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HoR Standing Committee on Industry, Innovation and Resources inquiry into social issues relating to land-based driverless vehicles in Australia

To whom this may concern,

Geoscience Australia is pleased to make this submission to the House of Representatives Inquiry into social issues relating to land-based driverless vehicles in Australia. Geoscience Australia applies geoscience information, services and capability to Australia's most important challenges. Geoscience Australia has a strong interest in the enhancement of the accuracy and reliability of Australia's national positioning infrastructure capability for the use by driverless vehicles in Australia.

Yours sincerely,

[redacted]

Gary Johnston
Geodesy and Seismic Monitoring Branch Head
Geoscience Australia
[redacted]

Geoscience Australia submission to the Inquiry into social issues relating to land-based driverless vehicles in Australia

Introduction

Geoscience Australia applies geoscience to Australia's most important challenges by providing geoscience information, services and capability.

GA are the national focal point for coordination on Australia's National Positioning Infrastructure Capability[1] (positioning, navigation and timing) and National Location Information; both of which are required to ensure driverless vehicles meet safety and regulatory requirements, as well as social acceptance.

The following information is provided for consideration in response to the Terms of Reference.

National Positioning Infrastructure Capability (NPIC)

Geoscience Australia (GA) chairs the Australian Government Positioning, Navigation and Timing (PNT) Working Group to coordinate and prioritise civil space PNT activities of national significance. As the Australian Government agency responsible for national positioning, GA facilitates technical and policy coordination on data and service standards, capability development, multilateral cooperation and legal traceability of position amongst other activities.

GA is leading the development of the NPIC in Australia to utilise next-generation satellites, namely Global Navigation Satellite Systems (GNSS), as a foundation for innovation and development over the coming decades. The NPIC vision is to deliver instantaneous, reliable and fit-for-purpose access to PNT information anytime and anywhere across Australia's land and maritime jurisdictions.

In the 2016/17 Mid-Year Economic and Fiscal Outlook, $12 million in funding was announced for a two-year project to test a Satellite Based Augmentation System (SBAS) for Australia. This will enable government and the commercial industry to test two new satellite positioning technologies including next generation SBAS and Precise Point Positioning, which will provide positioning accuracies of several decimetres and five centimetres respectively. These technologies are expected to play an important enabling role for many sectors including intelligent transport and will highlight Australia's interest in becoming a global leader in the field of driverless vehicles.

In reviewing this submission, it is critical to recognise that positioning and location information are fundamental to enabling driverless vehicles. This includes a robust national positioning network of ground-based infrastructure and analysis capability to provide high integrity and accurate PNT information.

[1] *Australia's Satellite Utilisation Policy (2013).*

What is an SBAS?

A Satellite-Based Augmentation System (SBAS) utilises space-based and ground-based infrastructure to improve the accuracy, integrity and availability of basic Global Navigation Satellite System (GNSS) signals, such as those currently provided by the Global Positioning System (GPS).

SBAS already developed internationally include Wide Area Augmentation System (WAAS) in the United States and the European Geostationary Navigation Overlay Service (EGNOS) in Europe.

An SBAS will overcome the current gaps in our mobile and radio communications and, when combined with on-ground operational infrastructure and services, will ensure that accurate positioning information can be received anytime and anywhere within Australia.

National Location Information

Location information and technology (or geospatial technology) are complementary capabilities to the positioning technology described above. In order to make best use of position, a consumer or business also needs to know what is happening around them, where and when it is happening, and why. Geoscience Australia is leading a number of programs to maximise the intelligent use of location information and technologies to reduce the cost and time of decision-making, and drive innovative use of information, across a range of sectors including infrastructure.

- The *Foundation Spatial Data Framework* is a cross-government program which will improve the quality and accessibility of fundamental location information used across a range of government, business and community sectors for decision-making.[2]
- The *Australian Geoscience Data Cube* is an initiative of Geoscience Australia, CSIRO and the National Computing Infrastructure which has organised Australia's archive of continental-coverage satellite imagery to allow time-series analysis of change in Australia's landscape.[3]
- Geospatial technology is used to visualise the world. Google Maps and Google Earth led the way in the mid-2000s; however this technology is now expanding and becoming more open, with a greater range of functionality. On-line and interactive mapping tools are now essential decision-making tools for business, government and consumers. Geoscience Australia is leading the way in Australia with a number of new approaches to mapping including the *NationalMap*[4] and *Interactive Maps*[5], and specific examples

[2] http://www.anzlic.gov.au/foundation_spatial_data_framework
[3] http://www.ga.gov.au/about/what-we-do/projects/earth-observation-and-satellite-imagery/australian-geoscience-data-cube
[4] http://nationalmap.gov.au/
[5] http://www.ga.gov.au/interactive-maps/#/

focused on infrastructure planning such as *GA Explorer*[6] to assist in the planning of pipelines and other infrastructure for the management of CO2 and other waste.

Societal benefits of driverless vehicles

Driverless vehicles used for road transport and industry sectors such as aviation, maritime and agriculture will deliver myriad societal benefits. Positioning enables faster and more informed decisions, leading to increased productivity, community safety, innovation and efficiency. Furthermore, in combination with accurate location information, it has the capacity to eliminate technical, economic and institutional barriers that prohibit these benefits been accessed on a national scale. Table 1 provides an overview of the capabilities and technologies that will emerge to benefit society through a fusion of positioning, location information and ICT technologies.

Table 1: Overview of industry capabilities and societal benefits enabled by a fusion of positioning, location information and ICT technologies.

Industry Sector	Capabilities	Societal Benefits
Road Transport	• Incident detection • Dynamic navigation and route planning • Variable speed limits and ramp monitoring • Situational awareness • More efficient emergency services • Better disability support • Hazards monitoring • Service delivery	• Congestion avoidance • Reduced injuries and fatalities • Fuel efficiency and reduced emissions • Reduced road damage • Speed enforcement • Improved public safety • More efficient delivery of services
Agriculture	• Automated guidance, sowing, spraying, irrigation and weeding • Accurate topographic and yield mapping • Accurate water forecasting • Unmanned Aerial Vehicles (UAVs) • Livestock tracking	• Improved safety • Increased yield and productivity • Reduced water run-off, soil compaction, soil erosion and fuel consumption • Cost savings and more efficient use of inputs (fertilisers, pesticides, seeds)
Aviation	• Route guidance and tracking • Integrity monitoring and reporting • International standardisation	• Public safety • Fuel efficiency • Cost savings for navigation aids • Defensible compliance with legislation
Maritime	• Reduced under keel clearance • Reliable navigation • Vessel monitoring • International standardisation	• Environmental protection • Greater fuel efficiency • Higher tonnage and more efficient trade • Public safety

[6] http://www.ga.gov.au/about/what-we-do/projects/energy/co2-infrastructure-project

		• Defensible compliance with legislation

The role of the Australian Government

Australia has taken an important step towards enabling driverless vehicles in Australia with the announcement of the two-year project to test SBAS and Precise Positioning throughout Australia. Future-proofing Australia's NPIC to ensure ongoing, accurate, high integrity positioning and location services will be necessary to ensure safer transport by driverless vehicles and deliver the societal benefits shown in Table 1. This includes the establishment of a permanent SBAS and NPIC.

Further considerations for the Australian Government include:

SBAS

- The United States, Europe and Japan are leading exporters of connected and automated vehicles. The governments of each of these regions fund and operate SBAS to improve the accuracy and integrity of GPS for civil aviation applications. In the absence of investment in a comparable SBAS capability across Australia, we would enter the automated vehicle market at a significant disadvantage to international competitors.
- Current SBAS technologies approved by the International Civil Aviation Organization (ICAO) are only certified for limited GNSS signals. Looking forward, ICAO is developing standards to certify the use of multi-constellation, multi-frequency GNSS data for delivery via SBAS. Next generation SBAS will further enhance positioning accuracy to levels suitable for 'where-in-lane' vehicle positioning. Whilst these standards are unlikely to be implemented for 5-10 years, they provide insight on the significant opportunities available to Australia for future-proofing positioning infrastructure and services with an SBAS or comparable satellite delivery capability in line with international trends.
- If an operational SBAS was established for Australia, the Australian Government would has a role to play to regulate the Minimum Operational Performance Standards (MOPS) of the system for the range of industries that would utilise it (e.g. aviation, mining, intelligent transport, agriculture, marine, etc.).

Data Accuracy and Integrity

- Testing and development of positioning technology and data must be national in scale to ensure the full benefits of connecting regional and remote Australia can be realised.
- Improving national positioning accuracy and integrity to a minimum standard is vital to Australian competitiveness in emerging markets for connected and automated vehicles.
- A national approach to the development of infrastructure to support driverless vehicles is required to encourage interoperability and consistency of position and location information. National guidelines are fundamental to overcoming the 'rail

gauge' constraints on infrastructure, data and service standards currently restricting user mobility and precise positioning coverage across jurisdictional borders.

- Foundation spatial data, and geospatial technology platforms such as NationalMap, are already considered integral to the achievement of Australian Government priorities for e-Government and the Digital Economy. Both programs have policy carriage with the Department of Prime Minister & Cabinet's Public Data Branch and have strong inter-jurisdictional relationships with states and territories via ANZLIC – the Spatial Information Council, and the Intergovernmental Committee on Surveying & Mapping[7]. As such there is already a strong policy recognition of the importance of this technology and information to promote productivity; the next series of goals in this space will focus on the application of this technology to specific sectors of society, including infrastructure.
- GNSS signals are broadcast free of charge and state-of-the-art Australian software is being developed to validate GNSS performance. Connecting smart ICT infrastructure and devices to multi-GNSS positioning systems will ensure the highest possible accuracy and integrity is available to any user, anytime and anywhere. Existing positioning infrastructures in Australia are disparate and together lack complete coverage, particularly in regional and remote areas. A more harmonised, national approach requires smart technology integration, the outcome of which is more consistent mapping and modelling for the wider user community.
- Location information and technology (or geospatial technology) are complementary capabilities to the positioning technology described above. In order to make best use of position, a consumer or business also needs to know what is happening around them, where and when it is happening, and why. Geoscience Australia is leading a number of programs to maximise the intelligent use of location information and technologies to reduce the cost and time of decision-making, and drive innovative use of information, across a range of sectors including infrastructure.

Interoperability

- The true value of location information depends on how accurately and efficiently different datasets and information systems can be integrated to enhance decision-making. This concept is known as 'interoperability'. Datasets that are interoperable are easier to combine and analyse. Position is a key enabler of interoperability.
- National access to reliable and accurate positioning information strengthens interoperability, leading to greater productivity, safety and innovation. A piece of infrastructure like a major road for example requires positioning information to design, plan, construct, maintain and use the road. All assets above, below, beside and on the road itself must be positioned with high accuracy and integrity.
- Positioning systems also guide machinery and equipment during construction, and monitor the position of assets before, during and after installation (e.g. to detect any hazardous movement). Accurate positioning creates efficiencies at each step in the supply chain by aligning and integrating data for planning, design and verification purposes.

[7] http://www.dpmc.gov.au/pmc/about-pmc/core-priorities/public-data-branch-within-dpmc/data-initiatives-administered-public-data-branch. Accessed 19 November 2015.

- The emerging market for autonomous vehicles is a useful example of the critical need for interoperability. Autonomous vehicles require a high degree of certainty that positioning information from satellites and other roadside infrastructure aligns with the mapping systems used to navigate the national road network. Smart positioning infrastructure leads to smarter decision-making.

Spectrum Management

- The spectrum management framework in Australia authorises the reception of GNSS signals from all constellations, and prohibits the use of any device that interferes, disrupts or disturbs the reception of these signals[8]. These legislative instruments are vital for protecting the reception of GNSS services into perpetuity as society's critical dependence on positioning, navigation and timing information continues to grow (see Table 1 above). Geoscience Australia strongly advocates the protection of GNSS spectrum to support economic productivity and community safety.

[8] http://www.acma.gov.au/theACMA/Consultations/Consultations/Current/remaking-the-communication-with-space-object-class-licence