ANZPAA
Australia
New Zealand
Policing Advisory
Agency

REMOTE ENGINE IMMOBILISER REFERENCE REPORT [2019]

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Contents

EXECUTIVE SUMMARY

This report was commissioned in the wake of serious injury to Queensland Police Service Constable Peter McAulay who was hit by a stolen vehicle involved in a police pursuit. The premise underlying this work is that if remote engine immobiliser (REI) technology were available, the safety of the public, police officers and offenders would be enhanced. Safety, not vehicle crime is therefore the primary focus of this report.

REI technologies already exist and are in use throughout the world. However, these systems are:

- anti-theft focused and are predominantly used to prevent a vehicle from being re-started as opposed to stopping a moving vehicle.
- decentralised with system management the responsibility of car manufacturers or third party fleet managers.
- an opt-in service which rely on vehicle owners' consent.
- in operation on a much smaller scale than envisaged for Australian policing.

There are also issues unique to the Australian context that need to be considered when analysing the feasibility of a nationwide REI system:

- Australian Design Rules (ADRs) which govern the establishment of standards under the *Motor Vehicle Standards Act 1989*, require evidence of a clearly defined and tested safety benefit before a standard can be implemented. This is not available for REI's because no single in-vehicle REI technology with an enabling environment currently exists anywhere in the world.

- Almost all vehicle manufacturing is currently undertaken overseas. With Australia representing 1.2%[1] of the international vehicle market it will be challenging to influence manufacturers to include REI technology in all vehicles across the market.

- Making allowances for current vehicle age proportions in Australia, it would take approximately 16 years from the time REI technology becomes a standard inclusion for it to become available in approximately 80% of Australia's vehicle fleet.[2] An after-market solution is not deemed feasible for a range of reasons including technological and effectiveness.

[1] "Provisional Registrations or Sales of New Vehicles - All Types, 2017," International Organisation of Motor Vehicle Manufacturers, accessed January 22, 2019, http://www.oica.net/wp-content/uploads/Sales-all-vehicles-2017.pdf

[2] Projection assumes continued proportions of registered vehicles, grouped by year of manufacture. Data from "9309.0 – Motor Vehicle Census, Australia, 31 Jan 2018", Australia Bureau of Statistics, accessed January 22, 2019, http://www.abs.gov.au/ausstats/abs@.nsf/mf/9309.0.

In a perfect scenario, enabling the remote immobilisation of a vehicle would undoubtedly lead to better safety outcomes for the public, police officers and offenders. However, whether such a system is currently feasible is the more difficult question. This report examines that question with consideration given to:

Technical Considerations	▪ In vehicle technology ▪ Enabling environment
Implementation Considerations	▪ Installation ▪ Mandatory frameworks ▪ Voluntary frameworks
Stakeholder Considerations	▪ Technology ▪ Costs borne by industry ▪ Privacy and consumer rights
Future Considerations	▪ Automated vehicles ▪ Connected vehicles

Examination of the above has led to the following overall findings:

- While the technology already exists to immobilise certain vehicles, it is not yet feasible for such technology to be utilised across the entire Australian vehicle fleet.
- There has been no successful implementation of a mandated REI solution across a whole vehicle fleet anywhere in the world.
- At this time, there is no single in-vehicle technology available, nor is there the required enabling environment to support the use of REI technology. However, with continued technological development REI may be feasible in the future.
- While the technology is developing rapidly, it is likely to be superseded by connected and automated vehicles.
- Until connected vehicles have saturated the fleet, line of sight to identify the applicable vehicle would be required which may not mitigate the risk that currently exists with police pursuits.
- Until the process associated with timelines and deployment of an REI is addressed, such as vehicle verification, authorisation and connectivity, the safety impact of the technology may not be able to be realised.
- There are scenarios where there may be unintended safety consequences from deploying an REI on a moving vehicle.
- The costs of administering one interconnected REI system would be substantial, notwithstanding the costs will be borne largely by industry and passed onto consumers associated with research, development and production.
- GPS technology will also be integral to vehicle identification. This will raise issues of privacy and who owns the data that is collected.
- Fleet saturation of connected / autonomous vehicles is more likely (even probable) before fleet saturation of REIs (assuming it is possible for an ADR to standardise REI).

INTRODUCTION

Background

In response to a proposal by the Queensland Police Minister, following an incident where Constable Peter McAulay was hit by a stolen vehicle involved in a police pursuit, the Ministerial Council for Police and Emergency Management (MCPEM) agreed on 26 October 2018 to establish a national working group to explore issues related to police use of remote engine immobilisers or related technologies as a means of reducing the risks to the public and police from vehicle-related crime. The terms of reference (TOR) for the working group is at Appendix A.

The working group membership is outlined in Appendix B. Relevant technical experts, government departmental and organisational representatives and other stakeholders were consulted through various meetings with the working group to ensure a cross-sector consultation process.

Structure

This report addresses all aspects outlined in the TOR arising from the MCPEM meeting through exploring technological, implementation, stakeholder and future considerations. The report is supported by a number of Appendices, noting Appendix C, which maps the terms of reference to the relevant section of the report.

Rationale

Increasing Safety

Police are sometimes required to stop, or interdict, moving vehicles, as vehicles may be stolen or may be used in the commission of other offences. In these circumstances the safety of the public, police officers and offenders is paramount. The decision to stop moving vehicles safely or ensuring that stopped vehicles cannot be started, has to be made quickly and decisively, while continuously assessing risk and safety.

This report recognises that police officers already use various vehicle stopping tactics; acknowledging that these tactics generally require physical contact with target vehicles.[3] The purpose of this report is to assess the feasibility and practical impacts of Remote Engine Immobiliser (REI) technology that do not require physical contact with target vehicles and could be used to augment existing police vehicle stopping equipment and strategies. It focuses on the safety of the public, police officers and offenders and not on the police rationale for stopping moving vehicles or the intent of the vehicle operator.

REI could enhance safe outcomes in many road policing contexts, including where the operator of a vehicle disregards police direction to stop or, where police have cause to stop a vehicle without the operator's knowledge. Pursuits are the most obvious policing activity where REI could enhance safety, however, this report acknowledges that jurisdictional differences in categorising and reporting police follow and stop activities expands the range of road policing interactions which could utilise REIs.

The case of James Gargasoulas exemplifies the potential benefit of utilising REI technology. In January 2017, Gargasoulas killed six and injured 27 when he deliberately drove down Melbourne's Bourke St Mall targeting pedestrians. If REI technology was available, notwithstanding the age of the vehicle, police may have been able to immobilise the car as soon as it was reported stolen or at an appropriate time when under surveillance.

REI technology may also be able to stop dangerous road use that causes serious injury or death. In December 2012, a speeding BMW drove in the wrong direction on the Princes Highway in Victoria for 30km before crashing head-on into a vehicle containing six people.[4] Five people were killed instantly. Again, REI technology may have

[3] Noting that this report will not comment on the appropriateness of police pursuits or pursuit policy.
[4] Cameron Houston and Deborah Gough, "Wrong Way Leads to Sudden Tragedy," The Age, last modified December 8, 2012, https://www.theage.com.au/national/victoria/wrong-way-leads-to-sudden-tragedy-20121208-2b1u7.html.

been able to stop the vehicle, and potentially provide police and emergency services with an exact location of the vehicle.[5]

REI technology may also enhance the safety of offenders, the party most likely to be seriously injured or killed in police pursuits. In February 2018, 16-year-old Jack Patterson died after his car hit a tree in a police pursuit. Police twice called on Patterson to stop before a Stinger spike system was deployed. In attempting to avoid the Stinger, Patterson lost control of the vehicle and crashed into a tree.[6] As the vehicle was twice spotted by police and line of sight was established, it is reasonable to assume that REI technology may have contributed to a different outcome.

Preventing Crime

Anti-theft immobilisers have been compulsory in all vehicles entering the Australian market since 2001.[7] Since this time, it has been increasingly difficult to steal a vehicle without an authorisation device, such as a transponder in the key.[8] To overcome this, instead of 'hot-wiring' a vehicle, there has been an increase in thieves breaking into homes to obtain vehicle keys.[9]

During the 12 months to September 2018, there were 53,016 vehicles stolen in Australia.[10] Of these vehicle thefts, seven out of ten were stolen with the keys, the authorising key being the primary objective of house burglaries.[11] Additional disabling devices are being developed by manufacturers that assist in overcoming this method of theft, most notably General Motors (GM) OnStar™. Widespread introduction of REI technology may have additional benefits in enhancing vehicle anti-theft capability.

OnStar™

OnStar is a subscription emergency service available in some countries. One of the services provided is Stolen Vehicle Assistance. When a vehicle is stolen OnStar operators provide GPS coordinates to local law enforcement who verify location by line-of-sight. In some contexts a stolen vehicle can be remotely slowed to a stop.

*Refer **Appendix E RelatedTechnology Glossary** for further information.*

Promoting Adherence to Regulations

REI may further support adherence to regulations related to driving unregistered or unroadworthy vehicles. Linking REI technology to vehicle conditions designated as unsafe could operate similarly to how fleet management companies abroad are deploying REI technology to allow private fleet vehicles to be immobilised when agreements of use have been breached.[12]

[5] David McClure, Francesca Forestieri and Andy Rooke, "Achieving a Digital Single Market for Connected Cars: eCall—implementation status, learnings and policy recommendations," accessed January 11, 2019, https://www.vodafone.com/content/dam/vodafone-images/public-policy/policy-papers-and-news/ecall-report-final.pdf.
[6] "Tributes Paid to Teen Jack Patterson after Police Chase Ends in Fatal Perth Hills Crash," ABC News, last modified February 9, 2018, https://www.abc.net.au/news/2018-02-09/teen-jack-patterson-killedin-perth-crash-after-policechase/9417968.
[7] "Vehicle Standard (Australian Design Rule 82/00 –– Engine Immobilisers) 2006," Federal Register of Legislation, last modified August 8, 2006, https://www.legislation.gov.au/Details/F2006L02665; Joshua Dowling,"Disturbing New Figures Confirm Most Car Thieves Now Break Into Homes to Get Keys," news.com.au; last modified September 15, 2015, https://www.news.com.au/technology/innovation/motoring/disturbing-new-figuresconfirm-most-car-thieves-now-breakinto-homes-to-get-keys/news-story/fc-8deff8d0118bf6205d27c902a8e11a.
[8] Dowling, "Disturbing New Figures."
[9] Ibid.
[10] "Theft Watch – 12 months to September 2018," National Motor Vehicle Theft Reduction Council, last modified December, 2018, https://carsafe.com.au/theft-watch.
[11] Dowling, "Disturbing New Figures."
[12] Chris Baynes, "Finance Firms Fitting Kill Switches to Immobilise Customers' Cars if they Miss a Payment," The Independent, last modified July 15, 2017, https://www.independent.co.uk/news/business/news/finance-firms-fitting-kill-switches-immobilise-cars-miss-paymentlenders-poor-credit-a7842646.html.

SECTION 1 | TECHNOLOGICAL CONSIDERATIONS

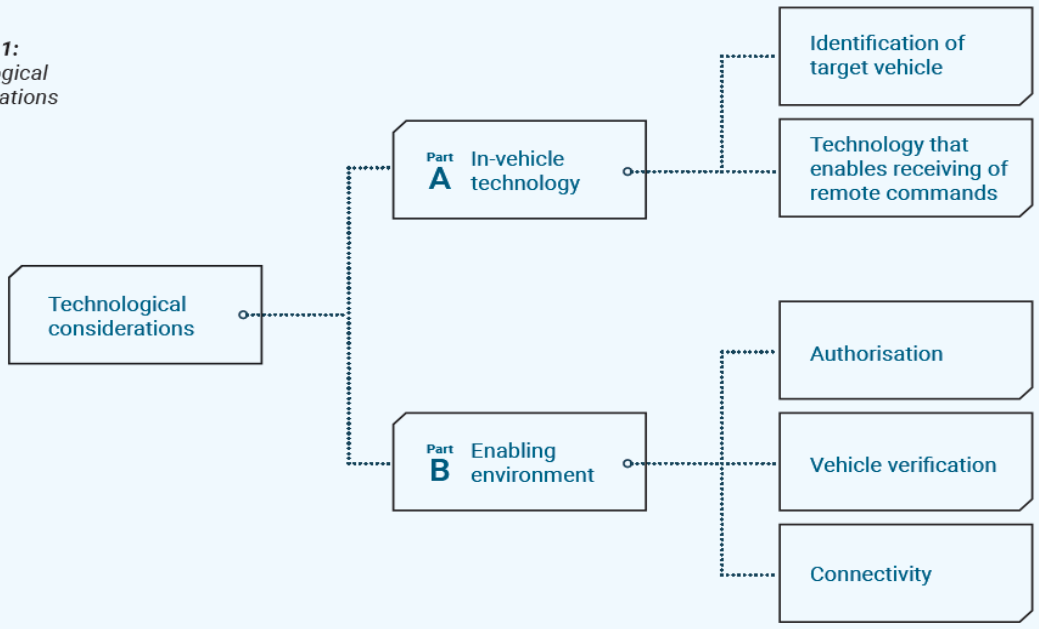
Engine immobilisers in the form of transponder-based immobilisers for anti-theft purposes have existed in Australia for some time.[13,14] The term 'remote engine immobiliser' is used to describe a wide range of technologies with diverse purposes and operating systems. For the purpose of this report 'remote engine immobilisers' have been organised into the following categories:

Category I	Technologies and supporting systems that are installed in vehiclesthat can safely **terminate** the **operation of moving or static vehicles**.
Category II	Technologies and supporting systems that are installed in vehicles designedto **disable** the **operation of a vehicle after it has been stopped and turned off**. These technologies are used primarily to prevent theft of vehicles.
Category III	**Related technologies that are not installed in vehicles** but can provide a functionthat may support immobilisation of a vehicle.

The working group agreed that Category I REIs are the focus of this report as these technologies and related technologies support the objective of enabling an authorised police officer to remotely, electronically and safely restrict the operation of a vehicle.

The technological considerations in relation to Category I are visually presented below:

Diagram 1: *Technological Considerations*



[13] "Australian Design Rule 82/00 – Engine Immobilisers."
[14] Noting that these are immobilisers that prevent the engine from running without the use of the correct transponder car key (or other token) present.

This section of the report will examine the technological requirements and challenges associated with a **Category I** REI technology for use in two parts:

PART A

In-vehicle Technology:

This section examines the requirements of technologies installed within vehicles (referred to hereafter as the 'on-board system') to enable the remote termination of both moving and static vehicles.

PART B

Enabling Environment:

This section explores the infrastructure and systems architecture required to support connectivity between vehicles and operational coordination 'call' centres that send remote commands to enable the remote termination of both moving and static vehicles.

PART A: IN-VEHICLE TECHNOLOGY

Developing and installing an on-board system that would allow remote termination of an operating vehicle is challenging as these systems would be required to:

- *allow for the **identification** of a vehicle targeted for remote immobilisation*
- ***receive remote commands** to immobilide the operation of the target vehicle.*

At the time of drafting of this report, there is no on-board system that could satisfy the requirements listed in Diagram 1: Part A. This report examines each of the listed requirements, drawing on examples of related technologies that can approximate each functional requirement.

Identification of Target Vehicle

Identification of the target vehicle is fundamental to the effectiveness and utility of an REI. A remote command to immobilise a vehicle (allowing for the safe slowing down, stopping and/or immobilisation of a vehicle) must be sent to and received by the exact target vehicle. Where this technology is currently successfully utilised abroad is when the owner initiates identification process.[15] Any identification technology will need to align to number plate technology reform because if a vehicle has false plates policing will have conflicting identifiers of the target vehicle.

The on-board system will require unique identification features and secure processes. This would ensure that any remote command would be sent to the right on-board system. Related technologies, such as Global Positioning Systems (GPS) tracking, may support such identification.

Considerations and Risks

Accuracy of information

Practically, visual identification of a target vehicle would be based on a combination of identifiers, such as registration number, make, model and colour of the target vehicle. This is challenging as using physical identifiers may not provide unequivocal identification of the target vehicle. The inherent challenge of relying on such identifiers is that the target vehicle may share some of its attributes with many other vehicles. Some identifiers (such as colour and number plates) can also be changed or removed, further complicating identification. Identification would likely rely on the ability of individual police officers engaged in pursuit to accurately identify and describe a vehicle's location, registration number, make, model and colour.

Timeliness

Consideration should be given to how many identifiers would be required before police could be reasonably assured that the vehicle targeted for termination is the correct vehicle as this will impact on the effectiveness of the technology. The time taken to verify all necessary identifiers will increase the duration of the pursuit. The longer the duration of a pursuit, the more risk to the public, police officers and the offender. Target vehicle identification can also result in procedural challenges, e.g. further authorisation and risk assessment processes may be required where most but not all identifiers are verified.

[15] "Stolen Vehicle Assistance", OnStar Services, accessed February 19, 2019, https://www.onstar.com/us/en/services/safety-security/stolen-vehicle-assistance/.

Technology that Enables Receiving of Remote Commands

On-board systems will require the capability to receive a remote command to activate slow down, stop and/or immobilise. Remote activation will require a communications network that not only enables transmission for commands to be sent to the on-board system, but also allows for the on-board system to send override commands to a number of other in-vehicle control systems.

Such vehicle systems will need to be able to:

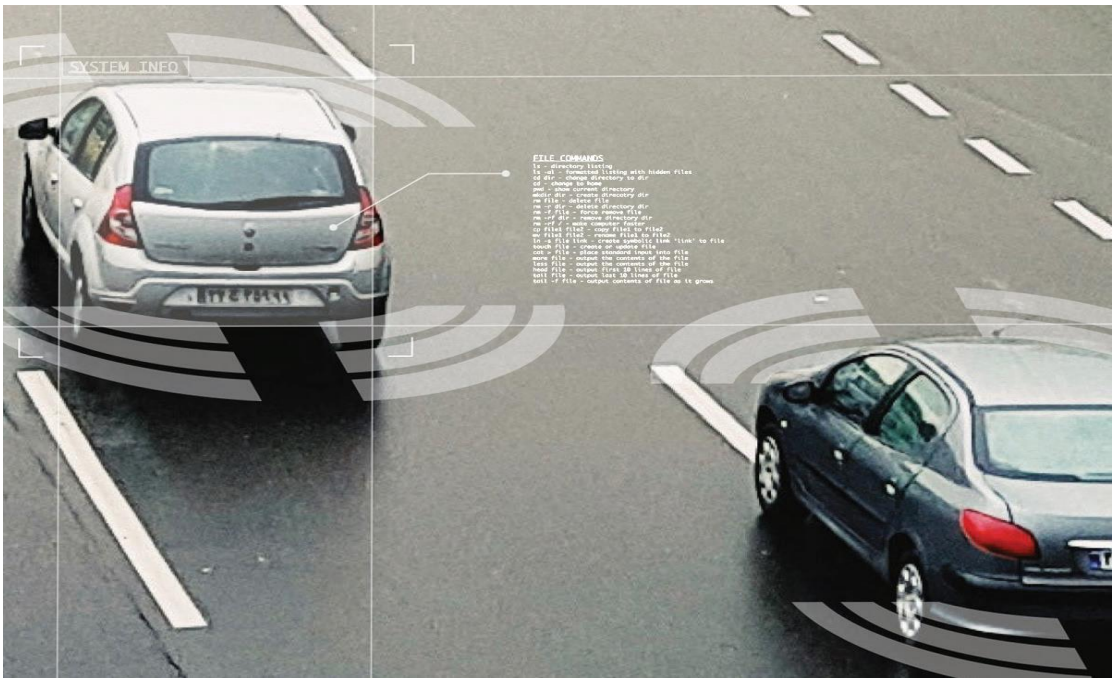
- slow down a moving vehicle to a stop, requiring control over brakes, throttle controls and transmission systems.
- immobilise vehicles by preventing them from being restarted, such as those that control the fuel pump, the ignition and/or starter motor.

Considerations and Risks

Technology that enables reception of remote commands through use of communication networks will require well-developed security infrastructure and technical capabilities.

Central to police use of remote commands is reliable security of transmitted information and the ability of a communication networks to protect data. Without robust and continually updated security, any information and data may be fabricated/intercepted or changed. Security vulnerabilities in some modern vehicles with wireless internet connectivity have already been identified. Hackers were able to develop software that exploited technologies such as wireless entertainment systems that allowed the hackers to take control of critical vehicle control systems (braking and steering).[16]

In the absence of an REI technology enabled with artificial intelligence capabilities, conducting a dynamic risk assessment will continue to be made by police officers engaged in pursuit.



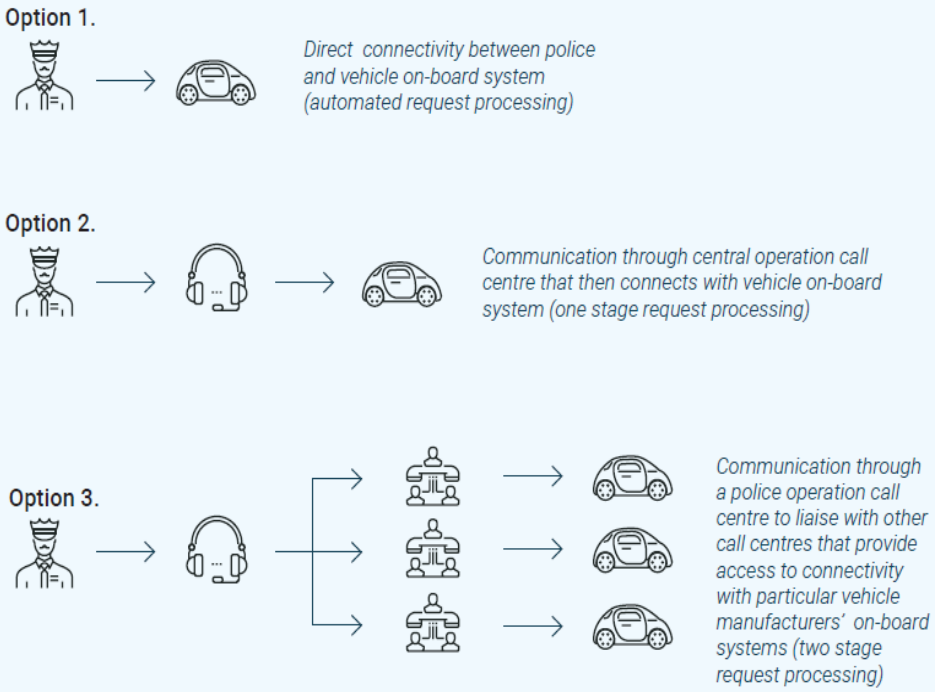
[16] "Hackers Remotely Kill a Jeep on a Highway", WIRED, accessed February 19, 2019, https://www.youtube.com/watch?v=MK0SrxBC1xs.

PART B: ENABLING ENVIRONMENT

If REIs are to be implemented, an appropriate enabling environment will need to be established. This enabling environment will need to provide the systems architecture to facilitate the end-to-end process of remote termination of the target vehicle. Implementing the enabling environment will require clearly defined responsibilities as to who will establish, manage and be accountable for different parts of the systems and termination process.

Depending on consistency and design/standard for on-board systems, and responsibility for management of an REI enabling environment, termination commands may be processed in different ways (Diagram 2).

Diagram 2: *Options of different enabling environments*



This could include police officers either having the capability to directly connect to the target vehicle's on-board system, or alternately channelling requests through one or more operation coordination centres.

An ideal enabling environment would allow operational police to connect directly with a target vehicle (Option 1, Diagram 2). However, this is not feasible at this time as there is no on-board system that can operate with different OBD-II port 'language'.

Due to the number of car manufacturers within the Australian market, it would be difficult for the police officer(s) on the ground to deal directly with a General Motors or Toyota for example, whilst also maintaining line of sight of the target vehicle. Therefore, it is envisioned that operational police would need to interface with manufacturers either through a centralised coordination centre (Option 2) or through a police coordination centre that contacts individual manufacturers (Option 3).

OBD-II port

Operation varies between manufacturers. These ports do not have interoperability because they are primarily a diagnostic interface that operates with numerous signal protocols.

A retrofitted solution utilising OBD-II port would need to be designed against a particular car which is very manufacturer specific.

If the solution is OBD-II port based it will be unlikely to reach complete fleet saturation.

Regardless of which enabling environment option is utilised, the process would still require:

- Authorisation: *police officers request authorisation for the operation of the target vehicle to be remotely terminated through slowing down, stopping and/or immobilisation*.
- Vehicle verification: *verifying the target vehicle would require pairing the unique identifier of the on-board system with other vehicle identifiers*.
- Connectivity*: linking remote commands sent through a communication network with a target vehicle's on-board system for actioning*.

Authorisation

Authorisation for the REI to be deployed would be provided by the operational police maintaining line of sight of the target vehicle. Line of sight would be critical to ensure the target vehicle was slowed and stopped safely. The national coordination centre would receive the termination request and action accordingly. This type of request processing is used in existing services such as StarChase™ and General Motor's OnStar™ (Appendix E).

Vehicle Verification

The identity of the target vehicle will need to be verified through a combination of pairing unique identifiers of the on-board system and physical vehicle identifiers such as number plate, make, model, colour and location. This will require both GPS monitoring and line of sight to be maintained throughout the verification process to ensure the termination of the correct target vehicle.

Connectivity

Telecommunications infrastructure is essential when receiving remote requests for termination and remotely actioning termination commands. The effectiveness of the entire enabling environment will rest on the capability and capacity of the network to provide reliable connectivity. Current communications infrastructure uses either short-range (peer-to-peer or one device connecting directly with another device) or long-range (peer-to-network or one device connecting through network infrastructure to other devices) capability. It is anticipated, partially through the rollout of 5G communication technology, that the use of 'mesh' networks could be more readily available allowing for the use of both long-range and short-range capability.

Considerations and Risks

Efficiency

Option 2 of Diagram 2 would be more efficient than Option 3 as every additional step will increase the time taken to deploy the REI. However, Option 2 is far more complex and would likely require greater time and money to establish. For the same reasons as Option 1 is not feasible, Option 2 may also prove difficult as it would require operation across all vehicle manufacturers to provide information to one coordination centre.

Management

Regardless of the preferred option, a 24/7 'coordination centre' capable of facilitating communication between parties involved in the termination process and connectivity with the target vehicle will be required. The establishment and maintenance of a national coordination centre raises the following considerations:

- What will it cost to establish and maintain the national coordination centre?
- Who (government or industry) will fund the national coordination centre?
- Who will be responsible for management and be accountable for the actions of the national co-ordination centre (government or industry)?

REI Specifications

There are a number of considerations relating to the specifications of on-board systems that will be a part of the enabling environment, including:

- Whether on-board systems will have one design or designed according to a standard?
- Will diverse on-board systems use different communication protocols?
- Whether the development and installation of on-board systems will be left to manufacturers' discretion?

Data Storage and Capture

The capture and storage of vehicle identifiers will require a database(s) that facilitates pairing unique identifiers of the on-board system with other vehicle identifiers. Questions arise as to who will be responsible for the development, maintenance and security of such a database(s). In the case of a factory fitted on-board system, if manufacturers elect to maintain separate databases, this will add to the complexity of the enabling environment and time from authorisation to effective actioning of the termination command.

Telecommunications Infrastructure

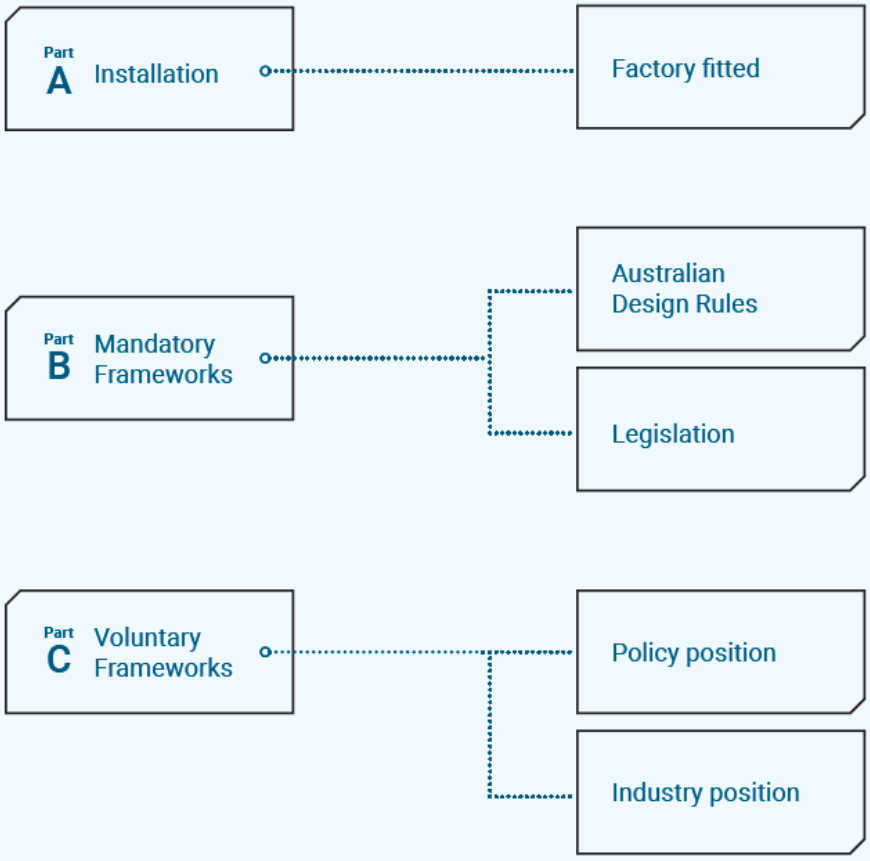
Current telecommunications infrastructure is used for commercial purposes and is maintained by privately owned telecommunications companies. Engagement with the telecommunications industry will be essential to ensure that additional loads will be planned for. The use of the telecommunications network raises considerations, including:

- communication security to prevent a termination command being intercepted, blocked or forged by non-policing actors.
- current coverage and reach of communication networks may mean mobile blackspots and low reception areas delay, or even prevent remote commands from reaching target vehicles.

SECTION 2 | IMPLEMENTATION CONSIDERATIONS

If a technological solution is available, the implementation of the technology and its enabling environment will be required. Implementation considerations are addressed as follows:

Diagram 3:
Implementation Considerations



PART A: INSTALLATION

This part examines the means by which the on-board systems could be installed in a vehicle fleet to facilitate termination of the operation of a target vehicle. Historically, there are two installation approaches:

After market installation:	*refers to retro-fitting an on-board system into existing vehicles.*
Factory fitted installation:	*refers to manufacturers installing the on-board system into vehicles as part of the manufacturing process.*

Due to the technology required of the enabling environment, the solution cannot be a modular device that is retro-fitted to a vehicle but requires a whole of system solution. The feasible solution therefore is to have the capability factory-fitted at the time of vehicle build.

Factory-Fitted Installation

Factory-fitted installation would require manufacturers to install REI technology in all newly built vehicles. This would only apply to the future fleet of vehicles. A factory-fitted approach would circumvent some logistical challenges as vehicles would be imported with REI technology already fitted. This option would have significant timeframes for nationwide REI vehicle fleet saturation as new vehicles entering the Australian market replace decommissioned vehicles.

Considerations and Risks

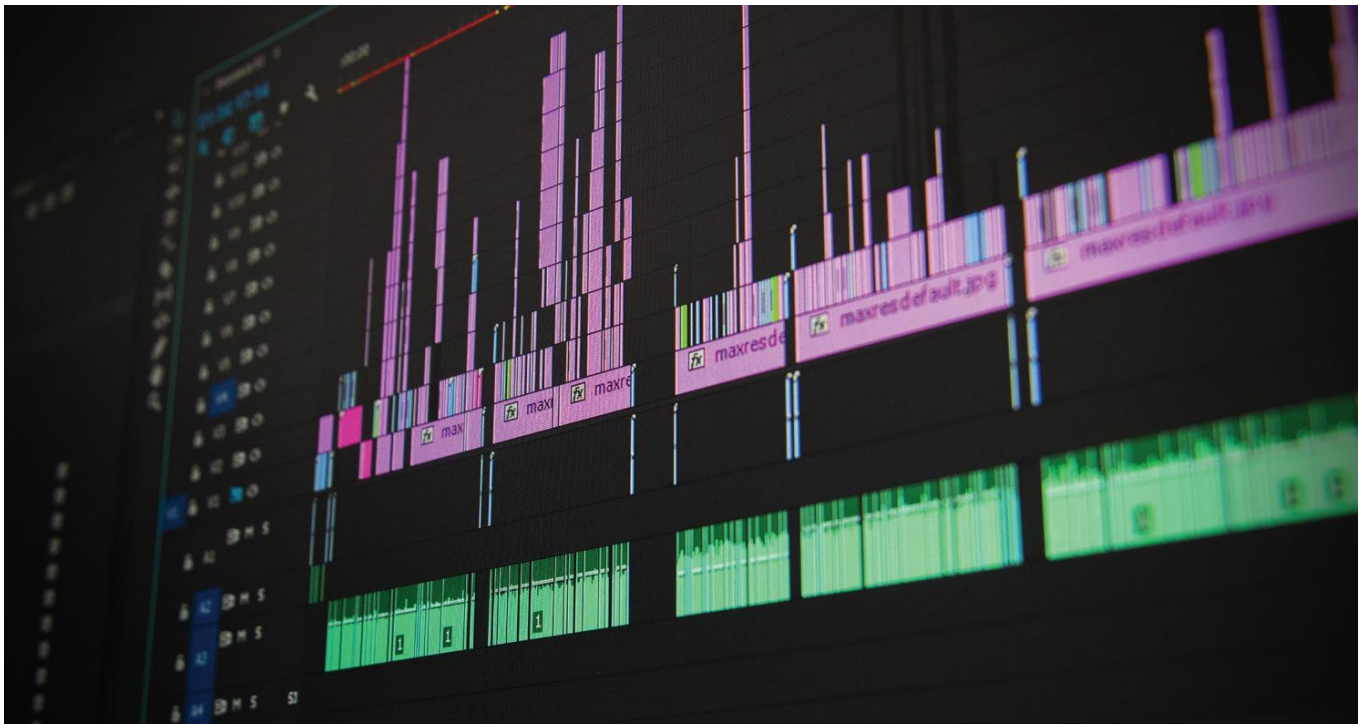
Ability to influence international market and manufacturers

Light passenger vehicles (cars) are all manufactured abroad with only some commercial vehicles manufactured in Australia. With Australia representing 1.2% of the international vehicle market it will be challenging to influence international markets and manufacturers, resting primarily in China, the United States, Japan and the European Union (EU), to include REI technology in all vehicles.[17] Combined, these countries and the EU represent 65% of global vehicle manufacturing and 72% of global vehicle sales.[18] Australia may also find it challenging to influence international vehicle regulations and standards. Should Australian regulations and importation rules be changed to require the installation of REI technology, consideration must be given to the potential for a less competitive vehicle market resulting in less choice for consumers.

[17] "Provisional Registrations or Sales," International Organisation of Motor Vehicle Manufacturers.
[18] Ibid.

Market Saturation

Factory fitted installation only represents an approach for new vehicles entering the Australian market. Consideration would need to be given to the delays in usability for REI technology due to the lead-in time required to saturate the active vehicle fleet. Under current vehicle age proportions in Australia, it would take approximately 16 years from the time REI technology becomes a standard inclusion for it to become available in approximately 80% of Australia's vehicle fleet.[19] This would be in addition to the time associated with changing regulation or importation rules as well as the time required to develop REI technology and manufacturers to include it in their manufacturing processes.



[19] Projection assumes continued proportions of registered vehicles, grouped by year of manufacture. Data from "Motor Vehicle Census," Australian Bureau of Statistics.

PART B: MANDATORY FRAMEWORKS

Mandatory frameworks refer to options that would make the installation of REIs compulsory.

There are two options available to achieve this:

Australian Design Rules (ADR)	*through the adoption of an ADR mandating the inclusion of REI technology in all newly manufactured vehicles imported into Australia.*
Model Legislation	*through the development of legislation that could be adopted as model legislation allowing for State and Territories to mandate the inclusion of REI technology in vehicles as part of State and Territory vehicle registration requirements. Further legislation will be required to allow for policing to lawfully use REI technology in pursuit resolution.*

Australian Design Rules

The current Australian Design Rules (ADRs) are administered by the Australian Government under the *Motor Vehicle Standards Act 1989*. The ADRs are standards for vehicle safety, emission control and anti-theft protection. The Act requires all vehicles, whether they are newly manufactured in Australia or are imported as new or second hand vehicles, to comply with the relevant ADR before they can be made available for use.

The ADRs are harmonised with international vehicle regulations adopted by the United Nations (UN) World Forum for the Harmonisation of Vehicle Regulations. The harmonisation of the ADRs with the UN Regulations is important for Australian import market controls as it allows vehicles built in larger markets to be imported with little or no modification. Regulation that is based on internationally agreed standards provides consumers with access to the safest vehicles from the global market at the lowest possible cost (Refer **Appendix F: Legislative and Regulatory Models for Implementation** for further information).

Considerations and Risks

Capability, not Technology

The ADRs entrench capability, not a specific technology. This allows manufacturers to satisfy the requirements of an ADR, as a standard, but use different systems. For example, Toyota would use a different ABS system to BMW or Mercedes with each system complying to the ADR standard. This promotes innovation but may also add to the complexity of the enabling environment.

This may lead to challenges as distinct REI technology may have different tracking abilities, collect dissimilar data and have diverse mechanisms that slow down, stop or immobilise a vehicle.

Lead in Time

The lead-in time for a new ADR is up to 10 years. This takes into consideration the time to develop the regulation (one to five years) and then allow manufacturers time to implement (up to five years). This timeframe will be extended when adding the time it would take for market saturation. It is reasonable to assume that by the time a new ADR has been adopted and market saturation of 80% has been achieved, the technology will have been replaced by new innovations (such as autonomous and connected vehicles). This raises questions in relation to the benefits of mandating REI technology through an ADR versus cost and time.

Demonstrated Safety Value

Currently, development of an ADR is prioritised in accordance with the potential for the ADR to improve overall safety to the public and alignment with internationally agreed standards.[20] Consequently, evidence of a safety benefit must exist before the ADR can be established. As such, an ADR relating to REI technology would require evidence demonstrating a safety value in relation to the approximate lives saved through the adoption of the technology. Currently such evidence does not exist and preliminary claims of enhancement to safety is based on assumptions. The logistics, time and costs of undertaking research to prove such a safety benefit would require consideration.

Model Legislation

Model law may be developed by a 'host' jurisdiction enacting a model law in its jurisdiction (usually as a Schedule to an Act of Parliament and, in recent times, usually called a 'National Law') or the Commonwealth can enact a model law. Other States and Territories pass an Act (an 'application Act') that applies the model law in its jurisdictions.

In relation to vehicles, the Australian Light Vehicle Standards Rules (ALVSR) and the Australian Heavy Vehicle National Law (HVNL) are developed by the National Transport Commission that set out the model laws for vehicles operating on Australian roads. The ALVSR are based on the ADRs and also mandate requirements that may not be contained in ADRs. Other legislation may require review or development in relation to how policing may use and access REI technology balanced against the rights of ownership.

National Laws

There are a number of examples of model approaches to national law including the NTCs Heavy Vehicle National Law and the establishment of the Australian Quality Skills Authority for regulation over the Vocational Education and Training sector.

Refer ***Appendix F: Legislative and Regulatory Models for Implementation*** *for further information.*

[20] Internationally agreed standards through the United Nations World Forum for the Harmonization of Vehicle Regulations.

Considerations and Risks

Agreement Between States

The NTC develops national regulatory and operational reform and implementation strategies for Australian roads. The process for developing model legislation, reaching agreement and uptake by States and Territories will likely require significant time.

Legislation and Regulation

Should mandatory frameworks allow for multiple REI technology providers, consideration may be required in relation to supporting regulations over the production, importation and use of REI technology.

Privacy and Surveillance

It is reasonable to assume that REI technology may require the use of some sort of tracking through GPS or network data. To allow police to track vehicles in pursuits, amendments to current surveillance and privacy legislation may be required. This raises privacy considerations in relation to civil liberties as GPS and network data is likely to contain information that is considered private (e.g. routines and places visited). This may result in public pressure not to use REIs as has occurred internationally (Appendix D).

Cross-border Challenges

Consideration should be given to situations where States and Territories do not adopt, or do not adopt at the same time, model legislation. This may have an impact where a pursuit crosses into another jurisdiction.

PART C: VOLUNTARY FRAMEWORKS

Voluntary frameworks will require agreement between governments, manufacturers and consumers. Using a voluntary framework in the first instance to promote the installation of REI technology, and later transitioning to a mandatory framework, may provide a more workable solution.

There are two voluntary frameworks that could be considered. Both will still require support from consumers, regardless of whether the implementation is government or manufacturer led.

Policy Position:	*Development of a common policy position between the Federal, State and Territory governments to guide engagement and negotiation with manufacturers, consumers and other stakeholders may provide a phased approach. Promotion of a policy position could be achieved through various means, for example uptake may be encouraged through reductions in insurance premiums.*
Industry Position:	*Industry (including manufacturers, regulators, associations etc.) could develop an industry led approach as has been done in the past with great success, for example with the introduction of new technologies such as GPS systems in vehicles. Industry can drive a voluntary uptake and promote REI technology with consumers. An industry led position could influence manufacturing specifications when factory fitting REI technology.*

Considerations and Risks

Impact

A policy position that is not mandatory may have low uptake and support, resulting in lengthy adoption timelines. The lead time to adopt an industry position may be affected as agreement between different industry stakeholders, such as manufacturers and distributors, will be required. The different legislation and manufacturing requirements or standards of countries in which manufacturing is occurring may also impact how timely the update will be.

Offender/Owner

Under a voluntary framework consideration and agreement would be required from police and manufacturers as to what would occur were the manufacturer asked to deploy the REI without the consent of the owner. Current voluntary frameworks rely on the consent of the owner. However, there may be circumstances where the owner is driving the vehicle which police need to intercept and therefore consent would be problematic.

Collaboration

Support from the Federal, State and Territory governments as well as the motor vehicle industry (associations, manufacturers and distributors) will be required to support a policy position. Further collaboration and agreements will be required between police jurisdictions and relevant third parties who may provide the enabling environment.[21] For example, in the United States police jurisdictions work in collaboration with companies such as General Motors, in apprehending offenders and recovering stolen vehicles) using REI technology.[22]

[21] Relates to potential outsourcing of services to access REI technology as occurring in the United States where police work in collaboration with companies such as General Motors, in apprehending offenders and recovering stolen vehicles.
[22] Jeremy Laukkonen, "GM's OnStar Service Explained," Lifewire, last modified January 7, 2019, https://www.lifewire.com/gms-onstar-service-534811.

SECTION 3 | STAKEHOLDER CONSIDERATIONS

Any attempt to develop and install REI technology will require engagement and commitment from a range of stakeholders.[23] The international experience demonstrates that without the cooperation of all stakeholders, any solution is likely to be unsuccessful.

In 2009, Brazil passed the 'Contran 245' legislation which required installation of tracking and immobilisation devices in all vehicles. The legislation was an attempt to mitigate a long-term vehicle theft crisis. However, the implementation of this mandate was delayed many times and suspended indefinitely in October 2015.

In 2013, the European Union (EU) established a working group to examine the potential roll-out of REI technology. The working group undertook a feasibility study to develop a technological immobilisation solution that could be built into all vehicles entering the European market. The study ultimately concluded that a scheme in the EU was not feasible.[24]

Many of the issues of concern to the motor vehicle industry have already been raised throughout the document. Here, the focus is on the three most significant issues of a mandated response evidence of which is derived from above two case studies in Brazil and the EU:

- *Technology*
- *Costs borne by industry*
- *Privacy and consumer rights.*

Technology

The information technology age has transformed the world in a generation. Within half a lifetime, computerisation has revolutionised vehicle manufacturing and how vehicles function. This challenges traditional views of vehicles as a solely human operated transport mode. With the rapid growth of technology and digitalisation, it is likely that REI technology will be overtaken and superseded by new technologies and innovations in short timeframes. It is likely that REI technology developed now may also lose its effectiveness in the near future. Evidence of this within the REI context is provided by the Brazil case study where evolving wireless network protocols made manufacturers' software obsolete during implementation delays.[25]

Another key consideration in the development of REI technology relates to whether there will be uniformity. Currently, while manufacturers meet safety and roadworthy standards internationally, many of the on-board vehicle components and systems vary between makes and models of vehicles. These differences are a result of (and create) market competition and are proprietary in nature. Seeking to affect manufacturers' different technologies may affect their competitive advantage.

[23] In accordance with the Terms of Reference of the working group, no consultation with industry has occurred, therefore, the considerations and constraints detailed in this report have been developed through secondary research and analysis only.
[24] Projection assumes continued proportions of registered vehicles, grouped by year of manufacture. Data from "Motor Vehicle Census," Australian Bureau of Statistics.
[25] Roger Lanctot, "A $100M Learning Experience from Brazil," Strategy Analytics, last modified October 22, 2015, https://www.strategyanalytics.com/strategy-analytics/blogs/infotainment-telematics/2015/10/22/a-$100m-learning-experience-from-brazil.

Costs

Inclusion of REI technology will likely result in additional costs associated with design, development and production. In Brazil, at the time the legislation was suspended, an estimated $100 million USD had been borne by industry for hardware, software and service development.[26]

There are also costs associated with management of the enabling environment. While a government body may have overall responsibility for the system, under the most likely scenario (Section 1, Part B) all manufacturers with fleets in Australia (no matter how small), would be required to operate a 24/7 call centre to service possible REI deployment requests.

Privacy and Consumer Rights

Current anti-theft kill switches developed by vehicle manufacturers use Global Positioning System (GPS) to locate stolen vehicles. While the REI technology being considered in this report does not necessarily require GPS functionality, it is likely this will nonetheless be included. The current opt-in practice for anti-theft kill switches means that consumers have agreed to have data concerning their locations and routines recorded and stored by manufacturers. A mandatory framework limits consumer choice and impinges on their rights to privacy and data rights. This may impact consumer purchasing decisions especially given the rise of rideshare and increasing urbanisation.

International benchmarking undertaken in regard to the European Union and Brazil exemplifies that attempts to mandate kill switches in vehicles for law enforcement purposes were met with consumer concerns over privacy of data. Before any findings were even made in the EU example, concerns were raised in relation to potential infringements on civil liberties.[27]

A number of surveys have been undertaken in recent years illustrating the privacy concerns of consumers in relation to data produced by their vehicle now and into the future.

Polling by the Australian Automobile Association found that:

- *85% of people surveyed believed that 'if the data is in my car it should be owned by me'.*
- *84% of people surveyed believed that 'if the data is in my car I should have the right to control access to it by third parties'.*

A 2016 survey by the Royal Automobile Club of Western Australia found 72% of people surveyed were concerned to extremely concerned (49%) as to who owns the information autonomous vehicles may collect about the trips users are making.

A 2018 'Member Panel' of the Royal Automobile Association of South Australia found 68% of people surveyed were concerned by data privacy issues related to their vehicles.

[26] Lanctot, "A $100M Learning Experience from Brazil."
[27] Antony Ingram, "EU Secret Plan Leaked ¬– Police to Remotely Stop Cars', Motor Authority, last modified February 3, 2014, https://www.motorauthority.com/news/1090088_eu-secret-planleaked--police-to-remotely-stopcars.

SECTION 4| FUTURE CONSIDERATIONS

Technological innovation continues to evolve enabling ever greater connectivity between people and devices through the Internet. Some emerging technologies of note include the Internet of Things (IoT) and automation, often make it easier to innovate, creating substantial disruption to existing industries.

There are two areas of technological development in the automotive industry that, over time, may impact the need for REI technology:

Automated Vehicles

Vehicles requiring decreasing degrees of human operation are expected to be available in commercial markets over the coming years. Estimates of their future market availability vary depending on the degree of automation. The NTC estimates that automated vehicles (AV) that do not require a human driver for some or part of the journey will become available after 2020. Volvo expect that fully driverless vehicles are achievable in Australia but are likely to be 'some decades away'.[28]

A notable recent event demonstrated that police are able to exploit safety control systems of semi-automated vehicles to slow and stop a target vehicle. A Tesla Model 3, travelling at speeds exceeding 110kmph, was safely stopped while the driver slept.[29] However, this example does not account for potentially deliberately erratic or unexpected manoeuvring by an offender once becoming aware of police in pursuit.

Many concerns raised in this report regarding REI technology (such as surveillance and privacy) also apply to AVs. There have already been indications that consumers may have data concerns, particularly in terms of the privacy of personal information and the vulnerability of data to cybersecurity threats. AVs' reliance on complex internet-connected software and advanced communication networks may also render them vulnerable to cyberattacks, this would be similar to REI technology.[30]

Public perception of data privacy and cybersecurity vulnerabilities are seen as barriers foradoption of AVs.[31] There would be similar concerns regarding REI technology.

[28] Volvo Car Australia, "Submission 11: Enquiry into the Social Issues Relating to Land-Based Driverless Vehicles in Australia" Parliament of Australia, accessed January 25, 2019, https://www.aph.gov.au/Parliamentary_Business/Committees/House/Industry_Innovation_Science_and_Resources/Driverless_vehicles/Submissions.
[29] Bryan Logan, "Police in the San Francisco Bay Area Took an Unusual Approach to Stop a Tesla Operating on Autopilot as a Drunk Driver Slept Behind the Wheel," Business Insider, last modified December 2, 2018, https://www.businessinsider.com.au/police-stopped-anautopilot-driven-tesla-withdrunk-driver-asleep-2018-11.
[30] Jill Bowles, "Autonomous Vehicles and the Threat of Hacking," CPO Magazine, last modified October 1, 2018, https://www.cpomagazine.com/cyber-security/autonomous-vehicles-and-the-threat-of-hacking.
[31] "Privacy Issues Raised on Driverless Cars," Flinders University, last modified January 11, 2018, https://news.flinders.edu.au/blog/2018/01/11/privacy-issues-raised-driverless-cars/.

Connected Vehicles

The introduction of internet connected sensors into transport infrastructure, also known as Cooperative Intelligent Transport Systems (C-ITS), enables vehicles to wirelessly communicate with other vehicles, infrastructure and other parts of the road network. Examples include collision avoidance systems through Vehicle-to-Vehicle connectivity or Vehicle-to-Infrastructure connectivity.

There are opportunities for policing to leverage from C-ITS to allow them to identify particular vehicles that may have had number plates switched. Opportunities to deploy C-ITS are also likely to expand following the introduction of a reliable and geographically-widespread 5G telecommunications network.

A combination of 5G and other dedicated short-range communication technologies may be sufficient to enable more widespread vehicle-to-vehicle and vehicle-to-infrastructure communication.[32]

It is possible that in the future, C-ITS could be leveraged to assist in or execute vehicle immobilisation, however given the early development phase of this technology, it is difficult to ascertain at present the process by which this might occur.

[32] "Costs and Benefits of Emerging Transport Technologies," Bureau of Infrastructure, Transport and Regional Economics, Department of Infrastructure and Regional Development, Research Report 146, last modified June, 2017, https://bitre.gov.au/publications/2017/files/research-report-146-emerging-road-transport-technologies.pdf.

FINDINGS

After careful consideration, the working group presents the following overall findings:

- While the technology already exists to immobilise certain vehicles, it is not yet feasible for such technology to be utilised across the entire Australian vehicle fleet.
- There has been no successful implementation of a mandated REI solution across a whole vehicle fleet anywhere in the world.
- At this time, there is no single in-vehicle technology available, nor is there the required enabling environment to support the use of REI technology. However, with continued technological development REI may be feasible in the future.
- While the technology is developing rapidly, it is likely to be superseded by connected and automated vehicles.
- Until connected vehicles have saturated the fleet, line of sight to identify the applicable vehicle would be required which may not mitigate the risk that currently exists with police pursuits.
- Until the process associated with timelines and deployment of an REI is addressed, such as vehicle verification, authorisation and connectivity, the safety impact of the technology may not be able to be realised.
- There are scenarios where there may be unintended safety consequences from deploying an REI on a moving vehicle.
- The costs of administering one interconnected REI system would be substantial, notwithstanding the costs borne largely by industry and passed onto consumers associated with research, development and production.
- GPS technology will also be integral to vehicle identification. This will raise issues of privacy and who owns the data that is collected.
- Fleet saturation of connected / autonomous vehicles is more likely (even probable) before fleet saturation of REIs (assuming it is possible for an ADR to standardise REI).

APPENDIX A: TERMS OF REFERENCE

POLICE USE OF REMOTE ENGINE IMMOBILSERS NATIONAL WORKING GROUP – TERMS OF REFERENCE

Chair:

The Chair will be the current Chair of ANZPAA's Road PolicingNetwork (ie Queensland).

Membership:

- the Head of Road Policing of each police jurisdiction in Australia and New Zealand;
- the Department of Home Affairs (DHA).

The working group is to draw on informal advice as necessary from:

- the Department of Infrastructure, Regional Development and Cities;
- the National Transport Commission;
- Austroads;
- the Australian Automobile Association; and
- each of the State and Territory road transport agencies.

Scope:

In relation to the police use of remote engine immobilisers or related technology, the working group is to:

- examine: technical alternatives; operational considerations; legal constraints; and international police experience;
- quantify the potential benefits, in terms of safety and vehicle crime;
- analyse the impact such technology would have had on recent vehicle-related crime incidents that caused significant casualties;
- identify the framework any solution would have to use to allow it to be put in place;
- examine models for the development of national law and regulation;
- indicate likely issues in relation to the motor vehicle industry and options for their resolution;
- at this stage, not engage directly the motor vehicle industry

Meetings:

The working group is to meet as required with secretariat support provided by ANZPAA.

Report:

The working group is to deliver an initial report in time for consideration by the MCPEM Senior Officers' Group meeting that will typically take place four weeks in advance of the first meeting of MCPEM in 2019.

APPENDIX B: WORKING GROUP MEMBERSHIP

Working Group Organisations	ACT Department of Justice
	ACT Policing, Australian Federal Police
	Department of Home Affairs
	New South Wales Police Force
	New Zealand Police
	Northern Territory Police Fire and Emergency Services
	Queensland Police Service
	South Australia Police
	Tasmania Police
	Victoria Police
	Western Australia Police Force
	Australia New Zealand Policing Advisory Agency
Additional Attending Stakeholders	Automobile Association of Australia
	Austroads
	Department, Regional Development and Cities
	Department of Transport - NSW
	Department of Transport and Main Roads - QLD
	National Emergency Communications Working Group (NECWG)
	National Transport Commission
	Police Federation of Australia
	Qfree Technical Expert
	South Australia Department of Planning, Transport and Infrastructure

APPENDIX C: TERMS OF REFERENCE MAPPING

The Terms of Reference agreed by MCPEM are outlined below, with referencing to the relevant sections of the report.

Terms of Reference	Reference Report Section/Page no.
Examine:	
▪ technical alternative	Appendix E (p.34)
▪ operational considerations	Section 1, Part A (p.11) Section 1, Part B (p.13)
▪ legal constraints	Section 2, Part B (p.19) Section 2 Part C (p.22)
▪ international police experience	Appendix D (p. 31)
quantify the potential benefits, in terms of safety and vehicle crime	Introduction, Rationale (p.7)
analyse the impact such technology would have had on recent vehicle-related crime incidents that caused significant casualties;	Introduction, Rationale (p.7)
identify the framework any solution would have to use to allow it to be put in place;	Section 2, Part B (p.19) Section 2 Part C (p.22) Appendix F (p.36)
examine models for the development of national law and regulation	Appendix E (p.34)
indicate likely issues in relation to the motor vehicle industry and options for their resolution	Section 3 (p.23)

APPENDIX D: INTERNATIONAL BENCHMARKING

At the time of drafting of this report, there were no known international examples of mandatory, government regulated roll-out of REI technology that have been successfully implemented. As a result, a comparative study is challenging. This report draws on international examples of efforts to implement a mandatory, government regulated REI or related technology, including the European Network of Law Enforcement Technologies (ENLETS), the CONTRAN 245 legislation in Brazil and the eCall Emergency Management System in the European Union (EU).

Enlets

(European Network of Law Enforcement Technologies)

In 2013, the European Union established a working group to examine the potential roll-out of REI technology. The working group undertook a feasibility study to develop a technological immobilisation solution that could be built into all vehicles entering the European market. The primary aim of the police controlled technology was to end high-speed police pursuits.

Before any findings were made, the project plan was disclosed by a civil liberty monitoring group, StateWatch. This group raised concerns in relation to potential infringements on civil liberties. There was significant negative public reaction to the proposal and members of parliament of the United Kingdom issued concerns regarding attacks on personal and civil liberties.[33]

The study ultimately concluded that a scheme in the EU was not feasible. One of the contributing factors to this determination was that police pursuits were not a significantly widespread problem to rationalise the installation of mandatory remote engine immobilisers.[34]

Brazil

Contran 245 Legislation

In 2009 Brazil passed the 'Contran 245' legislation which required installation of tracking and immobilisation devices in all vehicles. The legislation was an attempt to mitigate a long-term vehicle theft crisis. However, the implementation of this mandate was delayed many times and suspended indefinitely in October 2015. Rationale for the suspension included:

- escalating costs. At the time the legislation was suspended an estimated $100 million USD had been borne by industry for hardware, software and service development.
- changing wireless network protocols during the implementation delays made obsolete developing software
- privacy concerns
- a lack of support from industry.[35]

[33] Ingram, "EU Secret Plan Leaked – Police to Remotely Stop Cars."
[34] Ibid.
[35] Lanctot, "A $100M Learning Experience from Brazil."

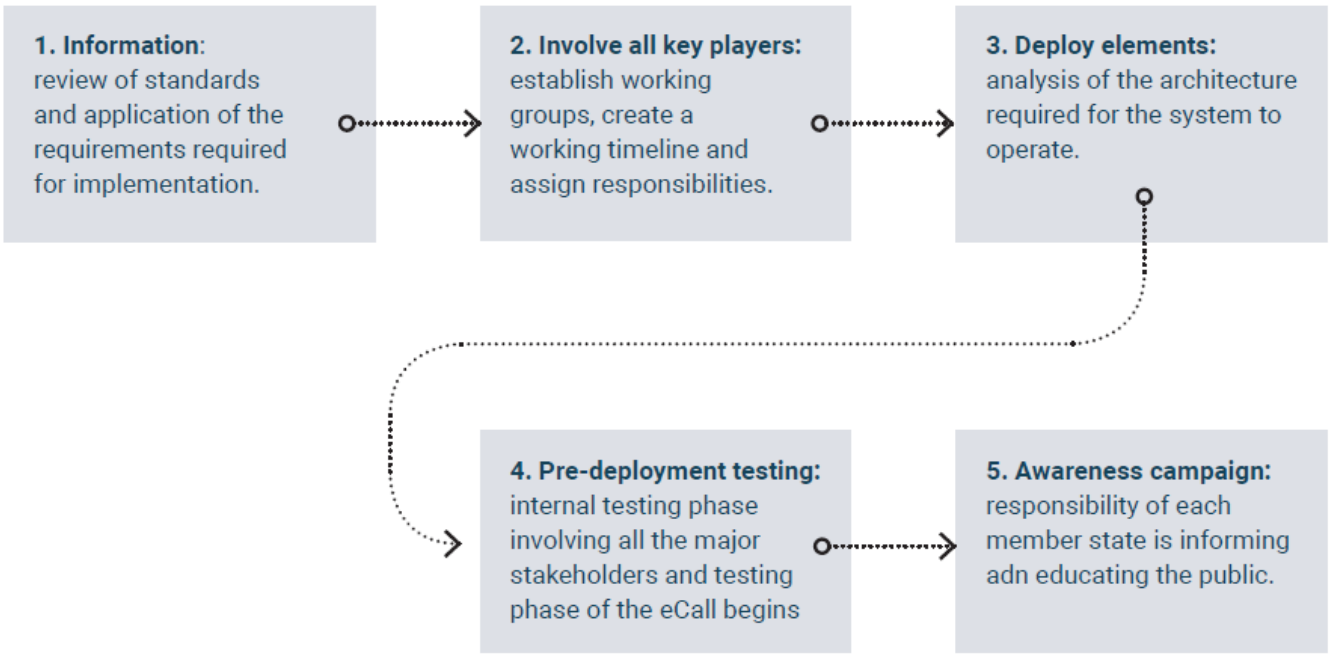
European Union
(eCall Emergency Management System)

While the eCall system is not related to REIs, it does provide a successful example of a mandated, wide-scale, implemented technology.

The European Union successfully implemented the eCall emergency management system from 1 May 2018. This system mandated that all new cars sold in the European Union must have an eCall system on board, after legislation was passed in 2014.[36]

The eCall system, in the case of an accident, automatically alerts and sends GPS coordinates to emergency services once the airbag has been released.[37] This system began as a Memorandum of Understanding (MOU) and included members such as the ACEA (European Automobile Manufacturer's Association).[38] The application of the system across the European Union demonstrates the shift from the ENLETS work to a publically accepted technology, focussing on safety. The system identifies the framework required to ensure a technology on this scale can be maintained, as technology rolled out on this scale in vehicles cannot operate on its own and requires stakeholder contribution, agreement, shared facilitation and allocated responsibilities.

The implementation of the eCall process involved the following five steps:[39]



[36] "Industry Welcomes Life-Saving eCall Proposal," European Automobile Manufacturers Association, last modified June 13, 2013, https://www.acea.be/press-releases/article/press_release_industry_welcomes_life-saving_ecall_proposal.
[37] Benjamin Uyttebroeck, "New Cars in Europe Need to be Equipped with eCall System from 1 May 2018," Fleet Europe, last modified February 27, 2018, https://www.fleeteurope.com/en/safety-environment/europe/features/new-cars-europeneed-be-equipped-ecallsystem-1-may-2018.
[38] "Industry Welcomes Life-Saving eCall Proposal', European Automobile Manufacturers Association.
[39] McClure, Forestieri and Rooke, "Achieving a Digital Single Market for Connected Cars."

Other key factors for the successful implementation of the eCall system were:

- *The legislation focussed on three stakeholder groups: Member states, OEMs (Original Equipment Manufacturer) and MNOs (Mobile Network Operators). Each group was tasked with separate responsibilities.*
- *A cross-stakeholder forum and interdisciplinary working group was convened involving public organisations, member states and network service providers.*
- *Cost-benefit analysis of the technology was completed and other forms of analysis.*[40]

[40] McClure, Forestieri and Rooke, "Achieving a Digital Single Market for Connected Cars."

APPENDIX E: RELATED TECHNOLOGIES GLOSSARY

Category [II] TECHNOLOGY

ANTI-THEFT SERVICES (ONSTAR)	A vehicle communication system using telematics owned by GM Motors. The system provides in-vehicle services such as navigation instructions, automatic crash response, roadside assistance and GPS tracking in the event of vehicle theft. The system installed in every vehicle obtains information from the vehicles on board diagnostics (OBD-II) system and built-in GPS, combined with the cellular network for transmitting this information to the centre.[41] In the event that a vehicle is stolen the system can be used to GPS track the location of the vehicle. Their process only allows police access to this information when the vehicle has been reported as stolen. Police have interacted with this technology mostly in the United States in situations where the vehicle is confirmed as stolen, police were in pursuit, then OnStar was able to slow down the vehicle.[42] For example, the technology was used to locate the Boston Bombers after they fled in a Mercedes Benz that had a similar telematics system. Police contacted the operation centre and were able to obtain the GPS coordinates of the vehicle.[43]
ANTI-THEFT IMMOBILISERS	Anti-theft immobilisers have been compulsory in Australian vehicles made from 1998. These relate to the use of a transponder key or fob to send an electronic code when a vehicle is being started. These are not remote activated and require proximity ot the vehicle to work.[44]
EMERGENCY MANAGEMENT SYSTEM (eCall)	An emergency assistance system deployed across the European Union which ensures that every vehicle sold in Europe must have an eCall device fitted. The device will automatically alert emergency services and send the GPS coordinates of a vehicle in the event of a serious accident for example when the airbag is deployed.[45]
GPS TRACKING	Global Positioning System that allows for the location monitoring (latitude and longitude) of a vehicle in real-time through a network.[46] This technology is used in most fleet management systems and, as an associate to remote engine immobilisers, is required in order to be able to safely slow down a vehicle and track where the vehicle could be apprehended.
TELEMATICS	Telematics (also known as GPS fleet tracking) is a way in which vehicles can be monitored using GPS and on-board diagnostics to record movements on

[41] Laukkonen, "GM's OnStar Service Explained."
[42] "Cops Use OnStar to Disable Suspect's Engine and End High-Speed Chase," South Bend Tribune, last modified January 21, 2016, https://www.southbendtribune.com/news/publicsafety/cops-use-onstar-todisable-suspect-s-engine-and-end/article_33029180-bfb7-11e5-9667-1f1e3bb2f345.html
[43] Jim Henry, "Luxury-Car Tech Helped Catch Boston Bombing Suspects; Your Chevy probably has it, too', Forbes, last modified April 30, 2013, https://www.forbes.com/sites/jimhenry/2013/04/30/the-mercedes-benz-technologythat-helped-catch-boston-bombing-suspects-is-probably-in-yourchevrolet-too/#112ca82c4869.
[44] "What is an Engine Immobilizer?" Toyota, accessed January 22, 2019, http://toyota.custhelp.com/ app/answers/detail/a_id/7732/~/what-is-an-engine-immobilizer%3F.
[45] "eCall Emergency Alert System Launched," European Global Navigation Satellite Systems Agency, last modified April 3, 2018, https://www.gsa.europa.eu/newsroom/news/ecall-emergencyalert-system-launched.
[46] "What is GPS Tracking?" Verizon Connect, accessed January 25, 2019, https://www.verizonconnect.com/au/glossary/what-is-gpstracking; Trevor A. Fischbach, Keo Hadsdy and Amanda McCall, "Pursuit Management: Fleeing vehicle tagging and tracking technology," National Criminal Justice Reference Service, US Department of Justice, last modified October 31, 2013, https://www.ncjrs.gov/pdffiles1/nij/grants/249156.pdf.

	a computerised map.[47] The vehicle must be fitted with the following devices in order for these movements and in-vehicle diagnostics to be recorded: ▪ GPS receiver ▪ Engine interface ▪ Input/output interface ▪ Sim card ▪ Accelerometer ▪ Buzzer In 2014, New York Police were able to activate and monitor the Sirius XM Satellite Radio device installed in a vehicle through asking SiriusXM to track the device for 10 days. The commercial radio and telematics company was able to do this through its Connected Vehicles Services technology.[48]
Category [III] TECHNOLOGY	
RADIO FREQUENCY (RF) PULSE IMMOBILISER	This technology disables all electronic systems using high frequency RF pulses to disrupt electronic components, slowing down and/or stopping vehicles. For example, RF Safe-Stop is a 350kg emitter that can be integrated into SUV sized vehicles that can disable small vehicle electronics from up to 50 meters away.[49]
PURSUIT MANAGEMENT SYSTEM (STARCHASE™)	A pursuit management system which involves the shooting of a tracking device from a pursuing police vehicle. The device attaches to the target vehicle allowing police to track its location. Once the vehicle has slowed down or stopped police can safely intercept it.[50] StarChase™ data demonstrates that once the pursuing vehicle has been tagged and the pursuit ceased, the driver will generally slow down within two minutes, driving to a normal speed. Police will then rely on the GPS mapping to monitor the vehicle and apprehend once it is safe to do so. This has led to an 80% apprehension rate.[51]
GEO-FENCING	This technology refers to the implementation of a geographically demarcated virtual zone where the entry, speed and fuel supply of vehicles can be controlled digitally. It limits vehicle operation in geographical zones and would not apply to vehicles travelling outside that zone. The technology has been trialed in Stockholm Sweden, funded by Swedish Government departments and manufacturers including Veoneer, Scania, Volvo Cars and the Volvo Group.[52]

[47] Craig Michael, "What is Telematics?" GeoTab, last modified January 8, 2018, https://www.geotab.com/blog/what-is-telematics/.
[48] Thomas Brewster, "Cartapping: How Feds have spied on connected cars for 15 years," Forbes, last modified January 15, 2017, https://www.forbes.com/sites/thomasbrewster/2017/01/15/police-spying-on-car-conversations-location-siriusxm-gm-chevro-Page: 26 of 32 let-toyota-privacy/#177a8dc72ef8.
[49] Jason Forde, "Radio-beam Device Can Disable Car and Boat Engines from 50m," The Engineer, last modified October 16, 2013, https://www.theengineer.co.uk/radio-beamdevice-can-disable-car-and-boatengines-from-50m/.
[50] 'The pursuit ends here StarChase', accessed January 2019, https://www.starchase.com/StarChase_Brochure.pdf.
[51] Ibid.
[52] 'Autoliv's geofencing technology used in Swedish connected vehicles demonstration', traffic technology today, accessed November 2018, http://www.traffictechnologytoday.com/news.php?NewsID=91405.

APPENDIX F: LEGISLATIVE AND REGULATORY MODELS FOR IMPLEMENTATION

There are various models in Australia that could be drawn from when seeking to develop national law and or regulation. The following have been selected for this report as they respectively hold relevance to REI technology.

National Standard Model

Australian Design Rules

Background

The Australian Government administers the *Motor Vehicle Standards Act 1989*, which requires that all new road vehicles comply with national vehicle standards known as the Australian Design Rules (ADRs), before they can be offered to the market for use in transport. The ADRs are mostly performance-based standards for vehicle safety, emission control (noxious gases and external noise) and anti-theft protection.

The ADRs are being increasingly harmonised with international vehicle regulations adopted by the United Nations (UN) World Forum for the Harmonization of Vehicle Regulations. The harmonisation of the ADRs with the UN Regulations is important because vehicle sales in Australia represent approximately 1.2 per cent of the total world production of motor vehicles. Regulation that is based on internationally agreed standards provides consumers with access to the safest vehicles from the global market at the lowest possible cost.

Adoption of new a ADR

The adoption of new UN Regulations under the ADRs are prioritised according to the overall benefit expected, under the National Road Safety Strategy (NRSS) 2011-2020 and its associated action plans. The National Road Safety Action Plan (NRSAP) for the final three years (2018-2020) of the NRSS was agreed to by transport ministers in May 2018.

Both the NRSS and the NRSAP set out a number of agreed national goals and actions to improve road safety, many of which focus on increasing fitment of priority safety technologies to new vehicles. This includes a priority action to increase deployment of Autonomous Emergency Braking (AEB) in both heavy and light vehicles, and the review of Australia's occupant protection standards.

Implementation of these proposed actions will be subject to Australian Government Regulation Impact Statement (RIS) requirements. This consists of considering a range of regulatory and non-regulatory options, conducting a cost-benefit analysis comparing these options, and a public consultation on the options and any proposed regulation. The option with the greatest net benefits is required to be the recommended option in the final RIS. The cost burden of new regulation must be offset by reductions through regulatory reform and/or deregulation. This is being achieved without any impact on the safety or environmental performance of vehicles.

National Laws Model

Applied Law, Referral of Powers and Regulatory Review

Background

In July 2009, the Council of Australian Governments (COAG) agreed to implement a national system of laws for heavy vehicles surpassing 4.5 tonnes with the laws being administered by one independent national regulator, the National Heavy Vehicle Regulator (NHVR).[53] Examples of the actions taken to enact this legislation included the following:

- A Regulatory Impact Statement
- Benefit costs analysis
- Industry Forum with representatives providing comments
- Stakeholder input and public release processes
- Independent expert panel to provide assistance where jurisdictions had difficulty in reaching agreement or changes to industry were to be made.

Following these actions, some sections of the legislation was drafted initially as a guide for States and Territories to adopt or change where necessary.[54]

Applied law

The HVNL is an applied law scheme that consists of:

- a 'host' jurisdiction (in this instance Queensland) enacts a model law in its jurisdiction (usually as a Schedule to an Act of Parliament and, in recent times, usually called a 'National Law').
- other States and Territories pass an Act (an 'application Act') that applies the National Law in thie jurisdictions.

The HVNL is managed by the NHVR and commenced on the 10 February 2014 in five States and the ACT.[55] Each State and Territory either adopted the national law in its entirety or duplicated its contents with some changes and passes as a State/Territory governed law.[56] Although the HVNL has not commenced in Western Australia or the Northern Territory, it still applies to vehicles when they cross into one of the States or Territories that have adopted the HVNL applies.[57]

[53] 'Public release of the draft heavy vehicle national law and regulatory impact statement cover note', accessed January 2019, https://www.ntc.gov.au/Media/Reports/(0EDB8FE7-CF74-5C35-0964-B4F648E6B05F).pdf.
[54] Ibid.
[55] 'Heavy Vehicle National Law and Regulations', NHVR, accessed January 2019, https://www.nhvr.gov.au/law-policies/heavy-vehicle-national-law-and-regulations.
[56] Ibid.
[57] Ibid.

Referral of Powers

Vocational Education and Training (VET) Regulation

Background

In 2011 the Australian Skills Quality Authority (ASQA) became the regulatory body for the VET sector in all but two of the States and Territories. ASQA's regulation of the VET sector was supported by establishing legislation and standards.

Referral of Powers

The establishing legislation for ASQA was developed through a referral of powers by the participating States and Territories to the Commonwealth Government to pass applicable legislation. ASQA eastablished on 1 July 2011 through the following Commonwealth Acts:

- *National Vocational Education and Training Regulator Act 2011*
- *National Vocational Education and Training Regulator (Consequential Amendments) Act 2011*
- *National Vocational Education and Training Regulator (Transitional Provisions) Act 2011*.

ASQA is further suppoted by a set of national standards for regulating the VET sector encompassed within the VET Quality Framework that includes:

- Australian Qualifications Framework: The national policy for regulated qualifications in Australia.
- Standards for Registered Training Organisations 2015: Standards to ensure nationally consistent training and assessment across Australia's VET providers.
- Fit and Proper Person Requirements: Requirements for people in control or influence over the operation of registered training organisations.
- Financial Viability Risk Assessment Requirements 2011: Requirement for registered training organisations to meet financial viability requirements
- Data Provision Requirements 2011: Requirements for providers to supply ASQA with data upon request, and to submit quality indicator data annually.

Regulatory Review Model

Drone Regulation

Background

The Civil Aviation Safety Authority manage the Civil Aviation Safety Regulations (CASR). CASR Part 101 (promulgated in 2002), relates to unmanned aircraft or drones. Similar to REI technology, drones are a relatively new technology undergoing constant change and development due to the changing nature of its use. As such, various reviews and amendments have been undertaken since 2002 to keep up with the ever changing nature of the technology.

Similar constraints present for drones as with REI technology, for example the connectivity and storage of GPS and network data. These factors are important in terms of privacy and surveillance risks, particularly as they are largely manufactured overseas.

Referral of Powers

One example of a review which led to regulatory change in the CASR was Project OS 11/20 'Review of Regulations and Guidance Material relating to Unmanned Aircraft Systems (UAS)'. The project spanned 6 years, being approved in July 2011 and completed in August 2017.

The process for writing a CASR Part included the following stages:

Writing a Civil Aviation Safety Regulation Part	
Initiation and Planning	A CASA project team with a project sponsor writes the initial terms of reference and a project plan.
Initial Consultation	Research is conducted, the aviation community are consulted and all interested parties are involved in the process. This includes aviation community meetings, distribution of information on the CASA website, advertisements in the aviation press and initial consultation through representative bodies. A discussion paper is drafted to present ideas and possible options for industry to consider and provide input into before a regulation or policy is drafted.
Formal Consultation	The Aviation Safety Advisory Panel (ASAP) considers the discussion paper before tasking a technical working group to provide views on the safety of the change. A summary of consultation is produced for public consideration through CASA's Hub. The draft regulation is released for public comment. CASA's systems and the education and training needs of both the aviation community and CASA staff also needs to be considered.
Legal Drafting	The legislative drafting instructions produced out of the consultation process go to the Attorney-General's Department to ensure they meet the Government's standards for Australian Legislation.
Regulatory Best Practice	All Australian Government agencies are required to apply 'regulatory best practice' to the development of all new or amended legislation. This means that CASA must follow the 'Best Practice Regulation Handbook' published by the Office of Best Practice Regulation (OBPR), which is part of the Department of Finance. The Handbook requires CASA to undertake an analytical process to ensure that regulations are effective in achieving policy objectives. In addition to extensive consultation, this may involve documentation of the development process in the form of a Preliminary Impact Assessment, Business Cost Calculator Report, or Regulation Impact Statement (RIS). CASA is required to discuss all regulatory amendments with the OBPR which examines the proposals and determines whether a RIS is required to be prepared.
Legislative Approval	The legislation in its final form is cleared by the Department of Infrastructure, Regional Development and Cities (the Department) and EXCO (Executive Council) secretariat. The legislative package is approved by CASA's Executive and sent to the Department for the Minister's approval, before being tabled in Parliament.
Implementaion	CASA sets up the procedures, authorisations, delegations, fees and other internal systems and changes needed to be ready for the new regulations. There may be a transition period to allow industry to move to the new regulations or they may commence in full from day one.
Project Closeout and Review	The entire process from initial planning to implementation is reviewed to see how it can be improved.

Policy Position Model

Guide for Managing Work Health and Safety in Australian Policing

Background

In 2011, Safe Work Australia established a model law to be implemented by jurisdictions across Australia, aimed at ensuring consistency and harmonisation in the health and safety of workers and workplaces.[58] This law was developed as a Model Law and allowed jurisdictions to adopt themselves. A key challenge within policing has been balancing the hazards associated with operational policing with ensuring the health and safety of their workforces. To support this, the *Guide for Managing Work Health and Safety in Australian Policing* (Guide) was developed to support a cross-jurisdictional policy position in relation to meeting police's responsibilities under the Work Health and Safety Model Law.

Policy Position

The purpose of the Guide is to provide practical information to support duty holders in Australia's Commonwealth, State and Territory jurisdictions in fulfilling their duties in accordance with Model Work Health and Safety (WHS) laws.[59] It aims to provide jurisdictions and police officers with a guide to understanding the potential health and safety implications of their duties, and how risks can be managed in each unique working environment, including consultation and issue resolution.

The Guide was developed in 2013 through consultation with subject matter representatives from each police jurisdiction and Safe Work Australia. Once developed, the Guide was reviewed and approved by the Commissioners of all police jurisdictions across Australia in April 2014.

Industry Position Model

Alarm Activation Response Guidelines

Background

The development of a National Police Alarm Activation Response Guideline to harmonise jurisdictional police response to alarms and alarm activations.[60] These guidelines were enacted on July 1 2018. The guideline was developed by the National Emergency Communications Working Group- Australia and New Zealand with the Australian Security Industry Association Limited.[61]

Industry Position

Due to the nature of the way in which corporations were selling their security systems and promises in relation to response behavior by police. There was an increase in the responses required by police to the activation of alarm systems, most of which were not actual activations.[62]

The following steps were taken in implementing a national police guideline:

- each police jurisdiction provided information on their policies
- a comparative analysis and review of all policies was undertaken to decipher where the majority of these were in alignment
- guidelines were developed to support police responses while allowing for discretion in their application in reach jurisdiction.

The processes included in the Guidelines were in relation to police responses to alarm activations, identifying the types of alarms police could not respond to and defining the parameters for the genuine alarm activations.[63]

[58] 'Model WHS laws', safe work Australia, accessed January 2019, https://www.safeworkaustralia.gov.au/law-and-regulation/model-whs-laws.
[59] At the time of the review, all jurisdictions except Western Australia and Victoria had adopted the Model Work Health and Safety laws.
[60] 'National Police Alarm Activation Response Guidelines', https://www.asial.com.au/documents/item/1588.
[61] Ibid.
[62] 'National Police Alarm Activation Response Guidelines for Industry Use', http://necwg-anz.org/wp-content/uploads/2018/06/National-Police-Alarm-Activation-Response-Guidelines-For-Industry-Use.pdf.
[63] Ibid.

Acknowledgements

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