Submission to the Australian Communications and Media Authority (ACMA) Consultation into “Facilitating trials of radionavigation-satellite service (RNSS) repeater devices in road tunnel networks”

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and

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Executive Summary

The Australian Communications and Media Authority (ACMA) should be complimented on its significant commitment to supporting and enhancing public safety communications. The current discussion paper regarding *"Facilitating trials of radionavigation-satellite service (RNSS) repeater devices in road tunnel networks"* is a further example of this commitment. Thanks to the proliferation of a broad range of mobile communication technologies, Geographical Information System (GIS) and Global Positioning System (GPS) technologies have become ubiquitous in our modern society. When combined GIS and GPS systems provide a broad range of Location-Based Services (LBS) to an extensive range of mobile users. These users include wide range of consumer, public safety, commercial and public-purpose applications.

In terms of incident response, establishing an accurate location is a critical step for ensuring that response resources can quickly locate both an incident and response assets deployed to that incident. Whilst GPS technologies have greatly enhanced the establishment of an accurate location and way finding to that location, the modern urban environment creates a number of difficulties for establishing location accuracy. These difficulties exist for both the indoor and underground environment. As a result, the Federal Communications Commission (FCC) has identified indoor location accuracy benchmarks for wireless E911 callers[1]. Whilst underground location accuracy requirements are unclear at this stage the FCC's work regarding indoor location accuracy may be informative. Conversely, the ACMA's research regarding the deployment of RNNS devices underground may provide a pathway for enhancing indoor navigation across Australia.

Major fires within road (and rail) tunnels are relatively rare; however, when they do occur they can be catastrophic. For example, McDaniel (4:2017)[2] has identified 21 incidents where fatalities have occurred due to vehicle fires within tunnels. In addition to vehicle fires, road collision (ranging in severity from minor injuries to fatalities) and vehicle breakdowns are common incidents that occur within the underground road network. When these incidents occur quickly establishing an accurate location and developing both response and traffic management plans ensures that road management authorities can simultaneously provide assistance to the affected parties and minimise the adverse impact on the road network. It is anticipated that the ACMA's proposed trials of radionavigation-satellite service (RNSS) repeater devices in road tunnel networks will help to identify a policy and legislative framework that will enhance this process.

The parties to this submission believe that the three options outlined in the discussion paper are all workable; however, Option 3 *Amend the Declaration, and authorise trials through scientific licensing* provides an approach that will develop the evidence base to support better policy and regulatory decisions. The parties further believe that the proposed trials will provide the ACMA a strategic opportunity to enhance location based services across other industries and within the urban environment more generally.

As a result of the issues raised in this consultation paper the parties to this submission have identified a number of practical and strategic issues relevant to facilitating trials of RNSS repeaters in road tunnels. In order to address these issues the table below provides a range of recommendations that the ACMA may choose to consider whilst developing the proposed trials.

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[1] https://www.fcc.gov/public-safety-and-homeland-security/policy-and-licensing-division/911-services/general/location-accuracy-indoor-benchmarks

[2] https://mountainscholar.org/bitstream/handle/11124/170970/McDaniel_mines_0052E_11224.pdf?sequence=1

Key Recommendations:

1. Option 3 *Amend the Declaration, and authorise trials through scientific licensing* be adopted as the preferred approach for the proposed trials.
2. The assumptions supporting the proposed trials should be clearly articulated and shared with the relevant trial stakeholders.
3. A common Test Plan based on international standards should be developed and shared with the relevant trial stakeholders.
4. Consideration be given for the independent testing of the performance and potential interference of any RNSS repeater and associated technology.
5. In addition to RNSS repeater technology alternate technologies should be included in the trial process.
6. The trial needs to consider and identify the Critical Spatial Data Infrastructure requirements (including relevant spatial data set requirements) that are needed to convert RNSS derived data in a meaningful manner for a range of location based services.
7. The ACMA consider potential user groups and stakeholders that could contribute to the development ACMA policy regarding the deployment and use of RNSS repeater devices and allied services.
8. RNSS repeater technology and location based services should be considered as key component of Australia's emerging next generation public safety communications ecosystem.
9. The ACMA consider the strategic opportunities for enhancing location accuracy across a broad range of industries and contexts flowing on from the proposed trials.

1 Introduction

This Submission provides a response to the Australian Communications and Media Authority (ACMA) Consultation into *"Facilitating trials of radionavigation-satellite service (RNSS) repeater devices in road tunnel networks"* May 2020.

This Submission is made on behalf of the following organisations (The Parties):

- **The University of Melbourne Centre for Disaster Management and Public Safety (CDMPS)**

The CDMPS is a Centre established by the University of Melbourne in 2014 to specifically focus on research associated with disaster management and public safety. Mission critical communications infrastructure essential to the management of major emergencies and disasters is a specific component of the Centre's Research Agenda. (https://unimelb.edu.au/cdmps/home).

- **The University of Melbourne Centre for Spatial Data Infrastructure and Land Administration (CSDILA)**

The CSDILA is a Centre established by the University of Melbourne in 2001 to undertake world-class research supporting sustainable development into the broad areas of spatial data infrastructures, spatial enablement and land administration (www.csdila.unimelb.edu.au).

- **Australian Control Room Network Association (ACRNA)**

ARCNA represents a broad spectrum of industry and government-based control room users. ACRNA is a not for profit Association that seeks to provide valuable information for members via education, information sharing and relevant new applicable initiatives (http://www.acrna.org).

1.1 Context

It is understood that this consultation process is an extension of the ACMA's dedicated and ongoing leadership in developing a national, unified strategies to implement a comprehensive and robust public safety communications ecosystem. The University of Melbourne's Centre for Disaster Management and Public Safety (CDMPS) strategic intent is to support multi-disciplinary collaboration between researchers, government, industry, agencies and the community in delivering exceptional public safety outcomes.

The primary objective of this Submission is to have location based services included in the national conversation about mission critical public safety communications infrastructure. The CDMPS has been actively involved in researching and influencing the development of the future mission critical public safety communications ecosystem to support Australia's Police and Emergency Management Sector. This ecosystem should be a key national policy priority as it enhances Australia's disaster resilience and is the link between the community, police and emergency services.

To provide evidence of the conversation between governments, bureaucracies and industry regarding the need for the holistic development of the future mission critical public safety communications ecosystem within Australia the ACMA's attention is drawn to previous Submissions by the parties responding to a range of papers released by Australian Government Departments addressing individual components of the ecosystem as follows:

- December 2011 – DBCDE Review of the Integrated Public Number Database;
- February 2013 - ACMA "The 803-960 MHz band – exploring options for future change"
- August 2014 – Department of Communications Triple Zero Review;
- June 2015 - Submission to the Australian Government Productivity Commission's Issues Paper "Public Safety Mobile Broadband";
- July 2015 - Submission to the House of Representatives Standing Committee on Infrastructure and Communications Inquiry into "The role of smart ICT in the Design and Planning of Infrastructure"; and
- July 2016 – DOCA - Consultation Paper on the proposed Radio Communications Bill 2016.

These Submissions refer to individual components of the public safety communications ecosystem and in particular the future ability of Public Safety Agencies to be able exchange and share information between agencies, the broader response community and with the public. Location based services, data and data analytics will be key elements of this emerging ecosystem.

1.2 Methodology

In preparing this submission the CDMPS has adopted the following methodology:

1. reviewed the consultation paper regarding into "Facilitating trials of radionavigation-satellite service (RNSS) repeater devices in road tunnel networks";
2. Identified a range of issues pertaining to the consultation paper;
3. Considered the issues raised in the consultation paper against the broader range of discussion papers pertaining to the public safety communications ecosystem;
4. Circulated the consultation paper with key stakeholders across the University of Melbourne and partner organisations;
5. Consolidated observations and comments from those stakeholders;
6. Circulated a draft of this response with those stakeholders;
7. Finalised this response document.

2 Observations arising from the discussion paper

A number of observations have been made regarding the issues raised in the discussion paper. These observations can be considered within seven broad categories, namely; Assumptions, Testing, Operational Performance, Spatial Data Infrastructure, Public Safety Communications Ecosystem, Strategic Opportunities and General Issues. Each of these categories will be discussed in the following sections of this response.

2.1 Assumptions

The ACMA states that "RNSS repeaters that are deployed in road tunnels operate on a different set of assumptions to those underpinning the existing apparatus licensing framework"[3]. It is unclear what assumptions have been made regarding the use of RNSS repeaters. For example do the assumptions only apply to the legislative framework or do they extend to the operational performance of the RNSS repeaters. Similarly, it is unclear if the intended use of RNSS repeaters and the associated signal strength is only applicable for the road surface area or if it is envisioned to provide location accuracy in emergency escape exits and other underground areas as well.

Prior to the commencement of any trial it is recommended that:

[3] See page 5 of the discussion paper.

the assumptions supporting the proposed trials should be clearly articulated and shared with the relevant trial stakeholder.

2.2 Testing

The intent of the trial is to ensure that trial operators adhere to technical guidelines determined by the ACMA, to minimise the risk of interference to radiocommunications services, particularly at tunnel boundaries. It is unclear from the discussion paper what level of location accuracy is required. Location accuracy is a key consideration as level of accuracy will be different for general navigation compared to the safe operation of autonomous vehicles along the road network.

Similarly, it is unclear what the ACMA's technical guidelines are and how these guidelines have been determined. There are a range of international standards that relate to RNSS repeater devices and these should be used to inform the testing process.

Additionally it is unclear if the ACMA intends to use an independent testing process and if the testing would extend to the certification of particular devices as being fit-for-purpose. More generally the actual testing process and procedures are not included in the discussion paper. It is critical that a common Test Plan is developed and used to ensure that the results of the trials can be compared and interpreted accurately within an evidence-based methodology.

Prior to the commencement of any trial it is recommended that:

A common Test Plan based on international standards be developed and shared with the relevant trial stakeholders.

The proposed Test Plan considers both the potential interference impact as well as the operational performance of the RNSS repeater in terms of coverage and accuracy.

Consideration be given for the independent testing of the performance and potential interference of any RNSS repeater and associated technology.

2.3 Operational Performance

The investment in particular technologies is often contextual in nature and the consideration of potential benefits, especially unanticipated benefits is often unclear. As the title of the discussion paper suggests the ACMA is focussed on RNSS repeater technology. More broadly there are a range of alternate technologies which have been used around the world to help enhance location accuracy, for example, the Wireless Ad Hoc System for Positioning (WASP)[4], Wi-Fi and Bluetooth technology. When considering location accuracy there is a need to consider the current and future planning decisions for the installation of RNSS repeater technology as part of the Smart City agenda including the next generation of Cooperative Intelligent Transport Systems (C-ITS) and introduction of autonomous vehicles on the road network. It is unclear if the ACMA is solely focused on RNSS repeater technology or if it is focused on enhancing location based services underground in a manner that does not cause radio communications interference.

A Location-Based Service (LBS) is a service that is able to provide targeted spatial information to owners and operators of critical infrastructure, public safety officials, mobile workers and the general community. In the context of road tunnels and other underground infrastructure a LBS

[4] The Wireless Ad Hoc System for Position was developed by the CSIRO to track people and objects underground to an accuracy of about half a metre. For more information see https://data61.csiro.au/en/Our-Research/Our-Work/Monitoring-the-Environment/Mobility-and-navigation/Tracking-in-underground-mines

could include basic navigation for a road user, accurate locations of incidents occurring in the tunnel, support for C-ITS, e-Call incident reporting[5], location of assets deployed within the tunnel, support mobile workers conducting maintenance on the tunnel, the location of the nearest Automated External Defibrillator (AED), emergency evacuation navigation or support the use of autonomous vehicles within the tunnel.

Each LBS potentially requires a different level of location accuracy. It would be helpful if the trial provided insight on the operational performance and suitability for the various technologies to support a particular range of current and future LBS.

It is suggested that the trial considers other technologies that help to enhance location accuracy. If these other technologies were considered it would provide the ACMA, Road Management Authorities and public safety officials a better understanding of the potential options or mix of options that are available for deployment. It is assumed that the broader range of technologies has to potential to:

- complement the performance of RNSS repeater technology;
- support the business continuity of location based services in the event of the failure of RNSS repeater technology; or
- provide an alternative choice to the deployment of RNSS repeater technology.

Prior to the commencement of any trial it is recommended that:

In addition to RNSS repeater technology alternate technologies should be included in the trial process.

2.4 Spatial Data Infrastructure

The ACMA refers to RNSS repeater technology but lacks any reference to the associated Spatial Data Infrastructure (SDI) which is required to convert RNSS repeater derived data to support LBS within the road tunnel. For example, effective navigation relies on both an accessible RNSS signal and an appropriate spatial data set or map to determine a location or support way finding. There may be a requirement to develop and make available new spatial data sets to take advantage of enhanced location accuracy derived by the RNSS repeaters. For example, data contained within the Building Information Models (BIM) used during the construction process of the tunnel could be used to develop new accurate spatial data sets; however, issues surrounding intellectual property and data ownership would need to be addressed.

The Australian New Zealand Land Information Council (ANZLIC) is the peak national spatial governance body in Australian and New Zealand and it recognises the need for a consolidated effort to develop an agreed Foundation Spatial Data Framework (FSDF) to provide easy access to authoritative government spatial data. In 2014 ANZLIC launched the Australian New Zealand Foundation Spatial Data Framework to make common foundation spatial data ubiquitous across Australian and New Zealand. Transport is a key theme within the FSDF and there is an opportunity to engage with ANZLIC to ensure that RNSS repeaters and any associated technology is able to take advantage of the FSDF.

[5] eCall and eReporting capabilities involves the autonomous reporting of incidents based on a vehicle's sensor network for example the detection of a major impact would autonomously report the vehicles location and details of the event to a Public Safety Answering Point (PSAP) or Emergency Communications Centre (ECS).

Stakeholders like Standing Council on Transport and Infrastructure (SCoTI)[6] and Austroads[7] should be in a position to identify key current and future LBS requirements in a road tunnel. This insight will help to identify operational performance requirements for the RNSS repeaters. Conversely, the findings of the proposed trials should assist these stakeholders with evidence to support the consideration of policy to facilitate the development of next generation intelligent transport systems (ITS) and implementation of autonomous vehicles. It would be beneficial to canvass location-based infrastructure providers as key stakeholders. The key location-based infrastructure providers in Australia are: The infrastructure providers in Australia are:

Telstra

Sigfox: https://www.sigfox.com/en/coverage

LoRaWAN: https://lora-alliance.org/about-lorawan

It would be beneficial if the ACMA included a clear statement on the spatial data infrastructure requirements for the trials. There is an opportunity to include other key stakeholders like ANZLIC, Austroads, SCoTI (and others referenced above) into the trial to ensure that issues pertaining to SDI and specific LBS are adequately considered in the process. These issues could include developing a better understanding of the costs, risks, and benefits associated with RNSS repeater –derived data sharing and use[8].

Prior to the commencement of any trial it is recommended that:

The trial needs to consider and identify the Critical Spatial Data Infrastructure requirements (including relevant spatial data set requirements) that are needed to convert RNSS derived data in a meaningful manner for a range of location based services.

The ACMA consider potential user groups and stakeholders that could contribute to the development ACMA policy regarding the deployment and use of RNSS repeater devices and allied services.

2.5 Public Safety Communications Ecosystem

Australia's complex public safety communications systems and arrangements provide a critical national capability for protecting and servicing the Australian community to ensure their day to day safety as well as supporting them when a disaster strikes. These systems have been transitioning from analogue to digital technologies. With the advent of mobile broadband technology they are set to transform to the next generation of public safety communications capability. Location based services, data and data analytics will be key elements of this emerging ecosystem. In the public safety context the Public Safety Communications Research Program (PSCR) located in Bolder Colorado is leading the way in research and develop and it has produced Research Roadmaps for

[6] The Standing Council on Transport and Infrastructure (SCoTI) brings together Ministers that have responsibility for transport and infrastructure issues across the Commonwealth, State/Territory Governments and New Zealand.

[7] Austroads is the association of Australasian road transport and traffic agencies and it considers the needs in respect to C-ITS and road safety more generally.

[8] For a detailed discussion on data sharing and use see the Productivity Commissions final report on its inquiry into dater sharing and use at https://www.pc.gov.au/inquiries/completed/data-access/report.

both Location Based Services[9] and Data Analytics[10]. Enhancing location accuracy has been key international priority for police and emergency services. For example, in 2019 the Federal Communications Commission in the United States adopted an order for a vertical, or z-axis, location accuracy metric of plus or minus three meters relative to the handset for 80% of indoor wireless 911 calls[11]. The findings of the proposed trials have the potential to establish the framework for enhancing location accuracy within buildings across Australia through the use of RNSS repeaters and associated technology.

Public safety communications is a key national policy priority and the governance arrangements and policy framework to support the development of a consistent approach towards the public safety communications ecosystem is still maturing. The Department of Home Affairs has been a key driver in developing this consistent approach as Australian Governments consider developing new Public Safety Mobile Broadband capabilities (PSMB). It would be advantageous if the Department of Home Affairs were kept abreast of the trials and the associated findings.

The Australian government has a unique opportunity to make strategic policy and technological investment decisions to ensure that there is a balance between establishing a new national public safety communications capability and the achievement of broader community benefits including the enhancement of community resilience. To fully understand and appreciate interoperability, public safety communications needs to be conceptualised as an ecosystem that enables public safety officials to deliver a critical service to the community[12]. Safety across the road network, including road tunnels, is a critical service that police and emergency services provide to the community.

The ACMA is responsible for managing the national policy and spectrum allocation for these communications networks under the Public Protection and Disaster Relief (PPDR) communications policy agenda. More recently there has been a focus on developing PPDR networks based on mobile broadband technologies to facilitate enhanced service delivery. This development will permit PPDR options to move from a primary reliance on voice-only communications to one based upon data[13] which may in the future also have a voice capability.

The ACMA has previously announced a multi-band layering approach to meet the communications requirements of Public Safety Agencies (PSAs) based on the three key bands of 400 MHz (for wide area narrowband mission critical voice and narrowband date), 4.9 GHz (for localised on-demand coverage extremely fast broadband sensor linking and meshing and other services) and 800 MHz (for cellular mobile broadband and associated services)[14] . As radio coverage in transport tunnels is essential for safety as well as tunnel management, it is critical that the trials focus on testing any potential interference caused by RNSS repeaters across these bands as well as the bands used for the management of the tunnel[15]. A further consideration is the implication for various types of

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[9] http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1883.pdf

[10] http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1917.pdf

[11] For more information see https://www.fcc.gov/document/fcc-helps-first-responders-quickly-locate-wireless-911-callers-0

[12] For more information see Department of Homeland Security (DHS), (2014), National Emergency Communications Planhttp://www.dhs.gov/necp

[13] Data services include text and video data formats.

[14] For more information see Australian Communications and Media Authority (ACMA), (2013), New Spectrum for Emergency Services http://www.acma.gov.au/theACMA/new-spectrum-for-emergency-services

[15] For a broader discussion on communications within tunnels see https://www.criticalcomms.com/features/intunnel-coverage-inside-knowledge

operation centres (or control rooms). These typically coordinate both the standard operational response and any emergency incident response. These types of centre are widespread within both emergency services and industry. A key to efficient response and safety is the availability of accurate location-based data. Similarly, it is important that the trials provide greater insight on how the deployment of RNSS repeater devices relate to the underground deployment of the next generation of mobile phone and other communications technologies more generally.

The CDMPS believes that the harmonisation of technology, standards, spectrum and devices at both a national and international level should be a fundamental aspect of Australia Communications policy. For this reason, the CDMPS attempts to understand the relationship between the development of new capabilities within the public safety communication ecosystem against broader developments Australia's communications landscape. When viewed from a systems perspective RNSS repeaters within road tunnels and other underground infrastructure could be considered as a specific component of a C-ITS or more broadly as a component of the Smart Cities concept Figure 1 provides a simplified representation of how RNSS repeater fit within the emerging public safety communications ecosystem.

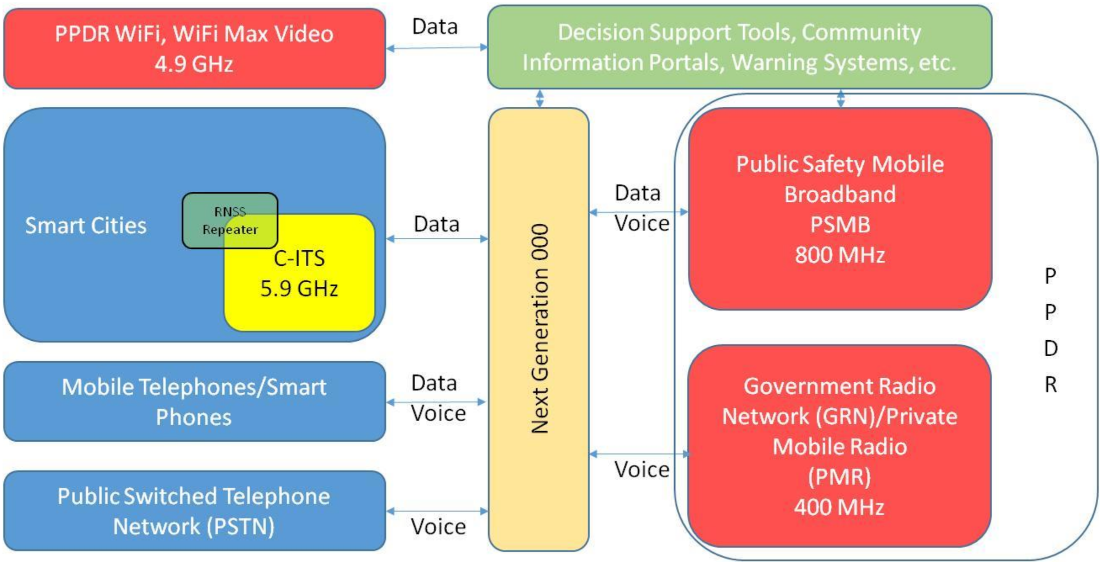

Figure 1 Simplified emerging public safety communications ecosystem.

It is recommended that:
RNSS repeater technology and location based services be considered as key component of Australia's emerging next generation public safety communications ecosystem.

2.6 Strategic Opportunities

The technologies and applications of LBS will play an ever increasingly important role in the modern, mobile, always-connected society. It is anticipated that location accuracy will be a key requirement as the smart city agenda continues to develop and advanced C-ITS are deployed. The proposed trials have the potential to provide a better understanding of the implications for digital twin city models (both above and below surface) and the role that RNSS repeaters and associated technologies play in developing those models.

Whilst GPS technologies have greatly enhanced the establishment of an accurate location and way finding, the modern urban environment creates a number of difficulties for establishing location accuracy. The proposed trials have the potential to provide the ACMA an opportunity for developing a common approach for enhancing location accuracy using RNSS repeater devices and other technologies for location accuracy and way finding. These capabilities are especially relevant in:

- the built environment more generally;
- underground mines (general applications as well as incident response);
- Sub-surface rail networks; and
- Major sub-surface utility tunnels.

Enhanced location accuracy has the potential to develop new LBS within a road tunnel.). ACMA should also consider the future potential implications for rail, mines, major underground water/sewer and other subsurface key infrastructure These trials have the potential to clarify how the RNSS repeaters and associated technology can provide new data streams that can be integrated into control rooms and communications centres (both industry and emergency response agency facilities Similarly, these data steams can lead to the development on new business services, enhanced data analytics, business insight and improved situational awareness in those control rooms and centres.

The discussion paper highlights the level of interest that has already been generated amongst key stakeholders in New South Wales and Victoria willing to be involved in the proposed trials. Developing trials using a scientific licence issued under the apparatus licensing framework appears to be an effective approach. ACMA have the opportunity to support ongoing research and development programs through a similar approach that:

- identifies enhanced approaches towards incident response facilitated by RNSS repeater devices and associated technologies;
- development of new technologies and devices to enhance location accuracy;
- support new commercial opportunities for Australia industries derived from RNSS repeater devices; and
- identifies future LBS service requirements in a road tunnel.

It is recommended that:

The ACMA consider the strategic opportunities for enhancing location accuracy across a broad range of industries and contexts flowing on from the proposed trials.

2.7 General Issues

The proposed trials are indicative of ACMA's ongoing efforts to develop co-existence measures indicate that identify and minimise potential interference across a broad range of radiocommunications user groups. This approach is strongly supported and it would be advantageous to stakeholders if there was some indication of the ACMA's thoughts regarding any ongoing documentation and management processes regarding RNSS repeaters.

It is anticipated that RNSS repeaters and associated technology will be a critical aspect of our future world and the CDMPS believes that the ACMA should consider potential responses regarding the intentional interference and damage to RNSS repeaters and associated devices. Part 4.2 of the *Radiocommunications Act* 1992 (Cth) contains offence provisions relating to radio emissions, in particular offences aimed at containing various kinds of interference with radiocommunications through the use of non-standard devices. State and Commonwealth legislation contains offences regarding wilful and criminal damage to property. It would be advantageous to stakeholders if there was some indication of the ACMA's thoughts regarding their views on potential responses regarding the intentional interference and damage to RNSS repeaters and associated devices.

3 Conclusion

The CDMPS acknowledges the significant commitment of the ACMA in supporting the enhancement of location accuracy in Australia as well as developing a strategic approach towards establishing a multilayered approach to meet the future needs of Australia's PSAs. Balancing the economic (particularly a licencing regime that is not cost prohibitive to a broad range of user) and broader social impacts associated with spectrum allocation in Australia is an incredibly complex task that requires multi-disciplinary collaboration between researchers, government, industry, agencies and the community.

The CDMPS commends our recommendations to you as detailed in the executive summary. We look forward to supporting ACMA and key stakeholders in developing Australia's future public safety and industry communications ecosystems including integrating RNSS repeaters and associated technology into that complex communications ecosystem.