solutions section. The lighting solutions and personalised sleep health management sections were also popular with website users.

The following major stories appeared on websites, including our own, as well as within industry magazines.

News item, "[Woolcock Named World's Best in Field](#)". The article was prepared by end-user participant The Woolcock Institute of Medical Research, and celebrated the new global rankings that placed the institute 52nd in the world for research excellence in the field of specialist sleep and respiratory health.

News item, "[PhD candidate awarded Nurses Memorial Centre Scholarship](#)". The article was prepared with Alertness CRC PhD student Lauren Bulfin, who was awarded a Nurses Memorial Centre Scholarship that would potentially enable her to better manage fatigue in shift working doctors and nurses.

Media release, "[Eye-tracking technology tests whether drivers are too tired to get behind the wheel](#)". The release was prepared in collaboration with end-user participants Seeing Machines and Monash University as part of a promotional campaign for the ASA Conference 2018.

Media Release, "[Sleep study findings could aid alertness in night shift workers](#)". The release was prepared in collaboration with end-user participants Austin Health and Monash University, and unveiled new information that could help night shift workers remain more alert while on duty.

Media Release, "[SA lifts the lid on better sleep worldwide](#)". The release was prepared in collaboration with end-user participants Philips and Flinders University, and focussed on novel and practical diagnostic and treatment approaches to address the major burden of sleep problems in the community.

Media Release, "[World first in fatigue research](#)". The release was prepared in collaboration with end-user participant the National Transport Commission (NTC), and communicated the results of a world-first study into heavy vehicle driver fatigue.



# 3

## Resources

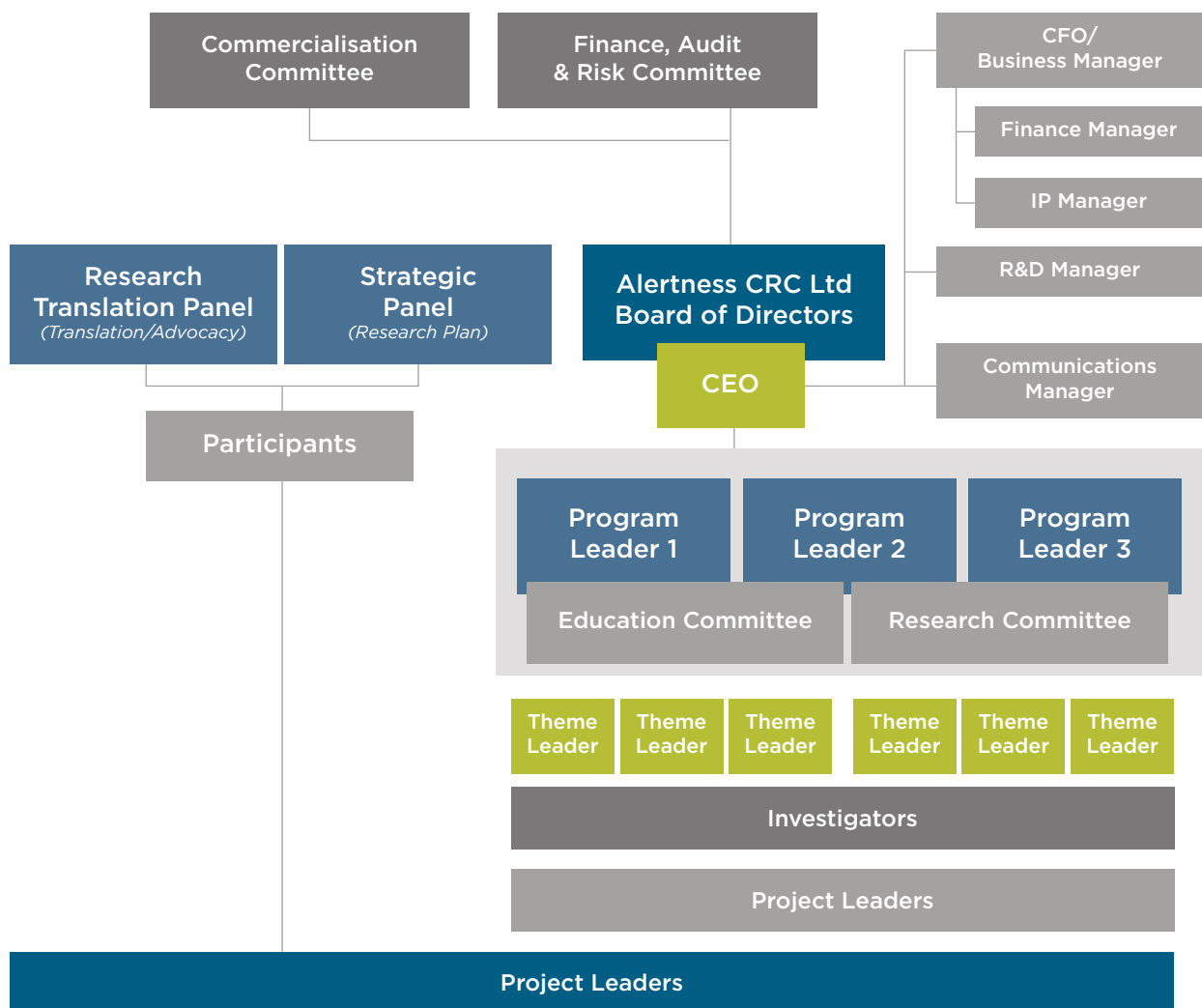
Our research and development collaboration remained focused on innovation and commercialisation with strong governance and access to an extensive array of industry and academic expertise.

## Governance – Board, Committees and Key Personnel

### The Board

The Governance structure of the Alertness CRC is represented in Figure 1.

Figure 1: Alertness CRC Governance Structure



The Board of Alertness CRC Ltd comprises four independent directors led by Chair, Deena Shiff. This year, Ian Farrar retired as Member of the Board and Chair of the Finance, Audit and Risk Committee, effective 31 March 2019. The Board subsequently appointed Ms Jan Bingley as Chair of the Finance, Audit and Risk Committee, who commenced in this role on 31 March 2019. Further details of our board members can be found in Table 1, and the dates of board meetings and attendance by board members can be seen in Table 2.

**Table 1: Board Members**

<b>Name</b>	<b>Role</b>	<b>Key skills</b>	<b>Independent/ Organisation</b>
Deena Shiff	Chair	Deena Shiff, B. Sc (Econ) Hons; B.A. (Law) Hons, has had a senior executive and a legal career and has held senior roles in the public sector. Deena served as a Group Managing Director at Telstra Corporation between 2005 and 2013, during which time she led the Wholesale Division, established Telstra's Business Division and was the founding CEO of Telstra's corporate venture capital arm, Telstra Ventures. Prior to that, Deena was a Partner at Mallesons, in house corporate and regulatory counsel at Telstra, and a senior executive and adviser on legal and social policy reforms for the Australian Government. Deena chairs the global board of BAI Communications Ltd, is the Chairman of the Supervisory Board of Marley Spoon AG, and is a director on a number of boards including ASX listed Appen, Infrastructure Australia and Opera Australia.	Independent
Anthony Williams	CEO	Anthony Williams, B. App. Sci., MPH, is a research and development professional with extensive experience and a proven track record in clinical research and business development. Anthony has expertise in research management, financial modelling, corporate governance, intellectual property management and contract development. He has extensive project management, communication and negotiation skills. He has worked in the area of sleep and alertness for over twenty years and has developed extensive networks and relationship across industry and academia, both in Australia and internationally.	Independent

Name	Role	Key skills	Independent/ Organisation
Ian Farrar (Retired 31 March 2019)	Board Member	Ian Farrar, B. Comm, ANU; FCPA; FAICD; FCIS, has extensive experience in research management. For over 20 years he held a number of senior executive positions in CSIRO, Australia's premier research organisation. These included Senior Principal Advisor (Special Projects) and General Manager (Corporate Resources). In 1992 he was appointed Chairman/CEO of the Joint Coal Board which had responsibility for monitoring the health and welfare of NSW coal miners. He chaired the JCB Health and Safety Trust which funded research in the health and safety area. He is also a member of the Advisory Board of the Climate Change Institute at the ANU.	Independent
Jan Bingley	Board Member	Jan Bingley, Bbus (Accounting); RTTP; ACSA; CPA; FAICD, has more than 17 years of experience in the financial sector, including 11 years at the Sydney Futures Exchange, where she managed research and business analysis for market and product design projects, including that of a 'carbon credit' market. In 2000 Jan formed Universal Carbon Exchange Ltd with three partners, which was active in facilitating funding in Australia for technologies promoting green energy and coupling those projects with secured carbon credits. Jan joined CSIRO in 2004 where she headed up CSIRO's Business Development and Commercialisation team and was responsible for developing commercialisation strategies involving IP protection, culminating in a wide range of transactions involving equity and commercial licensing. Jan left CSIRO in 2015 and has undertaken a number of consulting roles since then with a full-time executive role with the Global CCS Institute where she was responsible for business development and developing their 5-year strategy to transform the Institute to a more commercial operation. Jan has been a board member of several spin-out companies, was a board member of Commercialisation Australia and was on the Executive Committee of Knowledge Commercialisation Australasia. She is currently on the federal government's Entrepreneur's Program Committee and is on the Investment Committee for TankStream Ventures - a Sydney-based seed investing firm.	Independent

Table 2: Board of Director Meetings, 2019

Name	Number of meetings eligible to attend	Number attended
Deena Shiff	4	4
Anthony Williams	4	4
Jan Bingley	4	4
Ian Farrar (Retired on 31 March 2019)	3	2

## Committees

The Finance, Audit and Risk Committee (FAR) and the Commercialisation Committee continue to oversee activities of the Board.

The FAR Committee meets biannually and was chaired by Ian Farrar until his retirement on 31 March 2019. It is now chaired by Jan Bingley who immediately assumed the role. The Committee's primary functions are to review the appropriateness of the Alertness CRC's:

- i. Financial planning;
- ii. Performance reporting;
- iii. System of risk oversight and management;
- iv. System of internal control;
- v. Risk management framework (monitoring), and making recommendations to the Board on changes to the framework;
- vi. Recommendations to the Board on the appointment, assessment and removal of external auditors, and oversee their independence;
- vii. Recommendations to the Board on the approval of annual audited financial reports;
- viii. Annual review and approval of the external audit fees, plans and their audit scope;
- ix. Monitoring of the internal control environment and procedures designed to achieve compliance with laws, regulations, internal standards and policies; and
- x. Overseeing of compliance with statutory and other legal requirements.

The Commercialisation Committee continues to ensure that the Alertness CRC demonstrates impact in the field through the commercialisation of its outputs and measurable economic benefit to Australia. Following the retirement of Ian Farrar on 31 March 2019, the oversight of the Commercialisation Committee was placed directly under the purview of the Board chaired by Deena Shiff, allowing for Jan Bingley to be appointed as Chair of the FAR Committee with immediate effect. Terms of reference include:

- i. Assessing the commercial value of project proposals;
- ii. Setting performance milestones;
- iii. Identifying industry partners to attach to a project;
- iv. Offering mentoring or business support by arrangement with specialists within participating universities and relevant partners;
- v. Reviewing proposed commercialisation structures and returns for Alertness CRC project parties; and
- vi. Making recommendations to the Alertness CRC Board regarding resource allocation to project activities.

## Key Personnel

Alertness CRC key personnel are listed in Table 3.

Alertness CRC operations continued to be managed by the CEO with the assistance of the CFO/Business Manager, Research & Development Manager, Finance Manager, Communications Manager and Intellectual Property Manager.

The CEO also chairs a Management Committee with the Research Program Leaders, who met monthly during the reporting period to ensure direct communication between the executive and research teams. This Management Committee remains supported by the Alertness CRC's Education Committee and Research Committee.

The Research Committee is chaired rotationally by the Program Leaders. All Program and Theme Leaders met routinely to discuss and resolve issues in relation to the research plan and associated activities.

The Education Committee, which is comprised of representatives from the three university participants, met quarterly during the year. They approved the award of scholarships or top-up stipends to the students, and ensured that the students' research projects were relevant to the objectives of the Alertness CRC.

**Table 3: Alertness CRC Key Personnel as at 30 June 2019**

Name	Organisation	Position/Role
Anthony Williams	Alertness CRC Ltd	CEO
Wee Mong Wong	Alertness CRC Ltd	CFO / Business Manager
Andrew Tucker	Alertness CRC Ltd	General Manager Research & Development
Susan Waterer	Alertness CRC Ltd	Communications Manager
Jenna Teh	Alertness CRC Ltd	Finance Manager
Leo Lai	Alertness CRC Ltd	Intellectual Property Manager
Ron Grunstein	Woolcock Institute of Medical Research	Program Leader
Shantha Rajaratnam	Monash University	Program Leader
Clare Anderson	Monash University	Theme Leader
Doug McEvoy	Southern Adelaide Local Health Network	Theme Leader
Karen Reynolds	Flinders University	Theme Leader
Mark Howard	Institute for Breathing and Sleep / Austin Health	Theme Leader
Mark Wallace	Monash University	Theme Leader
Svetlana Postnova	The University of Sydney	Theme Leader



Name	Organisation	Position/Role
Peter Robinson	The University of Sydney	Chief Investigator
Sean Drummond	Monash University	Chief Investigator
Bradley Edwards	Monash University	Site Investigator
Andrew Vakulin	Flinders University	Project Leader
Bryn Jeffries (Resigned)	The University of Sydney	Project Leader
Christopher Gordon	The University of Sydney / Woolcock Institute of Medical Research	Project Leader
Peter Catcheside	Flinders University	Project Leader
Tracey Sletten	Monash University	Project Leader
Anna Clark	Monash University	Project Leader
Michelle Magee (Resigned)	Monash University	Project Leader
Jennifer Cori	Institute for Breathing and Sleep	Project Leader
Katy Jeppe	Monash University	Project Leader
Fabio Ramos	The University of Sydney	Co-investigator
Maree Barnes	Institute for Breathing and Sleep / Austin Health	Co-Investigator
Nathaniel Marshall	The University of Sydney / Woolcock Institute of Medical Research	Co-investigator
Sean Cain	Monash University	Co-investigator
Sherry Randhawa	Flinders University	Co-investigator
Angus Wallace	Flinders University	CRC Engineering Lead
Nicole Lovato	Flinders University	Sleep Trial Lead
Stuart Knock	The University of Sydney	Key Reseacher
Rosalinda Polivka	Institute for Breathing and Sleep	CEO
Alan Dormer	Opturion	CEO
Leslie De Koninck	Opturion	Chief Technology Officer

# Resources

Name	Organisation	Position/Role
Andreas Maihoefer	Philips Respironics	Product Management & Strategic Marketing
Bill Gausa	Philips Respironics	Chair of Alertness CRC Strategic Review Panel & Clinical / Advance Innovation Leader
Birpal Sachdev	Philips Respironics	Senior Manager Advanced Innovations
Brent Bellinger	Philips Respironics	Marketing, Advanced Innovations
Chris Owens	Philips Respironics	Project Manager
Chris Wilhite	Philips Respironics	Senior Consumer Marketing Manager
Craig Oaks	Philips Respironics	Senior Architect
David White	Philips Respironics	Chief Medical Officer
Edouard Gebski	Philips Respironics	Creative Lead
Eline de Graaf	Philips Respironics	Marketing Director
Mark Aloia	Philips Respironics	Global Lead Behaviour Change
Mary Beth Navarra-Sirio	Philips Respironics	Innovator & Senior Executive Leader
Matt Hogan	Philips Respironics	Senior Manager, Project Management
Mike Colbaugh	Philips Respironics	Senior Staff Innovator
Monica Bush	Philips Respironics	Senior Global Product Manager
Nancy Bullock	Philips Respironics	Program Director
Noah Papas	Philips Respironics	Clinical Project Manager
Sara Sibenaller	Philips Respironics	Project Manager
Sharon Baer	Philips Respironics	Director of Advanced Innovation
Sreeram Vissapragada	Philips Respironics	Product Manager
Stefanie Bristol	Philips Respironics	Strategic Alliances and Partnerships
Todd Patterson	Philips Respironics	Global Director of Consumer Advertising

Name	Organisation	Position/Role
Victoria Wytcherley	Philips Respironics	Senior Manager, Digital Marketing
Walt Grumski	Philips Respironics	Senior Product Manager
Mike Lenné	Seeing Machines	Chief Scientific Officer, Human Factors

## Participants

The Alertness CRC concluded the year with 32 Participants, all of whom are listed in Table 4.

**Table 4: Alertness CRC Participants**

No	Participant Name	Participant Type	ABN/ACN	Organisation Type
1	Austin Health	Essential	96 237 388 063	State Government
2	Australian Sleep Trials Network	Other	88 002 198 905	Other
3	Australian Salaried Medical Officers Federation	Essential	56 536 563 722	Other
4	Bioplatforms Australia Limited	Essential	40 125 905 599	Other
5	BUPA Foundation (Australia) Pty Ltd	Essential	67 113 817 637	Industry/Private Sector
6	Cogstate Pty Ltd	Other	80 090 975 723	Industry/ Private Sector
7	Commonwealth Scientific and Industrial Research Organisation	Other	41 687 119 230	Australian Government
8	Electrolight Pty Ltd	Other	93 288 579 088	Industry/Private Sector
9	Fatigue Management International	Other	UK company registration 06431894	Industry/Private Sector
10	Grey Innovation Pty Ltd	Other	14 083 304 214	Industry/Private Sector
11	goACT Pty Ltd	Other	28 142 877 049	Industry/Private Sector
12	Institute for Breathing and Sleep	Essential	39 093 685 879	Other
13	International Council on Mining and Metals	Essential	UK based	Industry/Private Sector
14	Monash University	Essential	12 337 614 012	University
15	National Transport Commission	Essential	67 890 861 578	Australian Government

No	Participant Name	Participant Type	ABN/ACN	Organisation Type
16	Neuroscience Research Australia	Other	94 050 110 346	Other
17	Optalert Australia Pty Ltd	Other	79 121 747 591	Industry/Private Sector
18	Opturion Pty Ltd	Other	13 146 662 053	Industry/Private Sector
19	Respiroics Inc - A Phillips Healthcare Company	Essential	24 008 445 743	Industry/Private Sector
20	Roads Corporation (VicRoads)	Other	61 790 960 480	State Government
21	Seeing Machines Limited	Other	34 093 877 331	Industry/Private Sector
22	SmartCap Technologies Pty Ltd (f.k.a. EdanSafe Pty Ltd)	Other	61 094 352 959	Industry/Private Sector
23	Solemma LLC	Other	US based	Industry/Private Sector
24	Southern Adelaide Local Health Network	Essential	14 227 133 467	State Government
25	The Defence Science and Technology Group of The Department of Defence	Other	68 706 814 312	Australian Government
26	The Flinders University of South Australia	Essential	65 542 596 200	University
27	The Sleep Health Foundation	Essential	91 138 737 854	Other
28	The University of Sydney	Essential	15 211 513 464	University
29	Transport Accident Commission	Essential	22 033 947 623	State Government
30	Versalux Pty Ltd	Other	68 005 911 802	Industry/Private Sector
31	Woolcock Institute of Medical Research	Essential	88 002 198 905	Other
32	WorkSafe Victoria	Essential	90 296 467 627	State Government



## CASE STUDY 5: PARLIAMENTARY INQUIRY INTO SLEEP HEALTH AWARENESS IN AUSTRALIA



PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA

### Bedtime Reading Inquiry into Sleep Health Awareness in Australia

House of Representatives Standing Committee  
on Health, Aged Care and Sport

It has been estimated that approximately 7.4 million Australians do not get enough sleep. Inadequate sleep can impact on a person's health, wellbeing and productivity, as demonstrated by Deloitte Access Economics who assessed the health system costs associated with inadequate sleep to be approximately \$1.8 billion in 2016-17.

After a coordinated campaign of lobbying and representations by the Sleep Health Foundation and the Australasian Sleep Association, the national parliamentary Standing Committee on Health, Aged Care and Sport announced an inquiry into sleep health awareness in Australia and formally invited the Alertness CRC to make a submission to the Committee.

The submission was coordinated through the Alertness CRC's Research Program Leadership and provided to Committee Chair Mr Trent Zimmerman MP on 18 October 2018. In addition to the submission process, the Alertness CRC was also formally invited to appear at a roundtable public hearing at Parliament House in February 2019 for the Committee's inquiry.

The Federal Government Report on the Inquiry into Sleep Health Awareness was tabled in Parliament on 4 April 2019. Notably, the Alertness CRC was referenced several times within the report, with key recommendations suggesting that Safe Work Australia and the Alertness CRC provide updated guidelines (based on current research and science) for industries using shift work, regarding optimal shift structures and other workplace practices that promote alertness and productivity, and ensure worker safety.

The background features a blurred image of financial documents with various line graphs and data points. A large, dark blue number '4' is prominently displayed in the center, surrounded by two overlapping light blue circular outlines. The overall aesthetic is professional and data-oriented.

# 4

## Financial Management

During the 2018-19 financial year, the Alertness CRC received total cash contributions of \$3.820 million. Of the total cash received, 54% was provided by the Commonwealth through the CRC funding agreement, 38% was received from participant organisations, and the remaining 8% was made up of other revenue from third party participants (7%) and interest income (1%), as shown in Figure 2.

Figure 2: Composition of Cash Received during FY19 vs Agreement

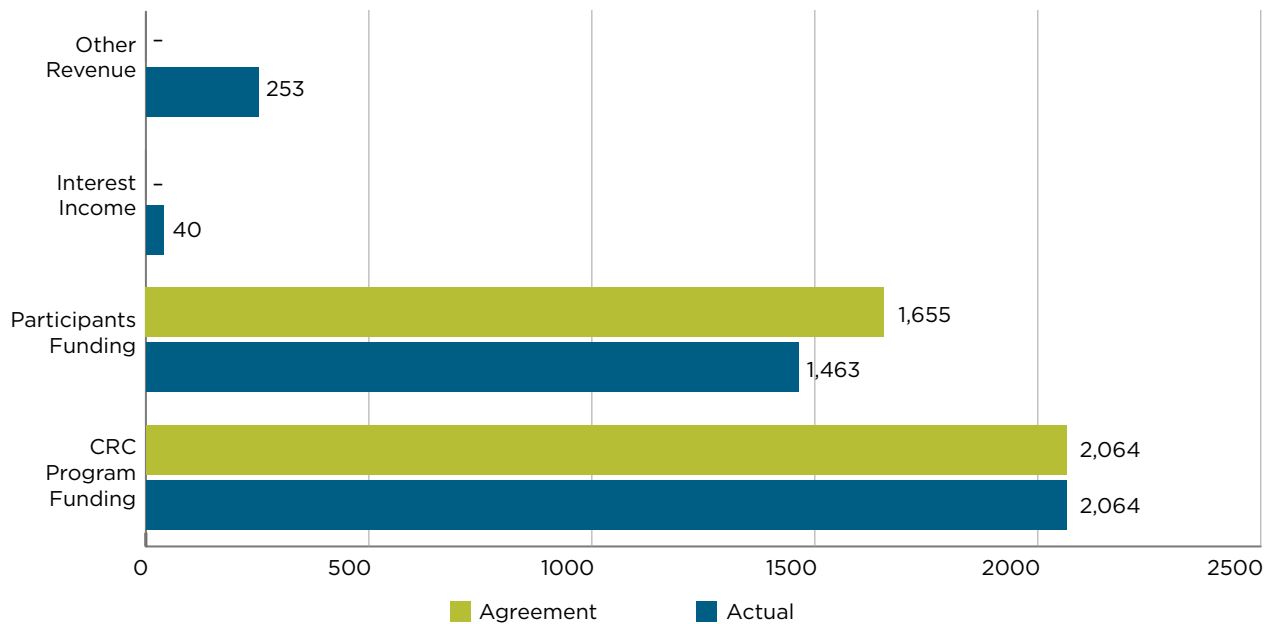
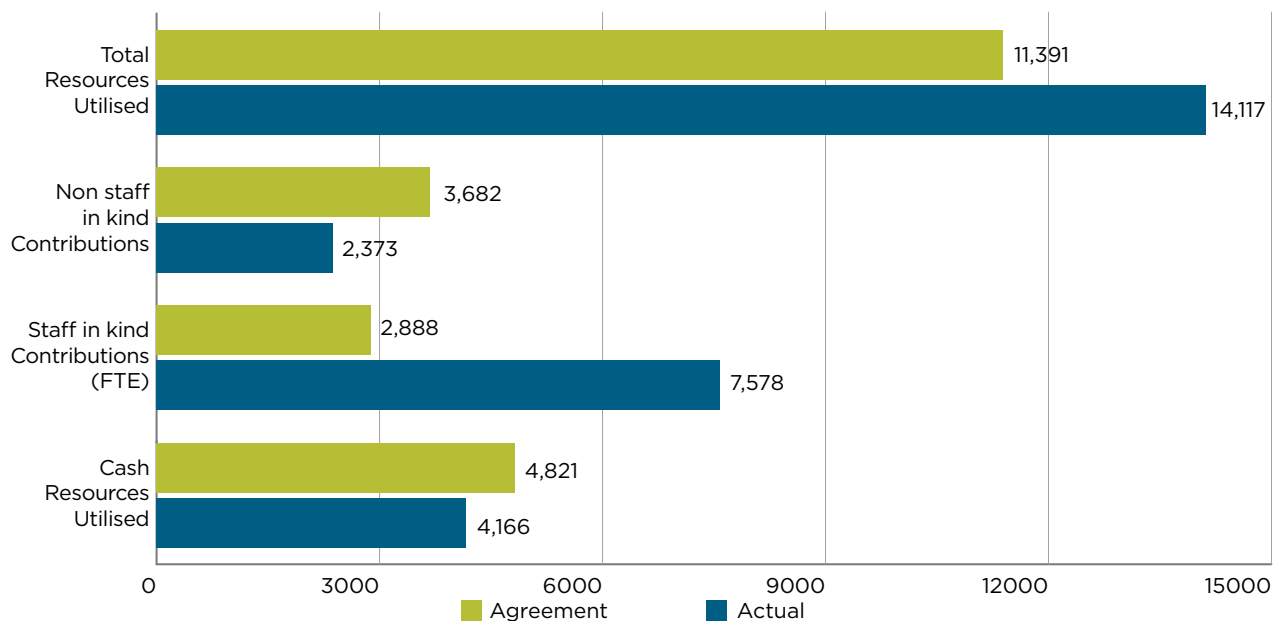


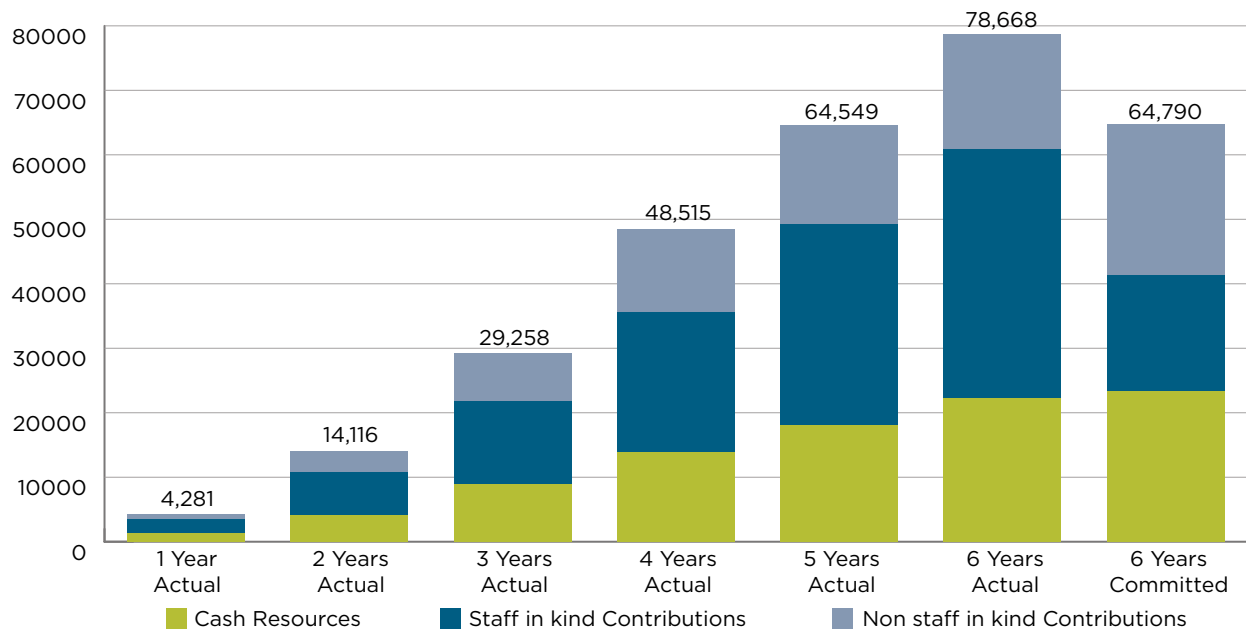
Figure 3 highlights the breakdown of Year Six resources utilised by category relative to original participant commitments for 2018/19.

Figure 3: FY19 Allocation of Utilised Resource Category - Actual vs Agreement



As at 30 June 2019, the Alertness CRC recorded an additional \$13.876 million (21%) in total resources utilised over the cumulative six-year period when compared to original commitments over the same period, as shown in Figure 4.

Figure 4: Six Years Cumulative Resources Allocated into Activities – Actual vs Agreement



The independent auditor’s report to the members of the Alertness CRC, for the financial year 2018-19, confirms that the financial reports of the Alertness CRC have been prepared in accordance with the Australian Charities and Not-for-Profits Commission Act 2012, and that they comply with the Australian Accounting Standards – Reduced Disclosure Requirement and the Australian Charities and Not-for-profits Commission Regulation 2013.

Their opinion further states that:

- The financial statements as at 30 June 2019 give a true and fair view of the Company’s financial position as at that date and of its performance for the year ended on that date;
- Both cash and in-kind contributions have been made and recorded in accordance with the budget as specified and in accordance with the terms of the Commonwealth Agreement;
- The Commonwealth funding and the participants contributions have been expended solely for the Activities and in accordance with the Commonwealth Agreement and Australian accounting concepts and applicable Australian standards; and
- All transactions for the Activities as specified in the Commonwealth Agreement have been conducted through the Account.





# 5

## Appendices

## Appendix 1: Publications

### Accepted articles in peer reviewed journals 2018-19 FY

Chapman JL, Comas M, Hoyos CM, Bartlett DJ, Grunstein RR, Gordon CJ. *Is Metabolic Rate Increased in Insomnia Disorder? A Systematic Review*. Front Endocrinol (Lausanne). 2018 Jul 16;9:374. doi: 10.3389/fendo.2018.00374. eCollection 2018. PubMed PMID: 30061861; PubMed Central PMCID: PMC6054926. <https://www.ncbi.nlm.nih.gov/pubmed/30061861>

McGlashan EM, Burns AC, Murray JM, Sletten TL, Magee M, Rajaratnam SMW, Cain SW. *The pupillary light reflex distinguishes between circadian and non-circadian delayed sleep phase disorder (DSPD) phenotypes in young adults*. Plos One. September 2018. <https://doi.org/10.1371/journal.pone.0204621>

Booker LA, Magee M, Rajaratnam SMW, Sletten TL, Howard ME. *Individual vulnerability to insomnia, excessive sleepiness and shift work disorder amongst healthcare shift workers. A systematic review*. Sleep Med Rev. October 2018. doi: 10.1016/j.smrv.2018.03.005. <https://www.ncbi.nlm.nih.gov/pubmed/29680177>

Booker LA. *Poor sleep hygiene is the biggest contributor to sleep impairment in healthcare shift workers*. ResearchGate. October 2018. [https://www.researchgate.net/publication/329428562\\_Poor\\_sleep\\_hygiene\\_is\\_the\\_biggest\\_contributor\\_to\\_sleep\\_impairment\\_in\\_healthcare\\_shift\\_workers](https://www.researchgate.net/publication/329428562_Poor_sleep_hygiene_is_the_biggest_contributor_to_sleep_impairment_in_healthcare_shift_workers)

Diep C, Ftouni S, Manousakis J, Drummond S, Nicholas C, Anderson C. *Executive function improves following acoustic slow wave sleep enhancement with a novel, automated device*. Journal of Sleep Research. 5 October 2018. [https://doi.org/10.1111/jsr.58\\_12766](https://doi.org/10.1111/jsr.58_12766)

Mulhall MD, Cori J, Kuo J, Magee M, Collins A, Anderson C, Sletten TL, Lenné MG, Rajaratnam SMW, Howard ME. *Pre-drive ocular assessment predicts driving performance in shift workers: A naturalistic driving study*. Journal of Sleep Research. 5 October 2018. [https://doi.org/10.1111/jsr.08\\_12765](https://doi.org/10.1111/jsr.08_12765)

McMahon W, Ftouni S, Phillips A, Drummond S, Lockley S, Rajaratnam SMW, Anderson C. *Fixed sleep schedules prior to an in-lab study: Individual differences in sleep and circadian timing*. Journal of Sleep Research. 5 October 2018. [https://doi.org/10.1111/jsr.49\\_12766](https://doi.org/10.1111/jsr.49_12766)

McMahon W, Ftouni S, Drummond S, Maruff P, Lockley SW, Rajaratnam SMW, Anderson C. *The wake maintenance zone shows task dependent changes in cognitive function following one night without sleep*. Sleep, Volume 41, Issue 10, October 2018, <https://doi.org/10.1093/sleep/zsy148>

Gordon CJ, Dodds KL, Marshall NS, Miller CB, Taylor CE, Phillips CL. *Getting to the heart of cardiac autonomic dysfunction in insomnia*. J Sleep Res. 2018 Dec;27(6):e12738. doi: 10.1111/jsr.12738. Epub 2018 Jul 31. Erratum in: J Sleep Res. 2019 Feb;28(1):e12815. PubMed PMID: 30062685. <https://www.ncbi.nlm.nih.gov/pubmed/30062685>

Grant LK, Ftouni S, Nijagal B, De Souza DP, Tull D, McConville MJ, Rajaratnam SMW, Lockley SW, Anderson C. *Circadian and wake-dependent changes in human plasma polar metabolites during prolonged wakefulness: A preliminary analysis*. Scientific Reports. 14 March 2019. <https://www.nature.com/articles/s41598-019-40353-8>

Ganesan S, Magee M, Stone JE, Mulhall MD, Collins A, Howard ME, Lockley SW, Rajaratnam SMW, Sletten TL. *The Impact of Shift Work on Sleep, Alertness and Performance in Healthcare Workers*. Sci Rep. 15 March 2019. doi: 10.1038/s41598-019-40914-x. <https://www.ncbi.nlm.nih.gov/pubmed/30874565>

Lovato N, Miller CB, Gordon CJ, Grunstein RR, Lack L. *The Efficacy of Biofeedback for the Treatment of Insomnia: a critical review*. Sleep Med. April 2019. doi: 10.1016/j.sleep.2018.12.011. Epub 2018 Dec 26.

<https://www.ncbi.nlm.nih.gov/pubmed/30846410>

Miller CB, Robertson DJ, Johnson KA, Lovato N, Bartlett DJ, Grunstein RR, Gordon CJ. *Tired and lack focus? Insomnia increases distractibility*. Journal of Health Psychology. 22 April 2019.

<https://doi.org/10.1177/1359105319842927>

Aji M, Gordon CJ, Peters D, Bartlett D, Calvo RA, Naqshbandi K, Glozier N. *Exploring User Needs and Preferences for Mobile Apps for Sleep Disturbance: Mixed Methods Study*. JMIR Publications. 24 May 2019.

<https://mental.jmir.org/2019/5/e13895/>

Booker LA, Sletten TL, Alvaro PK, Barnes M, Collins A, Chai-Coetzer CL, Naqvi A, McMahon M, Lockley SW, Rajaratnam SMW, Howard ME. *Exploring the associations between shift work disorder, depression, anxiety and sick leave taken amongst nurses*. J Sleep Res. 29 May 2019:e12872. doi: 10.1111/jsr.12872. [Epub ahead of print].

<https://www.ncbi.nlm.nih.gov/pubmed/31144389>

Murray JM, Phillips AJK, Magee M, Sletten TL, Gordon C, Lovato N, Bei B, Bartlett DJ, Kennaway DJ, Lack LC, Grunstein RR, Lockley SW, Rajaratnam SMW; Delayed Sleep on Melatonin (DeSoM) Study Group. *Sleep regularity is associated with sleep-wake and circadian timing, and mediates daytime function in Delayed Sleep-Wake Phase Disorder*. Sleep Med. June 2019. doi: 10.1016/j.sleep.2019.03.009. Epub 2019 Mar 23.

<https://www.ncbi.nlm.nih.gov/pubmed/31132578>

## Papers presented at conferences 2018-19 FY

Mulhall M. *A pre-drive ocular assessment predicts subsequent driving impairment: a naturalistic driving study in shift workers*. ESRS Conference September 2018.

Stone J. *Predicting circadian phase in rotating shift workers using a limit-cycle oscillator model*. Australasian Chronobiology Society Meeting, October 2018.

Aji M. *Exploring the user preferences and needs for mobile apps for sleep- a mixed-methods study*. ASA conference, Brisbane, October 2018.

Anderson C. *Developing a biological marker of sleep loss*. ASA conference, Brisbane, October 2018.

Booker L. *Shift Work and Individual Management Project (SWIM)*. ASA conference, Brisbane, October 2018.

Diep C. *Shift Work and Individual Management Project (SWIM)*. ASA conference, Brisbane, October 2018.

Howard M. *Optimising 24 Hour Healthcare: Reducing the Impact on Healthcare Workers and Patients*. ASA conference, Brisbane, October 2018.

McMahon W. *Fixed sleep schedules prior to an in-lab study: Individual differences in sleep and circadian timing*. ASA conference, Brisbane, October 2018.

Murray J. *Phenotyping Delayed Sleep-Wake Phase Disorder*. ASA conference, Brisbane, October 2018.

Postnova S. *Sydney-CRC Model of Alertness, Sleep, and Circadian Dynamics*. ASA conference, Brisbane, October 2018.

Stone J. *Measuring/tracking circadian phase in shift workers*. ASA conference, Brisbane, October 2018.

Vakulin A. *Development of a consumer sleep health management system*. Presented during the "Towards Personalised Sleep Health" Symposium at the ASA conference, Brisbane, October 2018.

## Invited Presentations 2018-19 FY

Sletten T. *Case study: Applying the Australian-first body clock rostering system to improve workforce performance and wellbeing*. Rostering and Fatigue Management, Sydney, September 2018.

Anderson C. *The Science of Sleep and Fatigue Management*. Longwall Conference, Hunter Valley, NSW, November 2018.

Remington S. *Sleep-Smart Roster Initiative*. Aon Insurance Health and Wellbeing seminar. Melbourne, March 2019.

Jeppe K. *Developing a metabolomic biomarker of sleep deprivation*. Proteomics and Metabolomics Victoria Symposium, Melbourne, 12 April 2019.

## Posters 2018-19 FY

Booker L. *What impact does shift work disorder have on depression and anxiety severity amongst healthcare shift workers?* ESRS Conference, September 2018.

Tekieh T. *Quantitative modelling of the direct alerting effects of light*. ESRS Conference, September 2018.

Booker L. *Poor sleep hygiene is the biggest contributor to sleep impairment in healthcare shift workers*. ASA Conference, October 2018.

Diep C. *Shift Work and Individual Management Project (SWIM)*. ASA conference, October 2018.

McMahon W. *Improvement in cognition during the wake maintenance zone following sleep loss is dependent on cognitive domain*. ASA conference, October 2018.

## Submitted Abstracts 2018-19 FY

Aji M. *Exploring the user preferences and needs for mobile apps for sleep – a mixed-methods study*. Submitted for the ASA conference, October 2018.

Osman A. *The upper airway is most collapsible during expiration in obstructive sleep apnoea*. Submitted for the Thoracic Society of Australia & New Zealand (TSANZ) Meeting, November 2018.

Osman A. *The upper airway is most collapsible during expiration in obstructive sleep apnoea*. Submitted for the Motor Impairment Meeting, November 2018.

Osman A. *An assessment of a simple clinical technique to estimate pharyngeal collapsibility in people with OSA*. Submitted for the Upper Airway Symposium 2019, February 2019.

Collet J. *Sleep/wake and circadian modulation of inhibitory attentional control: A characterisation using the antisaccade task*. Submitted for Eye Movements Gordon Research Seminar, April 2019.

Collet J. *Diurnal rhythms in the inhibitory control of attention: Characterisation using the antisaccade task*. Submitted for Eye Movements Gordon Research Seminar, April 2019.

Howard M. *Fatigue among heavy vehicle drivers: the impact of shift-start times and time of day*. Submitted for the Australasian Transport Research Forum (ATRF), June 2019.

Osman A. *Major changes in pharyngeal collapsibility and genioglossus reflex responses to negative pressure throughout the respiratory cycle in obstructive sleep apnoea*. Submitted for Sleep and Breathing Meeting, August 2019.

Stone J. *Are models ready for predicting circadian phase in real-world settings?* Submitted for European Biological Rhythms Society (EBRS) Conference. August 2019.

Bickley K. *Novel evaluation of task participation as a metric for daytime functioning in the insomnia population*. Submitted for World Sleep 2019, September 2019.

McMahon W. *Task-Dependent Effects of the Wake Maintenance Zone on Cognition and Alertness, With and Without Sleep Loss*. Submitted for World Sleep 2019, September 2019.

Bickley K. *Novel evaluation of task participation as a metric for daytime functioning in the insomnia population*. Submitted for ASA Sleep DownUnder Conference, October 2019.

Osman A. *An assessment of a simple clinical technique to estimate pharyngeal collapsibility in people with OSA*. Submitted for ASA Sleep DownUnder Conference, October 2019.

## Submitted Manuscripts 2018-19 FY

Mullins A. *Sleep EEG microarchitecture is associated with neurobehavioral impairment after extended wakefulness in obstructive sleep apnea*. Submitted to Clinical Neurophysiology, April 2019.

Osman A. *An assessment of a simple clinical technique to estimate pharyngeal collapsibility in people with OSA*. Submitted to Journal of Physiology, May 2019.

Osman A. *Marked changes in pharyngeal collapsibility and genioglossus reflex responses to negative pressure throughout the respiratory cycle in obstructive sleep apnoea*. Submitted to Journal of Physiology, May 2019.

## News and Media Releases 2018-19 FY

News item: "[Woolcock Named World's Best in Field](#)". August 2018.

News item: "[PhD candidate awarded Nurses Memorial Centre Scholarship](#)". August 2018.

Media release: "[Eye-tracking technology tests whether drivers are too tired to get behind the wheel](#)". October 2018.

Media Release: "[Sleep study findings could aid alertness in night shift workers](#)". March 2019.

Media Release: "[SA lifts the lid on better sleep worldwide](#)". March 2019.

Media Release: "[World first in fatigue research](#)". April 2019.

## Videos 2018-19 FY

Wolkow A, Clark A. *Heavy Vehicle Driver Fatigue Project Recruitment Drive*. Used on (social) media as part of a participant recruitment campaign.

Various. *PhD Placements*. Contributed to content for this video that was produced by the Turner Institute for Brain and Mental Health (formerly MICCN), Monash University.

## Theses 2018-19 FY

Osman A. *Development of a simple clinical technique to quantify upper airway collapsibility*. Submitted June 2019.

## Other 2018-19 FY

Howard M, Clark A. *Six Study Reports for the National Transport Commission Heavy Vehicle Driving Project*. February 2019.

Wolkow A. *Recent Research Outputs from the Alertness CRC. Newsletter article for ASA Newsletter*, June 2019.

## Appendix 2: Education

### Postdoctoral Fellows

No	Name	Research Project (Program Number#)	Research Organisation
1	Alexander Wolkow	Heavy Vehicle Driver Fatigue Research Project (RP1 & RP2)	Monash University, Australia
2	Andrew Vakulin	Sleep Disorder Phenotyping & Sleep Companion Decision Support Tool (RP3)	Flinders University, Australia
3	Angela D'Rozario	Sleep Disorder Phenotyping & Insomnia Decision Support Development (RP3)	Woolcock Institute Of Medical Research, Australia
4	Angus Wallace	Device Development & Sleep Companion Decision Support Tool (RP1, RP2 & RP3)	Flinders University, Australia
5	Ben Fulcher	Laboratory (RP1)	Monash University, Australia
6	Bradley Edwards	Sleep Disorder Phenotyping (RP3)	Monash University, Australia
7	Bryn Jeffries (resigned)	Database Development & Sleep Companion Decision Support Tool (RP3)	The University of Sydney, Australia
8	Christopher Gordon	Sleep Disorder Phenotyping, Insomnia Decision Support Development & SleepFix® (RP3)	The University of Sydney / Woolcock Institute of Medical Research, Australia
9	Christopher Miller	Sleep Disorder Phenotyping (RP3)	Woolcock Institute of Medical Research, Australia
10	David Stevens	Sleep Disorder Phenotyping (RP3)	Flinders University, Australia
11	Emily Anderson	Device Development (RP1, RP2 & RP3)	Flinders University, Australia
12	Gleb Belov (Resigned)	Group Work Scheduling (RP2)	Monash University, Australia
13	Jennifer Cori	Healthcare (RP2), Sleep Disorder Phenotyping (RP3), Ocular Measure Fitness to Drive (RP1) & Heavy Vehicle Driver Fatigue Research Project (RP1 & RP2)	Institute for Breathing and Sleep, Australia
14	Jong Won Kim (resigned)	Modelling and Data Fusion (RP1)	The University of Sydney / Woolcock Institute of Medical Research, Australia
15	Kathryn Jeppe	Biomarker for Alertness (RP1)	Monash University, Australia

No	Name	Research Project (Program Number#)	Research Organisation
16	Maria Comas	Sleep Disorder Phenotyping (RP3)	Woolcock Institute of Medical Research, Australia
17	Michelle Magee (resigned)	Healthcare (RP2) & Shift Work Management (RP1)	Monash University, Australia
18	Nicole Lovato	Sleep Disorder Phenotyping & Sleep Companion Decision Support Tool (RP3)	Flinders University, Australia
19	Pasquale Alvaro	Healthcare (RP2)	Institute for Breathing and Sleep, Australia
20	Peter Catcheside	Sleep Disorder Phenotyping & Sleep Companion Decision Support Tool (RP3)	Flinders University, Australia
21	Romesh Abeysuriya	Modelling (RP1)	The University of Sydney, Australia
22	Senthooran Ilakaikone	Group Work Scheduling (RP2)	Monash University, Australia
23	Shane Landry	Sleep Disorder Phenotyping (RP3)	Monash University, Australia
24	Simon Joosten	Laboratory (RP1) & Sleep Disorder Phenotyping (RP3)	Monash University, Australia
25	Stuart Knock	Modelling & Group Work Scheduling (RP2)	The University of Sydney, Australia
26	Suzanne Ftouni (resigned)	Laboratory (RP1)	Monash University, Australia
27	Svetlana Postnova	Modelling & Group Work Scheduling (RP2)	The University of Sydney, Australia
28	Tracey Sletten	Healthcare (RP2) & Heavy Vehicle Driver Fatigue Research Project (RP1 & RP2)	Monash University, Australia

# denotes:

Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) – Safety and Productivity Improvements

Research Program 3 (RP3) – Sleep Health

## PhD Degree Scholarships

No	Name	Date Started	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
1	Amal Osman	14-Jul-15	Sleep Disorder Phenotyping (RP3)	Development of A Simple Clinical Technique to Quantify Upper Airway Collapsibility.	Neuroscience Research Australia (NeuRA) / UNSW	13-Jul-18
2	Anna Cai	01-Jul-18	Biomarker for Alertness (RP1) & Vicroads projects (RP1)	The CRC Metabolite Program - Novel Assessment of Biomarker for Alertness & Development of a Roadside Test to Detect Driver Drowsiness Using Ocular Measures.	Monash University, Australia	30-Jun-20
3	Anna Mullins	22-Jan-15	Sleep Disorder Phenotyping (RP3)	Quantitative EEG Biomarkers for Sleep Disorder Phenotyping and Personalised Sleep Health Quantitative Analysis of Polysomnography: From Sleep Macrostructure to Microstructure.	The University of Sydney, Australia	31-May-18
4	Charmaine Diep	22-Feb-16	Laboratory (RP1)	Laboratory-based development of systems and biomarkers to assess circadian, sleep and alertness State.	Monash University, Australia	22-Feb-19
5	Devaang Kevat	22-Jan-15	Healthcare (RP2)	Examining Worker Safety and Productivity in The Healthcare Setting.	Monash University, Australia	21-Jan-16
6	Haidar Naqvi	01-Sep-14	Sleep Disorder Phenotyping (RP3)	Neurobehavioural effects of sleep loss in patients with obstructive sleep apnoea.	Woolcock Institute of Medical Research, Australia	31-Aug-17
7	Jade Murray	01-Feb-14	Healthcare (RP2)	Investigating Circadian Misalignment in a Population of Patients with Symptoms of Delayed Sleep Phase Disorder (DSPD).	Monash University, Australia	31-Jan-17



No	Name	Date Started	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
8	Julia Stone	02-Mar-15	Healthcare (RP2)	Assessing Individual Vulnerability to Shift Work and Integrated Interventions for Alertness Management in the Healthcare Setting.	Monash University, Australia	01-Mar-18
9	Kelsey Bickley	01-Feb-15	Sleep Disorder Phenotyping (RP3)	To perform a comprehensive investigation of daytime functioning in individuals with insomnia across a range of insomnia subtypes.	Flinders University, Australia	31-Jan-18
10	Lauren Booker	21-Dec-15	Healthcare (RP2)	Impact of Insomnia, shift work and OSA management on individual outcomes in healthcare shift workers.	Monash University, Australia	20-Dec-18
11	Lauren Bulfin	03-Jul-17	Group Work Scheduling (RP2)	Development of software system for work group scheduling.	Monash University, Australia	30-Jun-20
12	Leilah Grant	01-Feb-14	Laboratory (RP1)	Identification and Validation of Biological and Physiological Biomarkers of The Alertness State.	Monash University, Australia	09-Feb-17
13	M S Zobaer	01-May-15	Modelling (RP1)	Proposal on Evoked Potentials and K Complexes in Sleep: Underpinning of Potential Biomarkers.	The University of Sydney, Australia	30-Apr-18
14	Marie Jinny Collet	27-Jan-16	Laboratory (RP1)	Specific vulnerability of attention mechanisms due to sleep loss, circadian misalignment and age.	Monash University, Australia	26-Jan-19
15	Megan Mulhall	01-Mar-16	Healthcare (RP2)	Assessing Individual Vulnerability to Shift Work and Integrated Interventions for Alertness Management in the Healthcare Setting.	Monash University, Australia	01-Mar-19

# Appendices

No	Name	Date Started	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
16	Melissa Aji	01-Feb-18	Sleep Health Management (RP3)	Development of a sleep restriction therapy "Sleep Right Tonight" App for Behavioural Management of Insomnia ("SleepFix®").	The University of Sydney, Australia	30-Jun-20
17	Rohit Philip	01-Feb-15	Sleep Disorder Phenotyping (RP3)	To determine the vulnerability to alertness failure (impaired driving performance and vigilance function) in OSA patients, using an extended wakefulness challenge paradigm; to develop and validate electrophysiological biomarkers (EEG and ECG) to distinguish between patients who are vulnerable to alertness failure; and, to validate this laboratory phenotyping approach against real world questionnaire outcomes.	Flinders University, Australia	31-Jan-18
18	Sachinkumar Nilkantha Wasnik	01-Sep-14	Sleep Disorder Phenotyping (RP3)	Across modelling/data fusion and phenotyping projects with potential value in biomarkers and healthcare.	The University of Sydney, Australia	31-Aug-17
19	Saranea Ganesan	22-Jan-15	Healthcare (RP2)	Cognitive Markers of Shift Work Vulnerability.	Monash University, Australia	21-Jan-18
20	Simon Joosten	01-Sep-14	Laboratory (RP1) & Sleep Disorder Phenotyping (RP3)	Test a simplified method for sub-classifying OSA patients into their underlying causal phenotype.	Monash University, Australia	31-Aug-15
21	Stephen McCloskey	01-Jul-18	Sleep Disorder Phenotyping: Stream C - Insomnia (RP3)	Sleep Disorder Analysis Using Machine Learning Technique.	The University of Sydney, Australia	30-Jun-20

No	Name	Date Started	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
22	Wei Qu	01-Mar-18	Sleep Health Management (RP3)	Insomnia Decision Support Development.	The University of Sydney, Australia	30-Jun-20
23	William McMahon	01-May-15	Laboratory (RP1)	Predicting individual vulnerability to alertness challenges following sleep deprivation.	Monash University, Australia	30-Apr-18
24	Yael Galgut	01-Aug-18	SleepFix® (RP3)	Development of a Sleep Restriction Therapy “Sleep Right Tonight” App for Behavioural Management of Insomnia.	The University of Sydney, Australia	30-Jun-20

# denotes:

Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) – Safety and Productivity Improvements

Research Program 3 (RP3) – Sleep Health

## Master Degree Scholarships

No	Name	Date Started	Research Project (Program Number#)	Research Title	Research Organisation	Completion Date
1	Helenmary McMeekan	22-Jan-15	Sleep Disorder Phenotyping Platform (RP3)	Individual-level Toolkit for Sleep Health Management in Occupational Settings.	Flinders University, Australia	Withdrew in Mar-16
2	Kirsty Dodds	22-Jan-15	Sleep Disorder Phenotyping Platform (RP3)	Cardiovascular markers of autonomic dysregulation in Insomnia Disorder.	The University of Sydney, Australia	21-Jan-17

# denotes:

Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) – Safety and Productivity Improvements

Research Program 3 (RP3) – Sleep Health

## Vacation Master Degree Scholarships

No	Name	Date Started	Research Project (Program Number#)	Research Title	Research Organisation	Completion Date
1	Baptiste Jolivet	11-May-15	Modelling and Data Fusion (RP1)	Stretched exponential functions in modelling the effects of chronic sleep restriction on alertness.	The University of Sydney, Australia	17-Aug-15
2	Gunther Klobe	16-Nov-15	Modelling and Data Fusion (RP1)	Mechanisms of the variability in the phase angle between DLMO and sleep onset.	The University of Sydney, Australia	15-Mar-16
3	Merijn Driessen	10-Jan-16	Modelling and Data Fusion (RP1)	Modelling effects of sleep inertia on alertness in a quantitative model of sleep - wake cycles.	The University of Sydney, Australia	09-Jul-16
4	Stephen McCloskey	13-Jan-15	Modelling and Data Fusion (RP1)	Incorporation of the direct alerting effects of white light in the physiologically based model of sleep-wake cycle developed at The University of Sydney.	The University of Sydney, Australia	24-Feb-15
5	Thibaut Lacroix	11-May-15	Modelling and Data Fusion (RP1)	Modelling the effects of prophylactic naps on alertness and sleep.	The University of Sydney, Australia	10-Aug-15

# denotes:

Research Program 1 (RP1) - Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) - Safety and Productivity Improvements

Research Program 3 (RP3) - Sleep Health

## Industry Based Learning scholarships

No	Name	Date Started	Program Number <sup>#</sup>	Research Organisation	Completion Date
1	Adrienne Bell	27-Jan-15	RP1	Swinburne University, Australia	26-Jan-16
2	Michelle Bravo	27-Jan-15	RP1	Swinburne University, Australia	26-Jan-16
3	Aaron Johnson	27-Jan-15	RP2	Swinburne University, Australia	26-Jan-16
4	Matthew McLaren	27-Jan-15	RP2	Swinburne University, Australia	26-Jan-16
5	Jessica Papaleo	27-Jan-15	RP2	Swinburne University, Australia	26-Jan-16
6	Todd Pickering	27-Jan-15	RP1	Swinburne University, Australia	26-Jan-16
7	Elly Spiteri	27-Jan-16	RP1	Swinburne University, Australia	26-Jan-17
8	Kaitlyn Crocker	27-Jan-16	RP2	Swinburne University, Australia	26-Jan-17
9	Niamh McDonald	27-Jan-16	RP2	Swinburne University, Australia	26-Jan-17
10	Phaybian Penita	27-Jan-16	RP1	Swinburne University, Australia	26-Jan-17
11	David Litewka	27-Jan-16	RP1	Swinburne University, Australia	26-Jan-17
12	Ellen Carter	23-Jan-17	RP1	Swinburne University, Australia	19-Jan-18
13	Karina Tasker	23-Jan-17	RP2 & RP3	Swinburne University, Australia	19-Jan-18
14	Liam Drury	23-Jan-17	RP1 & RP2	Swinburne University, Australia	19-Jan-18
15	Sarah Zivkovic	06-Feb-17	RP2 & RP3	Swinburne University, Australia	02-Feb-18
16	Aleksander Hart	20-Feb-17	RP1 & RP2	Swinburne University, Australia	16-Feb-18

# denotes:

Research Program 1 (RP1) - Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) - Safety and Productivity Improvements

Research Program 3 (RP3) - Sleep Health

## Appendix 3: Provisional Patents filed

Provisional Number	Title
AU2018903888	Sleep deprivation biomarker
AU2018904007	Sleep disorder diagnosis
AU2018904103	Personalised sleep organiser
US62812066 & AU2019902689	Decision support software system for sleep disorder identification
US62815562	Sleep disorder data fidelity management system
AU2019901214	Sleep deficiency biomarker

# Glossary

Term	Definition
ALFA	Adaptive Lighting For Alertness.
Biomarker	Short for biological marker, it is a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, disease or the effect of an intervention.
Chemiresistor	A material that changes its electrical resistance in response to changes in the nearby chemical environment.
Circadian rhythms	Are physical, mental and behavioural changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism's environment. They are found in most living things including animals and plants.
ECRs	Early Career Researchers.
EEG	An electroencephalogram (EEG) is a test that detects electrical activity in your brain using small, flat metal discs (electrodes) attached to your scalp. Your brain cells communicate via electrical impulses and are active all the time including during sleep.
Electrophysiological	The production of electrical phenomena, particularly in the nervous system, and their consequences in the living organism.
Melatonin	A hormone naturally secreted with the onset of fading natural light which helps tune the circadian rhythm as it moves in to a sleep cycle.
Metabolomics	The non-targeted detection and quantification of small molecules (metabolites) in biological materials (e.g., plasma, urine, tissue, plant and microbial extracts).
Nanoparticle	A particle between 1 and 100 nanometres in size.
Obstructive sleep apnoea (OSA)	When the airway at the back of the mouth is repeatedly partly or completely blocked during sleep reducing or stopping breathing altogether. When oxygen levels fall, the sleeper wakes up briefly and starts breathing again.
Phenotype	The observable characteristics of a person in the context of specific trait, behaviour or susceptibility to a certain condition.
VAF	Vulnerability to Alertness Failure.



**ALERTNESS  
SAFETY AND  
PRODUCTIVITY**



Australian Government  
Department of Industry,  
Innovation and Science

**Business**  
Cooperative Research  
Centres Programme

