



THE UNIVERSITY OF  
MELBOURNE

**The University of Melbourne's  
response to the  
Victoria's Government's  
Future Industries  
Transport Technologies  
Discussion Paper**



## EXECUTIVE SUMMARY

The University of Melbourne is pleased to respond to the Victorian Government's Future Industries Transport Technologies Discussion Paper.

The University of Melbourne has internationally recognised research and teaching capabilities that are aligned with the priorities identified in the Victorian Government's Future Industries Transport Technologies Discussion Paper. The University remains committed to growing its already considerable contribution to the success of the Victorian transport equipment sector.

Victoria has significant strengths in this area and has the potential to be at the forefront of the coming wave of innovation in transport equipment. The University is conscious of the advantages that leadership can play and has been investing in research and education that will contribute to the effort to maintain Victoria's position as a frontrunner in the transport technologies sector.

The University is pursuing initiatives such as the Victorian 'Proof of Concept Fund' or an initiative with an alternative name but the same core intent of assisting innovative ideas attain commercial success. The University is also working towards the development of the Victorian Institute for Powertrain and Emissions Research (VIPER) in order to underpin the future of the powered transport equipment manufacturing sector in Victoria, improve regulations and emissions monitoring and secure industry and defence-related powertrain research in Victoria.

By partnering with the University of Melbourne and working closely with the Victorian Government, the State's transport sector can focus on the production of new technologies and high-value manufactured goods. Done effectively, this will see the sector thrive in a State where connected transport technologies and other innovations have the potential to underpin the future of the transport equipment manufacturing, design, engineering and technical services, while also bringing dramatic and widespread improvements in Victoria's productivity, efficiency and community well-being.

This response to the Transport Technologies Discussion Paper contains a number of recommendations. In summary, these are that the Victorian Government:

1. encourage deeper cooperation between Government, the University of Melbourne and transport technology businesses through support for innovation hubs and clusters, as well as cooperative research programmes such as the Innovative Manufacturing Cooperative Research Centre;
2. assist the Geelong Heavy Vehicle Platooning Initiative which would benefit the Geelong region, as well as the State's transport technologies sector;
3. engage with the forthcoming Commonwealth review of the Research and Development (R&D) Tax Incentive with a view to improving this incentive's capacity to encourage innovation;
4. work closely with industry stakeholders and education providers to ensure Victoria develops the industrial, commercial, policy and technical skills base it needs to strengthen its transport technologies sector; and
5. take advantage of the wide range of expertise that is available at the University of Melbourne to help the Victorian Government with public policy development, regulation design and public investment decision-making.

The Victorian Government, with the support of commercial stakeholders, is in a position to play a significant leadership role in encouraging broad data access initiatives in the Victorian transport sector. This would allow the State to capitalise on the tools developed at the University of Melbourne, and elsewhere, that allow sophisticated analysis of information that sits within Victorian transport-related data. This, in turn, will enable more evidence based decision-making in areas such as public policy as well as private investments in transport, manufacturing and other arenas.

The University is committed to working with the Victorian Government to ensure that Victoria maintains its strengths in transport technologies innovation, design, engineering, technical services and manufacturing.

For further information, or to discuss the submission, please contact:

Professor Liz Sonenberg,  
Pro Vice-Chancellor (Research Collaboration and Infrastructure)  
Chancellery (Research)  
The University of Melbourne  
T: 03 8344 4447  
E: [l.sonenberg@unimelb.edu.au](mailto:l.sonenberg@unimelb.edu.au)

## INTRODUCTION

The transport technologies sector is a crucial component of Victoria's economy. Transport equipment design, engineering and manufacturing has long been a valued source of economic activity, employment and export income for the State. The broader transport sector is also important to productivity across Victoria through the role that transport plays in underpinning virtually all aspects of our economy and our way of life.

A significant disruption of transport industries is underway. New, smart transport technologies are emerging as we see the rapid emergence of innovations across road transport, rolling stock, aerospace and beyond. These changes, and the speed with which they are being developed, is driving a shift in the nature of transport equipment manufacturing in Victoria towards higher value, more sophisticated products.

The University of Melbourne has long worked in partnership with the Victorian transport equipment industry. The University will continue to play a key role in ensuring that, by using knowledge and innovation, the sector can remain globally competitive. As an example of this, Professor Majid Sarvi, who is the chair in Transport Engineering and the Professor in Transport for Smart Cities at the University of Melbourne, works closely with partners across the Victorian transport industry. He has decades of research experience in the areas of traffic and transport engineering. Professor Sarvi's fields of research cover a range of topics, including crowd dynamic modelling and simulation, large-scale multimodal transport network modelling, vulnerability and optimisation, as well as traffic flow theory and operations. All these matters are of critical importance to the Victorian transport technologies sector. Through the research of Professor Sarvi and others, the University will continue to contribute to our State's transport equipment sector as the latter works to diversify, innovate and collaborate.

The University appreciates the reasons behind the emphasis on the transport equipment manufacturing sector in the Victorian Government's Future Industries Transport Technologies Discussion Paper. The University of Melbourne shares the Government's express desire to support this portion of the transport technologies sector as it faces a period of particular challenge. Consequently, this response to the Discussion Paper reflects the University's strong commitment to continue to work closely with those companies involved in

transport equipment manufacturing activities across everything from recreational boats, buses, trains, trucks and caravans to aerospace components. In addition, the University of Melbourne's response provides a broader perspective that embraces a wide range of transport technologies, including those relevant to built infrastructure. The University has taken this approach because of the fundamentally interrelated nature of transport technologies. Close relationships exist between integrated public transport systems, rail infrastructure and the manufacturing of rail vehicles, for example. In the case of road transport, similar connections exist between intelligent transport systems technologies and infrastructure usage optimisation as well as vehicle design, engineering, manufacturing and operations.

Even more broadly, this document reflects the University's appreciation of the crucial role that transport plays in the Victorian economy and community. Given transport's fundamental place in the social and economic fabric of Victoria, the development, production and adoption of the smartest, most efficient and most effective transport technologies will increase productivity and quality of life in our State.

In this document, the University of Melbourne responds to the issues raised directly in the Future Industries Transport Technologies Discussion Paper. In addition, the University will continue to participate in the ongoing discussion about transport technologies in Victoria. In order to bring the greatest possible benefit to the State, it is our view that this continuing conversation should embrace the development, production and use of the many advanced technologies and disruptive innovations that will shape both the transport equipment sector and our State in the future.

## 1. WHY TRANSPORT TECHNOLOGIES PARTICULARLY MATTER TO VICTORIA

A new era of transport technology is upon us and it is crucial that Victoria, and its transport equipment sector, are poised to take a leadership role during this change. The State has a long, proud and continuing history of transport equipment manufacturing, maintenance and service across everything from aerospace components to specialty vehicles, through to rail vehicles, recreational vehicles and trucks. Because these industries have long been significant sources of employment and economic activity, Victoria has an imperative to respond effectively to the dramatic advances being made in transport technologies world-wide.

Victoria's strong transport equipment sector, with its large cohort of skilled workers, offers

the State a strategic advantage. When combined with Victoria's world-class research output in relevant disciplines, our State is primed to exploit the engineering, design, manufacturing and technology developments that are arising from intelligent transport technologies as well as new commercial and industrial innovations.

The benefits of leadership in the development and implementation of smart transport technologies are also particularly significant to Victoria in other ways. Firstly, compared with many other advanced economy jurisdictions, Victoria has a low population density. This makes transport a particularly important matter for the State. When combined with Victoria's reliance on transport-dependent industries such as manufacturing and agriculture, the centrality of transport to the Victorian economy is clear. Ours is a community that must have particularly efficient and effective transport systems in place if it is to remain globally competitive.

The success of our transport systems is important for Victoria in other ways too. Our State's low overall population density is combined with a high degree of urbanisation. In addition, Melbourne is, geographically, one of the world's larger cities and there are significant distances between many of Victoria's regional cities and rural towns. Consequently, our social cohesion, quality of life and even our health and education systems are particularly reliant on effective transport infrastructure, equipment, systems, technologies and industries operating in Victoria.

To give one example of the sort of change to transport demands that we are seeing, the rise of internet shopping has caused a dramatic growth in urban freight usage. Reflecting this development, the University of Melbourne's Associate Professor Russell Thompson is undertaking world-leading research into urban freight transport with the support of Volvo, a global transport equipment manufacturer. This project is seeking ways to maximise the efficiency of the transport equipment used in urban freight delivery to reduce its cost, impact on surrounding road users and effects on the environment.

In short, there are compelling economic, social and environmental reasons to position Victorian industry at the forefront of transport technology advances and ensure that the State is in the best position to develop and exploit new technologies and new approaches as they become available.

## 2. INTELLIGENT TRANSPORT TECHNOLOGIES

Technology is being developed in Victoria, nationally and overseas that will see fundamental changes to transport, particularly road and rail transport, but also aerospace and recreational boating. Vehicles fitted with technologies designed to work within intelligent transport systems are already appearing in Victoria and we anticipate that this technology will proliferate within a short period of time and be incorporated into everything from trains to trucks and their trailers.

The rapid growth in coverage and capacity of public wireless networks is forecast to continue into the future with the rollout of new technologies such as 5G. These public communications networks will play an important role in ensuring the transmission of real-time information and other data that underpins modern intelligent transport systems.

Like all other jurisdictions, Victoria will need to develop services, manufacturers, industries, policies, regulations and infrastructure that are optimised for emerging transport technologies and the new approaches and opportunities that they are bringing. In addition to manufactured transport equipment, Victorian waterways, roads, tunnels, bridges and other key infrastructure will need the sensors and communications tools that will be required to make best use of the new technologies as they emerge.

## 3. THE CHALLENGES AND OPPORTUNITIES OF GROWTH

Victoria's good governance, strong economic underpinnings, attractive lifestyle opportunities and other factors continue to drive significant population growth in the State. This is increasing strain on existing transport infrastructure and systems. Consequently, the State's growth is driving investment in new roads and public transport as well as creating demand for improved systems to enable more effective use of existing roads, tramlines, railways and other large capital investments. When combined with the availability of rapidly advancing transport technologies, Victoria has a once-in-a-generation opportunity to embrace new approaches to deliver transport solutions that are safer, more efficient and more effective.

By using new transport technologies, Victoria is positioned to achieve long-held aims such as the integration of modes of transport – linking road transport options with trains, for example. The Victorian Government can use its unique capacities to draw together the various manufacturers and operators to work more closely together and assist them to

implement intelligent transport systems for the benefit of those industry players as well as to the broader social and economic wellbeing of Victorians. The University of Melbourne has strength in areas such as transport planning and is working, through an Australian Research Council (ARC) linkage grant, on matters such as developing a model that simulates the use of demand responsive vehicles, autonomous operation and vehicle sharing. To help drive this next wave of innovation in Victorian transport technologies, the University's Professor Stephan Winter is working on a range of intelligent transport systems opportunities such as optimising the use of autonomous vehicles and the development of highly integrated transport systems.

In order to capitalise on the potential of intelligent transport systems, service providers need to be able to combine information from multiple datasets. The increase of automation delivered by the Internet of Things will rely upon combining both data from transport equipment and other devices to ensure optimal use, safety and efficiency. The University of Melbourne is working across a range of disciplines to meet this challenge. For example, Professor Chris Leckie, in the University's Department of Computing and Information Systems, is researching the applicability of artificial intelligence and machine learning in the transport technologies sector. The outcomes of this work can be applied in areas such as automotive aftermarket manufacturing, specialty vehicles and heavy transport.

#### 4. THE TRANSPORT DATA CHALLENGE

The vast majority of Victoria's rapid population growth is taking place in and around Melbourne and in Victoria's regional cities. The way in which transport works within and between these urban areas will continue to be a major determinant of the levels of economic activity, number of jobs and degree of wealth generated for Victoria and its people.

The use of effective and efficient transport technologies will have profound implications for the provision of the built infrastructure and systems that are required to ensure that Victoria's continuing growth can be accommodated. In particular, the State will need to ensure the provision of affordable and accessible housing as well as cost-effective commercial and industrial spaces that are linked by effective means of transport for goods and people. This is a major technical, commercial and public policy challenge.

The power of Big Data is driving demand by industry, governments and the community to share in its benefits. Big Data allows for more reliable methods to plan for – and achieve – the most effective transport infrastructure, transport technologies and transport equipment

design, servicing and manufacturing for Victoria. The volume of data continues to grow exponentially because of pervasive internet based technologies, as well as the rise of 'Open Data' initiatives and the principle of 'Creative Commons'. However, this vast quantity of information brings its own challenges when it comes to making sense of the information for investment or public policy purposes. In short, there is a challenge in dealing with growing data volumes and meeting the demand for the necessary powerful, efficient analytics that are capable of converting that data into meaningful information or knowledge for the purposes of evidence-based decision making. Well chosen and implemented effectively, these tools will bring highly desirable outcomes for the State. Benefits include a stronger transport equipment sector, more efficient goods transport, dramatically improved labour force productivity, more socially cohesive communities and greater wealth creation.

Over the last decade, the University of Melbourne has made advances in algorithmic data mining, agent based modelling, large scale simulation models and machine learning. The University's Professor Rao Kotagiri, for example, has developed expertise in relevant areas such as large databases, machine learning, data mining, robust agent systems, logic programming, deductive databases and distributed systems applied to matters such as traffic flow and car parking optimisation. For transport planners, transport technology developers and transport equipment manufacturers, tools such as geographic information systems and geo-spatial mapping are introducing intelligent systems design methods and significant commercial opportunities.

The Victorian Government, along with local governments and their urban and regional planners, face significant challenges in using Big Data to drive policy decisions. Despite the availability of a wide range of techniques and methods with which to understand and visualise transport planning and spatial data, there are impediments to the quality and pace of decision making at a system level. Equally, the private sector faces a wide range of important hurdles in making crucial investment decisions for capital projects and transport equipment servicing and manufacturing initiatives. In addition, there are other challenges to be faced: as urban centres in Victoria grow, effective use of transport technologies will be necessary to ensure a high degree of equity in the provision of, and access to, employment and services within urban areas as well as between them. This is key to ensuring that all Victorians have a consistent and high level of quality of life.

For these reasons, the University of Melbourne is proud to host the Australian Urban Research Infrastructure Network (AURIN). AURIN is an initiative funded by the Australian Government's Super Science scheme. AURIN provides built environment and researchers,

product designers and planners with the tools and infrastructure to facilitate access to a distributed network of aggregated datasets and information services. The University of Melbourne is the lead agent for AURIN and there are more than seventy key research collaborators who are central to the latter's research data modelling and tool development. AURIN is the only National Collaborative Research Infrastructure Strategy (NCRIS) project which specifically focuses on developing and operating a national research infrastructure that is needed to enhance the development of our diverse human settlements system, including our cities. Based on the University's Parkville campus, the \$24 million national investment in AURIN is providing, for the first time, programmatic on-line access to a wide diversity of data from multiple sources. This is powerful when it comes to developing transport technologies and making transport manufacturing investment decisions. AURIN provides this information to researchers, governments, private-sector investors, transport engineers and others. Equally importantly, AURIN gives users the ability to integrate the data and interrogate them using state-of-the-art statistical and spatial analysis, including advanced visualisation tools for modelling.

Working with governments, industry and researchers, AURIN is developing standards, ensuring coverage across jurisdictions, harmonising data and, through the application of appropriate benchmarking and analytic procedures, producing a comprehensive suite of value-added data. This gives industry, the Government of Victoria and the State's local governments, a single source of powerful information to enable evidence-based decision making about matters such as investments in transport infrastructure as well as transport technologies development and transport equipment design, engineering, manufacture and servicing.

The Victorian Government, with the support of the commercial sector, is in a position to play a significant leadership role in encouraging this type of Open Data and broad data access initiatives in the Victorian transport sector. Specifically, there is a significant opportunity to encourage and stimulate thinking and initiatives around how best to share the knowledge encoded in Victorian transport-related data and to boost awareness of and access to AURIN's interpretive tools to maximise the benefit that can be derived from this data.

## **5. FOSTERING COLLABORATION BETWEEN INDUSTRY AND RESEARCH ORGANISATIONS**

The University of Melbourne has comprehensive capabilities in teaching, research, innovation and commercialisation. These capabilities are particularly strong in a wide range

of disciplines that will underpin the future growth of Victoria's transport technologies sector. The University's strengths include Professor Michael Brear's work in vehicle propulsion systems and Professor Chris Manzie's work in control systems, through to advanced manufacturing and intelligent transport system development as well as transport-related public policy and regulatory reform. The University of Melbourne is proud of its long history of close cooperation with both the Victorian Government and our range of industry partners. The latter includes successful Victorian transport equipment manufacturers such as Air Radiators, and Bolwell. Close research ties with the Ford Motor Company and Toyota also continue. This research is funded directly from the US and Japan. This is clear evidence of the international standing of the work done at the University of Melbourne. The University sees this type of collaborative approach as a key mechanism for leveraging the greatest possible benefit for the State from Victoria's longstanding investments and capabilities in this area. This view is based on a recognition that the most successful innovation is collaborative and a consequent belief in the benefits of growing Victoria's research and development precincts as collaboration tools.

The University of Melbourne's *Growing Esteem 2015–2020* strategy articulates the institution's ambition to develop even more significant industry engagement in coming years. The University is seeking to develop an ever closer collaboration with the Victorian Government as well as our State's transport technology and transport equipment industry stakeholders. To address the need for deeper and broader engagement between industry and research, the University of Melbourne has restructured its Research, Innovation and Commercialisation Office (RIC) and employed a team of business development professionals to facilitate greater engagement between the University and industry.

In order to support further the growth and competitiveness in the State's transport technologies sector, the Victorian Government is encouraged to consider enabling greater use of innovation clusters or hubs to foster new start-ups and accelerate transport technology focused start-ups. Such organisations, the sector and the broader Victorian community will benefit from forums that translate knowledge, ideas and research outcomes into practice and products. As a way of doing this, the Victorian Government has the potential to influence and leverage Federal Government investment in the Advanced Manufacturing Growth Centre.

As an example of the type of research that is relevant to the Victorian transport technologies sector, the Melbourne Networked Society Institute (MNSI) is responding to the increase in the number of connected devices – a transformation that, although dramatic, is only in its

earliest stages. Consequently, the MNSI is taking an interdisciplinary approach to tackling the question of how society can take advantage of networks and connectivity to improve quality of life, efficiency and sustainability. The activities of the MNSI encompass a wide range of research, including improving the business, of tools and technologies that can drive productivity growth in areas such as the development, manufacturing utilisation and servicing of transport equipment.

## 6. COLLABORATIVE RESEARCH IN ADVANCED MANUFACTURING

The rapid changes taking place in both manufacturing technologies and techniques are especially relevant for Victoria, with its long history of manufacturing, particularly in the transport equipment sector. Victoria has, for example, long dominated Australian caravan building, truck making and automotive aftermarket manufacturing. Despite this, as a developed, high cost economy, Victoria cannot remain competitive where the basis of competition is merely scale and unit cost. However, we are seeing changes in technology and international supply chains such as increasing complexity and a tendency to international disaggregation. This is particularly evident in the aerospace component sector. Together with new innovative business organisational models, these changes have opened up opportunities for competitive new manufacturing, including in other parts of the transport equipment sector. These changes mean that being small is not necessarily a disadvantage, with manufacturing opportunities emerging that are based on short runs, high variability, high product complexity and rapidity to market – as well as high product value. Supporting Victoria's transition to this new reality means promoting competitive advantages for Victorian transport equipment industry that are based on innovation as well as operational superiority and agility across multiple value chains.

A key hub for building Victoria's transport equipment manufacturing strength is the Innovative Manufacturing Co-operative Research Centre (IMCRC). This Centre integrates technological and business innovation to significantly improve manufacturing competitiveness. A feature of the approach taken by the IMCRC is a high degree of interaction between and across all its programs and projects. IMCRC's objective is to help accelerate the shift into 'new manufacturing' opportunities and to develop more profitable value chains. IMCRC's active engagement with Australia's national research capability, comprising eighteen research partners including CSIRO, brings cutting-edge research capacity to our state. The Victorian Government and, in particular, the Department of Economic Development, Jobs, Transport and Resources has the opportunity to play a key role in helping IMCRC to develop its networks within the Victorian transport technologies

sector.

In addition, there are further opportunities for Victoria to build such collaborative opportunities through funding opportunities such as the ARC Industrial Transformation Research Program and through Linkage Programs. More generally, the University offers its assistance in convening policy discussions and other industry-focussed initiatives. Working with stakeholders, a shared research agenda and range of other programs could be developed to advance the Government's policy agenda to build a stronger, more productive and more inclusive Victorian economy.

#### RECOMMENDATION:

That there be deeper cooperation between Government, the University of Melbourne and transport technology businesses through support for innovation hubs and clusters, as well as cooperative research programmes such as the Innovative Manufacturing Cooperative Research Centre.

## 7. A HISTORY OF COLLABORTION IN DRIVETRAIN RESEARCH

The Advanced Centre for Automotive Research and Testing (ACART) is a collaborative undertaking between the University and Ford. For a decade, ACART has provided the Victorian transport equipment industry with state-of-the-art infrastructure and skilled personnel for research and testing.

ACART delivers high quality, commercial-in-confidence testing and research to numerous industry bodies, a wide range of transport equipment manufacturers, as well as government agencies. ACART's research and development activities are focused on reducing fuel consumption and emissions, whilst increasing the reliability of different types of vehicles.

ACART has particular expertise in:

- conventional and alternative fuels,
- modelling and control of conventional and hybrid powertrains,
- fuel chemistry,
- laser and other diagnostics for combustion and fuel sprays,
- chassis and engine dynamometer testing, and
- environmental wind tunnel testing.

As part of its commitment to building and maintaining strong industry links, the Melbourne School of Engineering, including ACART, is establishing a relationship with PACCAR, one of the world's largest manufacturers of medium and heavy duty trucks. PACCAR is particularly important company to Victoria because it owns Kenworth Australia and DAF Trucks Australia. The University of Melbourne is exploring ways in which we can increase our intellectual and infrastructure investments in areas that are of particular importance to PACCAR. These include:

- the design of conventional, hybrid and fully electric powertrains for medium and heavy duty vehicles,
- semi-autonomous guidance systems for road vehicles,
- complementary alternative fuels and engine systems for medium and heavy duty vehicles, and
- optimisation of medium and heavy duty vehicle drag and cooling.

Such work promises significant reductions in pollutant emissions and improved road safety, whilst enhancing Victorian innovation, manufacturing and exports. Indeed, there is a valuable opportunity to build a web of cooperative partnerships between PACCAR and other local suppliers, with whom the University of Melbourne also has ties.

In order to enable Victoria, and indeed Australia, to capitalise on these opportunities, there is a need to expand capability in drivetrain testing, research and development. The current absence of a national drivetrain testing and research facility limits local civilian and defence industry development and has consequent impacts on local employment and exports as well as our environment. The need for such a national facility has been recognised in many competitor countries. This has led to the establishment, and success, of publicly-owned entities in other jurisdictions. Examples include:

- Institute France du Petrole (IFP),
- Japan Automobile Research Institute
- German Aerospace Centre, transport facilities,
- Fuels, Engines and Emissions Research Centre, Oak Ridge USA
- Combustion Research Facility, Sandia National Laboratories, USA

The scale and cost involved in achieving and sustaining these capabilities is beyond the scope of individual organisations. There is significant advantage in concentrating the nation's investment in this area in the one facility. Given its strength in transport technology research

and transport equipment manufacturing, Victoria should be the home of such a national facility.

## 8. VICTORIAN INSTITUTE FOR POWERTRAIN AND EMISSIONS RESEARCH (VIPER)

The University of Melbourne is working to establish the Victorian Institute for Powertrain and Emissions Research (VIPER). Recognising the importance of such an initiative to Victoria, the University is seeking to create VIPER using a collaborative approach led by the University and the Victorian Government. Once established, VIPER would undertake research for transport equipment manufacturers, mining companies, defence, and government. For example, VIPER would be the ideal location for the national vehicles emissions testing facility that may emerge from the review of the failure to identify Volkswagen vehicles that do not comply with Australian Design Rules.

In the main, VIPER would test and develop advanced internal combustion engine systems hybrid and electric powertrains. These tasks include the further development of conventionally fuelled engines as well as their conversion to gas (CNG, LNG and LPG) fuelling. (Gas fuels are especially relevant for Victoria's road transport equipment manufacturers because of the existence of well-established gas refuelling infrastructure across Victoria). In addition, VIPER would enable Victoria to participate in the development of hybrid passenger vehicle and truck powertrains for both civilian and defence purposes.

Because these transport technologies have both civilian and military applications, it is intended that VIPER be staffed by personnel who specialise in advanced powertrain research and testing – and who are cleared to work on both military and civilian projects. Defence research and development opportunities in this area are significant because of the strong interest that the Australian Defence Forces (ADF) has in hybrid engine technology. Among other advantages, this transport technology allows stealthy advance and retreat in combat theatres. If it is established, VIPER would be equipped to undertake a range of activities relevant to the development of ADF land and sea vehicle propulsion systems. Most importantly, the prompt creation of VIPER would position Victoria for a key role in the development of the propulsion systems for the next generation of Royal Australian Navy submarines.

## 9. VICTORIAN 'PROOF OF CONCEPT FUND'

To help Victoria capitalise on innovations developed within the State, the University of Melbourne is investigating a range of models for the establishment of the Victorian 'Proof of Concept Fund'. Such a fund will create a pipeline of innovative proposals. These would be supported until it is clearer whether or not there is potential to secure seed funding to develop each concept through until the idea can be licenced or a spin-out company created. The University is keen to work with other established research institutions in order to ensure that the proof of concept fund becomes a key tool for Victorian innovators to bridge the gap that exists in translating research and ideas into products and services. The University of Melbourne is striving to create a syndicate of selected partners who, along with the University, will be responsible for raising the required capital. Once this has been achieved, this funding will ensure that Victoria is able to retain and develop its strongest ideas and the best talent. In this way, Victoria will be able to generate export income and high wage jobs. The University of Melbourne recognises that the Victorian Government shares our commitment to these aims. The University acknowledges the Government's work with Startup Victoria and asks that the Victorian Government assist with the next stage in the research and innovation value chain by supporting the establishment of a Victorian 'Proof of Concept Fund'.

## 10. PUBLIC POLICY

A key role for the Government is in the development and implementation of public policy that assists the transport equipment sector. There is an opportunity, and indeed an imperative, to develop a regulatory framework that is able to respond to the coming wave of transport technologies, such as vehicle connectivity. The changes brought to taxi transport by Uber are minor compared to the possibilities that arise from a range of intelligent transport technologies currently under development in Australia and internationally.

The Victorian transport technology sector has been operating in a changing and uncertain public policy environment. The University of Melbourne fully appreciates the challenge of developing public policy that reflects the dramatic technological changes sweeping the transport technology sector. Indeed, the University is helping to power some of these exciting technological changes. Because of this role in driving innovation (along with the University of Melbourne's capacity to bring together experts in areas such as demographics, innovation, engineering, data analytics, human-machine interfaces and advanced manufacturing), the University is well positioned to assist the Victorian Government in establishing durable policies that will allow necessary public and private investment to occur with confidence in the future policy settings. As an example of this capability, Anne Steinemann, Professor of Civil Engineering, and Chair of Sustainable Cities, at the

University of Melbourne, is an internationally recognised expert in the areas of engineering and sustainability, including environmental pollutants and infrastructure systems.

Professor Steinemann works closely with industry, government and the community to develop and apply research to practical transport technology problems. She brings an interdisciplinary approach to engineering sustainability, integrating her expertise in engineering with city and regional planning, climate and environmental science, economics, population health, law, and public policy. Professor Steinemann serves as an adviser to governments and industries around the world, and has directed major federally funded research programs. Her work has resulted in new federal and state legislation, agency policies, and industry practices.

Drawing on such expertise, working closely with the Victorian Government and the Victorian transport design, technical services, engineering and manufacturing industry, the University of Melbourne is able to provide powerful insights into a wide range of new transport technologies and industrial innovations. The University is also a leading source of knowledge on transport-related matters such as the current and the future states of Victoria's population and labour markets, the related infrastructure needs, and the well-being and quality of life of our peoples and communities. In this way, the capabilities offered by the University of Melbourne's existing research infrastructure can be applied to enabling high quality, evidence-based decision making by governments and industry in the transport equipment sector.

Taxation is an important policy instrument and lever for attracting and retaining the Research and Development (R&D) and manufacturing investment of companies. There are significant benefits to the nation that would accrue from targeting R&D incentives to more effectively grow innovation. Given that such reform would particularly benefit Victoria, with its knowledge-intensive industries, strong manufacturing base and high-quality research infrastructure, the Victorian Government is encouraged to advocate for policy improvements in this area. Changes to R&D tax incentive have considerable potential to strengthen Victoria's leadership in areas such as transport equipment and advanced manufacturing technology. In particular, reforms to the R&D regime could stimulate industry-directed world class research that strengthen Victorian manufacturing, engineering, design and technical services businesses operating in the transport sector.

**RECOMMENDATION:**

That the Victorian Government engage with forthcoming Commonwealth review of the Research and Development (R&D) Tax Incentive with a view to improving this incentive's capacity to encourage innovation.

**11. GOVERNMENT INVESTMENT IN TRANSPORT**

The University notes that the Victorian Government has considerable capacity to strengthen the transport technologies and equipment industry in the State through the Government's ongoing and extremely large investments in transport infrastructure and equipment. In addition, through its responsibility for matters such as road and rail transport in Victoria, the Government is able to drive the State's leadership in the development and adoption of new transport technologies and policy positions.

**RECOMMENDATION:**

That the Victorian Government take advantage of the wide range of expertise that is available at the University of Melbourne to help the Victorian Government with public policy development, regulation design and public investment decision-making.

**12. GEELONG HEAVY VEHICLE PLATOONING INITIATIVE**

Autonomous vehicles will soon revolutionise transport systems worldwide. There will be gains in safety, improved environmental performance, reduced transport times and changes in travel behaviour. For example, greater vehicle autonomy will enable heavy vehicle platooning, whereby trucks travel in single file with small inter-vehicle distances. This involves an array of technologies including radar, magnetic sensor and wireless communication systems that are used to maintain speed, distance and lateral control. Heavy vehicle platooning enhances the efficiencies in the transport system by reducing the space required by heavy vehicles across the road network. In addition, platooning reduces the drag each vehicle is exposed to and thereby brings both greater fuel efficiency and reduced emissions. There are also considerable safety gains to be achieved from automation.

Platooning, despite its advantages in fuel economy, in particular, offers a range of implementation challenges. These include matters ranging from responding to bridge load limits through to ensuring safe and effective freeway access and egress for other road users. The existence of significant opportunities in these areas is clear. Consequently, both New South Wales and South Australia have commenced initiatives focused on embracing these new transport technologies.

In Victoria, the University of Melbourne's Professor Mark Stevenson, working with industry partners such as MAN (a truck manufacturer), Cohda, Boral, Kelly Logistics and Telstra, is working to undertake the first heavy vehicle platooning trial in Australia. Professor Stevenson's Geelong Heavy Vehicle Platooning Initiative is intended to establish communications between vehicles and the infrastructure along a freight corridor (from Geelong Port to the Geelong Ring Road) and it will deploy autonomous heavy vehicles (in platoons) along the Princess Highway to Waurin Ponds. The Initiative will lead to the creation of heavy vehicle platooning technology innovations and hence commercial opportunities for Victoria. In addition, it will enhance freight movements and thereby contribute to important productivity gains for the State, commencing in Geelong.

The Port of Geelong is the State's largest bulk port. It has a cargo throughput worth about \$10Billion each year. This creates nearly \$1Billion worth of benefits to the local economy and nearly two thousand direct and indirect jobs for the Geelong region. Geelong's port plays a vital role in the freight network supporting the transportation of goods across the region and beyond. However, the Port of Geelong has much greater potential that could be exploited if freight operations around it could be enhanced through heavy vehicle platooning. Importantly, although it has particular focus on Geelong, the opportunities, knowledge and transport technologies from this project will also have application to the Port of Melbourne.

An important opportunity for Victoria in October 2016 is the hosting of the 23<sup>rd</sup> Intelligent Transport Systems World Congress where approximately 2000 participants and technology leaders from around the world will be in attendance. There is an opportunity for the State Government announce its support of the Geelong Heavy Vehicle Platooning Initiative and to showcase its willingness to play a lead role in developing and fostering these industry-changing transport technologies.

## RECOMMENDATION:

That the Victorian Government assist the Geelong Heavy Vehicle Platooning Initiative which would benefit the Geelong region, as well as the State's transport technologies sector.

## 13. SKILLS TRAINING

The University of Melbourne recognises that the transport technologies industries – and especially those parts of the sector involved in design, engineering, technical services and advanced manufacturing – have faced challenges in attracting, retaining and building skills. This challenge might be arbitrarily divided into two parts. The first is the need for both Victoria's researchers and industrial personnel to have high levels of business acumen. The University is providing these skills within a wide range of educational programs. The University of Melbourne is working to increase commercial understanding within the transport industry sector, particularly its graduates. Examples of this include activities undertaken in both the Carlton Connect Initiative (CCI) and the Centre for Workplace Leadership (CWL).

CCI is performing as an innovation cluster and as a source of thought leadership as well as a means to build links between, and amongst, academics and the business community. It gives the Victorian transport equipment sector a significant competitive and innovation advantage through access to excellent industry-focussed researchers and world-class research infrastructure.

The Centre for Workplace Leadership, also located at the University of Melbourne, specialises in areas such as High Performance Work Practices that can make up part of educational and training courses across Victoria. It is able to strengthen Victoria's transport equipment sector by providing training in techniques that maximise productivity.

The University of Melbourne is also very much aware of the need for more transport technology experts who have core training in science and engineering to be able to conduct research into the broad range of emerging technologies. The University has recognised the need for Victoria to have a pipeline of transport equipment experts with a multidisciplinary approach to transport technology challenges and opportunities. There is a gap in the

available expertise for people who have solid understanding of technical economic and regulatory aspects of the emerging technologies and their application across the Victorian transport system and across the range of transport equipment engineering, design, services and manufacturing activities. The Victorian Government is encouraged to work closely with Victorian universities to facilitate greater education and training in these areas across the state. The ability to assess simultaneously the technical, economic and regulatory feasibility of new technologies, or even existing technologies, in a rapidly changing transport technologies and equipment industry is a skill that will remain in demand.

#### RECOMMENDATION:

That the Victorian Government engage with forthcoming Commonwealth review of the Research and Development (R&D) Tax Incentive with a view to improving this incentive's capacity to encourage innovation.

#### CONCLUSION

The issues described in the Discussion Paper are important to the challenges facing the Victorian transport equipment sector.

The University is keen to continue working collaboratively with the Victorian Government, industry and key stakeholders to develop innovations and solutions across the entire transport industries value chain.

This response to the Transport Technologies Discussion Paper contains a number of recommendations such as that the Victorian government assist with the development of the Victorian 'Proof of Concept Fund', the creation of the Victorian Institute for Powertrain and Emissions Research (VIPER), the implementation of the Geelong Heavy Vehicle Platooning Initiative and the ongoing success of innovation hubs and clusters and cooperative research programmes such as the Innovative Manufacturing Cooperative Research Centre. In addition, this document provides many examples of the University of Melbourne working with Victorian companies to develop and exploit new intelligent transport technologies. Rapid, effective and co-ordinated uptake of smart and sustainable transport technologies will be vital to Victoria's future economic prosperity. As one of the most important sectors of the State's economy, transport equipment will continue to be a crucial element in driving Victoria's productivity across other sectors and in increasing our state's competitiveness. Not

only does the Victorian transport equipment sector provide key infrastructure and equipment that allows our community to function, but it also delivers the recreational vehicles, services, goods and prosperity that underpin the quality of life in our State. Consequently, it is clear that a close partnership between the Victorian Government, the University of Melbourne and the transport technologies sector has great potential to bring economic, social and environmental benefits to Victoria.

The University appreciates the discussion paper's strong focus on design, engineering and manufacturing. Transport equipment manufacturing is an activity where the University of Melbourne has long had deep links with the Victorian manufacturing industry. By successfully bringing together transport equipment manufacturers and the nation's best researchers, Victoria can drive innovation and commercial success for this crucial industry sector.