

Economic impact of geospatial information services in Australia

Case studies – A companion document
to “The economic impact of geospatial
information services in Australia”

30 October 2024



Foreword

This assessment of the value of geospatial information in Australia in 2023-24 and projections to 2033-34 was commissioned by the Geospatial Council of Australia. The Geospatial Council of Australia is the peak body representing the interests of organisations and individuals, including new and emerging professionals working in the vast range of occupations for surveying, downstream space and geospatial in the digital world.

We are extremely grateful to the organisations listed overleaf that have supported this work by contributing funding, and also through their participation via a steering committee, without which this work would not have been possible.

The study aims to highlight the critical role of geospatial information in enhancing national productivity, showcasing its significant direct economic impact on our national economy. Additionally, it seeks to explore opportunities for expanding its usage further. The study is not just an analysis of our current industry value – it's a forward-looking initiative projecting the potential impact of the geospatial industry on the Australian economy in 2034.

While there is a very strong focus on the economic and productivity benefits that geospatial data and technology deliver, we are also interested in capturing some of the broader benefits, including various societal benefits from the day-to-day use of geospatial information, such as finding our way around, knowing your kids are safe and when your bus is arriving.

From a strategic policy perspective, geospatial information and services are essential to tackling climate change, environmental management, sustainability and emissions reduction monitoring, resilience planning, emergency and national disaster response and management, along with defence and security.

By understanding where we stand today and envisioning our potential influence on the national economy over the next decade, we are aiming to use this report to shape the future policies that will not only foster further growth of Australia's economy but also position the geospatial sector at the heart of Australia's broader narrative and economic growth.

Kate Lundy
Chair
Geospatial Council of Australia

Acknowledgements

The Geospatial Council of Australia would like to thank the following organisations for their generous support, that has made this study possible.



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Glossary

Abbreviations	Definitions
ABS	Australian Bureau of Statistics
AI	Artificial intelligence
ANZSIC	Australian and New Zealand Standard Industrial Classification
API	Application Program Interface
CEBR	Centre for Excellence for Biosecurity Risk Analysis
C-ITS	Cooperative Intelligent Transport Systems
CORS	Continuously Operating Reference Station
CTF	Controlled traffic farming (self-steering tractors)
EOS	Earth Observations from Space
FTE	Full Time Equivalent which equates to the standard hours that an employee has worked over a week. In this report, one FTE is equivalent to 40 hours.
G-NAF	Geocoded National Address File
GNSS	Global Navigational Satellite Service
ICSM	Intergovernmental Committee on Surveying and Mapping
LIDAR	Light detection and ranging
Nec.	Not elsewhere classified
NMG	National Management Group for the Varroa Mite
NPIC	National Positioning Infrastructure Capability
NPV	Net present value
PV	Present value
RI	Real income which is the sum of income to Australians plus company profits
RTK	Real time kinematics (a technology for augmenting GNSS position)
SBAS	Satellite Based Augmentation Service
SLM	Serpentine Leaf Miner
SouthPAN	The Southern Positioning Augmentation Network
STES	State and Territory Emergency Services
VLM	Vegetable leaf miner
BoM	Bureau of Meteorology

About this document

This is a companion document to the report “The economic impact of geospatial information services in Australia” published on 30 October 2024. These two documents are the result of research and analysis conducted by ACIL Allen commissioned by the Geospatial Council of Australia with the support of the organisations listed inside the front cover of this document.

The Council issued a call for case studies in December 2023. A total of 167 studies were assembled from this call and from other research. These case studies provided evidence to support an estimate of the economic impact of geospatial information in Australia. A summary list of these case studies is provided in Attachment A.

Sixty-five case studies were selected from the longer list to illustrate the various impacts of geospatial information on the Australian economy and society. These are described in this companion report. They are grouped into the following categories:

- emergency response and management of natural disasters
- climate change, environment, and natural resources
- planning, government services, defence, development, construction, and infrastructure
- mining
- agriculture
- biosecurity.

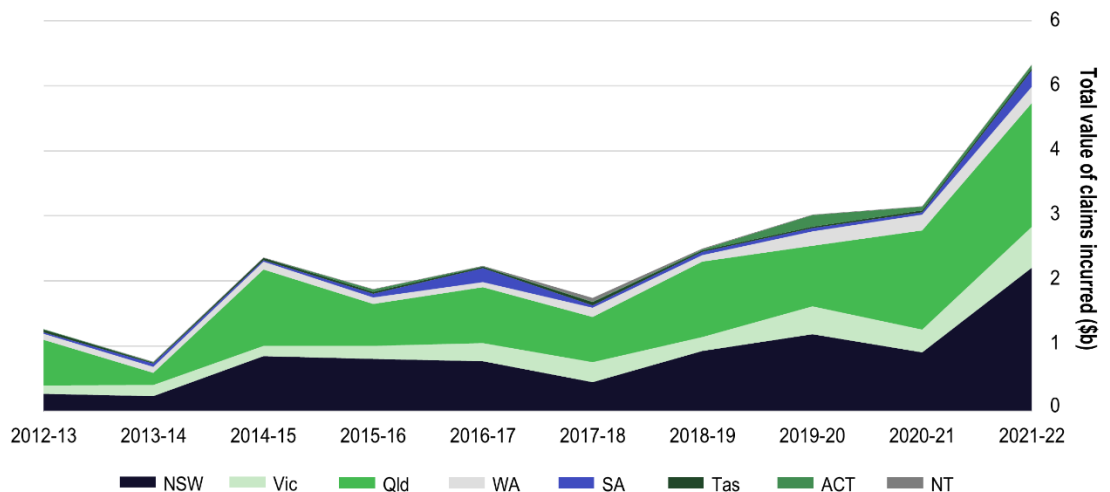
We would like to thank all the organisations and individuals who contributed examples of the use and application of geospatial information services to support this project.

1 Emergency response and management of natural disasters

Natural disasters in Australia

Australia has long experienced the impacts of natural disasters. The total value of claims for building and content losses from other natural hazards in Australia was \$5.3 billion in 2021-22, climbing steadily in recent years (see Figure 1.1).

Figure 1.1 Total value of household claims incurred, other natural hazard event building and contents insurance claims (including major events), 2021-22 dollars, \$b



Source: (Productivity Commission, 2023)

When considering both financial and social impacts, the total impact of natural disasters in Australia was estimated to be \$38 billion in 2021 (Productivity Commission, 2023). As we look to the future, compounding factors presented by climate change are predicted to continue to worsen the severity and increase the incidence of extreme weather events such as extreme rainfall, heatwaves and droughts (International Actuarial Association, 2022). Recent estimates by Deloitte propose that even under a low-emissions scenario, natural disasters will cost the nation \$73 billion per year by 2060 (and \$94 billion per year under a high-emissions scenario). Over the next 40 years, the cumulative cost of natural disasters was estimated to total \$1.2 trillion (Deloitte Access Economics, 2021).¹

Australia faces a challenging future regarding mitigation of natural disaster, with increasing financial and social impact due bushfires, floods, severe storm and tropical cyclones.

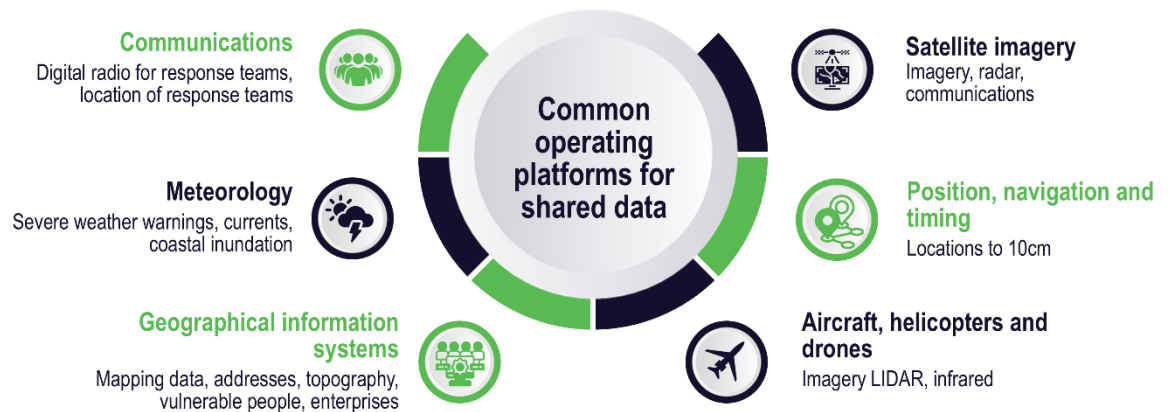
¹ Ibid.

How is geospatial information relevant?

Geospatial information is a fundamental enabling capability that supports response and recovery from natural disaster events. It also supports ongoing mitigation activities by government, the insurance industry and society to reduce the future exposure of the community to natural disaster experiences.

Increasingly, emergency services agencies rely on common operating platforms to display multiple data streams on one platform. Geospatial information technologies provide the data and operating framework to share this data in real time (Figure 1.2).

Figure 1.2 Geospatial inputs to emergency response



Source: ACIL Allen

Satellite imagery provided by Geoscience Australia and by commercial providers, provides important monitoring and early warning of dangerous conditions. For example, Geoscience Australia’s Digital Australia Hot Spots is used to identify early warning of bushfires. Infrared sensors mounted on aircraft or drones provide real time situation awareness of fire spreading.

Weather forecasts from the Bureau of Meteorology provide early warning and updates of weather conditions to support response planning by emergency services. Accurate positioning services provided by Geoscience Australia’s SouthPAN program and commercial providers deliver accurate location to support emergency response operations. Foundation spatial data and data from the Geocoded National Address File (GNAF) provide information on vulnerabilities, assist ambulance services, support police, defence and fire services operations to protect the community and businesses during natural disaster events. Communications and location services enable tracking of responders in the field to support tactical responses and protect them in highly dangerous situations.

Prevention and preparedness

Prevention and preparedness are ongoing challenges to emergency management agencies. The 2 case studies below indicate how geospatial data is used in these circumstances.

Case study – National Exposure Information System – Geoscience Australia

The National Exposure Information System (NEXIS) and the Australian Exposure Information Platform (AEIP) are critically important to reducing the economic and social impact of bushfires in Australia.

Geoscience Australia developed NEXIS and AEIP in 2002 and has continued to develop it over the following years. It was further developed following recommendations arising out of the Royal Commission into National Natural Disaster Arrangements in 2022.

Since that time, its use by emergency management across Australia has increased. On average around 400 reports are generated each month with peaks of up to 14,000 reports during natural disaster events.

Case Study 1 NEXIS and AFIP

WHO BENEFITS: Emergency service organisations

CHALLENGE: Easy access to a nationally consistent exposure information gives emergency managers the ability to quickly prepare an exposure report to help identify what is potentially at risk.



SOLUTION: The National Exposure Information System (NEXIS) contains a collection of exposure datasets stored, maintained and managed within Geoscience Australia from a variety of both openly available and restricted datasets used to create nationally consistent exposure information. The key exposure types are buildings, institutions, infrastructure, businesses, agriculture areas (including value of commodities produced) and places of environmental importance (such as World Heritage areas and Ramsar wetlands).

The Australian Exposure Information Platform (AEIP) is the delivery platform that allows that exposure information to be available to users at all times. This makes it possible for decision makers to perform critical pre-planning or carry out real time assessments of different scenarios to see what is potentially exposed by a hazard event, anywhere across Australia. A user can submit a customised area of interest, identifying what may be exposed to a potential hazard – from fires floods to pandemics. This helps emergency managers to make informed decisions relating to hazards and their potential risk to Australian communities and to plan and estimate likely construction needs of communities that have been affected by a natural disaster.

Western Australia and New South Wales Emergency Services draw on NEXIS.

The benefits delivered by NEXIS and AIEP are estimated to be of the order of around \$30 million per year with a net present value of around \$300 million calculated over 15 years at a discount rate of 7%.

Source: Geoscience Australia and ACIL Allen estimates

Case study – Use of satellite imagery for planned burn operations

The Forest Fire Management (FFM) Group in the Victorian Department of Environment, Energy and Climate Change (DEECC) utilises satellite imagery for the planning of planned burn activities in Victoria. This is critically important to the tactical reduction of potential fuel for bushfires in forested and areas of the state.

Case Study 2 Use of satellite imagery to manage planned burn operations

WHO BENEFITS: Emergency services, society and businesses in high-risk areas

CHALLENGE: Understanding where planned burns should occur (particularly the dryness of particular areas) has always been difficult to understand unless they are on the ground. FFM required data to understand the areas that would require planned burns across the state.

SOLUTION: The group utilises satellite imagery procured through the Digital Twin Victoria (DTV) program for planned burn operations, providing important data for planning, execution, and evaluation of the burn. Use of the whole of Victorian Government Geospatial Data and Analytics Panel has allowed the procurement of satellite data across the state for a number of uses including for planned burn activities. DTV's Satellite Tasking Service opens up a range of satellites for DTV with a data delivery timeframe of between 2-12 hours making this a service that can be provided for emergency management when natural disasters occur.



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Source: Department of Energy, Environment and Climate Action, Victoria.

Responding to natural disasters

Emergency services operations rely on timely information and common operating platforms to share data between emergency management organisations, fire services, ambulance services, police, search and rescue and in some circumstances the Department of Defence.

The following 4 case studies illustrate how geospatial information services provide critical support to natural disaster responders.

Case study – National Joint Common Operating Picture (NJCOP)

The NJCOP was developed in response to recommendations from the 2020 Royal Commission into National Natural Disaster Arrangements. It delivers on a vision that displays nationally significant event information such as flood, fire, cyclone, drought, earthquake, and tidal surge/tsunami events.

The NJCOP is located in the National Emergency Management Agency (NEMA) of the Commonwealth Government.

Case Study 3 National Joint Common Operating Picture

WHO BENEFITS: Emergency services, government, individuals and businesses impacted by disasters

CHALLENGE: The Commonwealth and the State/Territory Governments need a common overview of event information such as floods, fire threat, cyclone, drought, earthquake, and tidal surge/tsunami.

SOLUTION: The NJCOP overlays this information with key infrastructure showing information such as road closures, the location of landmark buildings, as well as documenting biosecurity alerts and relevant space events.

The dashboard integrates data feeds from a range of sources including the Bureau of Meteorology, Geoscience Australia and State and Territory Emergency Services agencies and more. These are presented as RSS and Geodata feeds to the Data Interoperability Extension.

The system provides near real time inputs to enhance confidence in the data displayed, enabling decision-making at the time when the situation is occurring. It provides a consolidated national picture across multiple hazards, jurisdictions and other variables.

Intuitive graphic views and configurable dashboards enable accurate and rapid risk assessments which establish roadmaps for ongoing improvements, with strategic priorities agreed.



The NCOP System is used by NEMA to rapidly obtain an overview of an emergency situation to inform advice to Government on the deployment of Commonwealth Government support and assets.

Source: ESRI, Australian Institute for Disaster Relief

Case study – NSW Emergency Information Co-ordination Unit (EICU)

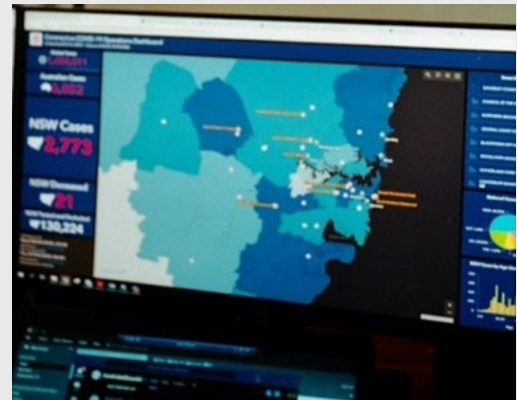
The NSW EICU assists frontline teams in saving lives, supporting the community in recovery, and protecting critical infrastructure. The EICU ensures that the emergency management sector has the most authoritative geospatial and intelligence available to manage emergencies. The EICU is an operational component of the Customer and Emergency Management Services in NSW.

Case Study 4 NSW Emergency Information Coordination Unit

WHO BENEFITS: Emergency services, government, individuals and businesses impacted by disasters

CHALLENGE: During a natural disaster event such as flooding or fire, many agencies need access to spatially related data to coordinate actions to support lifesaving activities, recovering impact commodities and protecting critical infrastructure.

SOLUTION: The EICU ensures the emergency management sector has the best intelligence and spatial data available to deal with emergencies, such as terrorism, natural disasters, and major events. This vital role directly supports lifesaving activities, recovering impacted communities, and protecting critical infrastructure, and is of essential use to over 160 agencies at local, state, and federal levels – including all of NSW Government. The EICU is tasked to work within 4 levels of emergency management: prevention, preparedness, response and recovery.



The EICU delivers a \$97.2m benefit to NSW Government in data processing overhead. This number would be significantly higher if software and hardware fees, licensing, and other ICT costs that are streamlined are included.

Source: NSW Emergency Information Coordination Unit

Case study – Digital Earth Australia Hotspots and Earth Observation Data

Launched in 2003 and now hosted by Geoscience Australia, Digital Earth Hotspots provides daily, consistent, accessible and actionable data to agencies and others monitoring fire risk.

Case Study 5 Digital Earth Hotspots

WHO BENEFITS: Emergency services and responders

CHALLENGE: To identify hot areas where fires are initiated in order to locate and implement early action to extinguish hotspots before they grow into major bushfires.

SOLUTION: Using rapid access to NASA and European satellite data stream through Australian Ground Stations, data processing algorithms and a customised interface, Geoscience Australia provides a visualised information frame to help emergency services and responders underrating and analyse the risk.



The Digital Earth Australia Hotspots web service has been developed as part of the Digital Earth Australia Hotspots national bushfire monitoring system. The service delivers hotspot data derived from a growing number of satellite-born instruments that detect light in the thermal wavelengths. The colour of the spot represents the time the Hotspot was last observed by a passing satellite (e.g. 0-2 hours). The colour does not indicate severity. Typically, the satellite data are processed with a specific algorithm that highlights areas with an unusually high temperature. In principle, however, Hotspots may be sourced from non-satellite sources as in the case of the Tasmanian case study above. However, this system provides an early warning sign that can be followed up with airborne infrared imagery to identify hotspots as part of deployment of response assets.

Using Digital Earth Hotspots, fire agencies have been able to implement more effective pre-planning efforts as well as establish on-the-ground monitoring and warning systems to protect properties, livelihoods and lives.

It has been estimated that earth observation data delivers benefits in avoided costs of bushfires of \$16.5 million per year.

Source: Geoscience Australia and CSIRO

Case study – Common Operating Platform (COP) and early detection and notification of bushfires in Tasmania

The Tasmanian COP provides emergency management staff with a single authoritative mapped view of shared information for use in emergency planning and response activities. The COP is a web-based mapping application that exists as part of the Land Information System Tasmania (LIST) which is the geospatial data platform on which all of the Tasmanian foundation spatial data is stored and shared.

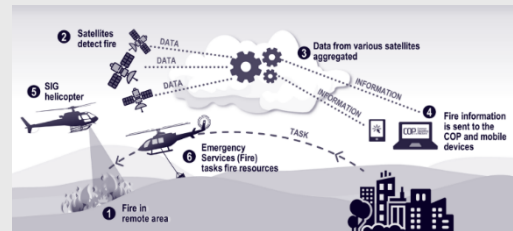
The COP includes a range of critical emergency management spatial data, some dynamic in nature, and when aggregated with foundational data for context, provides emergency managers with authoritative evidence-based data to support decision making. The delivery of data to a common operating platform and the deployment of data are illustrated in the case study below.

Case Study 6 Early detection system to attack remote bushfires in Tasmania

WHO BENEFITS: Emergency services, government, individuals and businesses impacted by disasters

CHALLENGE: Locating and quickly extinguishing remote bushfires before they can escalate. Once a bushfire gets away, the damage costs can be huge.

SOLUTION: The Tasmanian Emergency Service Organisations use a Common Operating Platform (COP) that provides emergency services organisations with a single authoritative mapped view of shared information for use in emergency planning and response activities. The COP is a component of the Land Information System Tasmania (LIST) which is the geospatial data platform on which all of the Tasmanian foundation spatial data is stored and shared. Since March 2022, the COP has included real-time satellite-based bushfire detection and notification data and real time geospatial data feeds from a Specialist Intelligence Gathering (SIG) helicopter.



The introduction of the early warning system means that new fire starts are detected in near real-time by a growing constellation of satellites, and automated notifications are sent out within minutes, rather than hours (or in some cases days). Within 10 minutes of receiving the notification, the fire start locations are shown in the LIST's Common Operating Platform. The COP combines these alerts with contextual mapping layers to give the fire agencies, and other emergency services full situational awareness, enabling them to decide where and when to deploy their available resources and equipment and coordinate responses.

Developments in infrared sensing also mean that potential fire risks can be detected from a distance of 20 kilometres from a sensor mounted on an SIG helicopter platform. This data can be transferred into the COP in real time providing planners and operational response teams with early bushfire location data to plan early responses to bushfire starts.

The 2018-19 bushfire season cost \$60 million to bring under control and incurred at least \$100 million in insured losses.

The new fire regime of more extreme, frequent, and longer fire events will have profound impacts for the response capacity of Tasmanian fire agencies. Improved situational awareness will be instrumental in efficient deployment of the available response capability.

Source: Department of Natural Resources and Environment Tasmania

The recovery phase

Recovery is a key stage in the response process. It occurs in less urgent circumstances but nevertheless is time critical given displacement and loss homes and facilities that are a result of fires, floods or severe storms. This phase also engaged geospatial information to inform actions to relocate people, stage rebuilding and coordinate services.

Mitigation of future potential impacts requires data such as flood mapping, controlled burning and coastal zone planning and, in some cases, rezoning vulnerable areas all of which depends on geospatial information.

Geospatial information is fundamental to managing these risks. It provides an illustration of the data and information that is required by planners, local authorities, governments, the insurance industry, the finance industry and industry sectors generally. The majority of information that is involved are all spatially coded, stored and shared in geospatial information systems and platforms.

The following 3 case studies that demonstrate the role of geospatial services in the recovery phase follow.

Case study – use of Foundation Spatial Data Framework in recovery phase

Governments in Australia developed the Foundation Spatial Data Framework (FSDF) in 2014. Today the FSDF is the authoritative geographic information that underpins much of the day-to-day business of Government. The FSDF provides an important source of authoritative geospatial data that is critical to both response and recovery phase in times of emergency.

This case study from NSW illustrates how important the FSDF was to responding to the 2019-20 bushfires and the 2022 eastern Australian Floods. The latter was considered one of the worst disasters on record.

Case Study 7 Foundation Spatial Data Framework supporting the recovery phase in NSW

WHO BENEFITS: Emergency services, government, individuals and businesses impacted by disasters

CHALLENGE: Recovery teams need authoritative spatial data during the recovery phase to make informed assessments about where and how the fires and floods affected communities, infrastructure and the environment.

SOLUTION: In the summer of 2019-20 around 50,000 square kilometres of bushfire affected areas across NSW were captured by Spatial services to update the FSDF imagery. The imagery was used by recovery teams to make informed assessments of where and how the fires affected communities, infrastructure, and the environment. The imagery also provides an authoritative record of the impact from the fires that is critical for future planning and mitigation projects.



In 2022, the east coast also experienced intense rainfall and flooding. FSDF data was used by the NSW Emergency Operations Centre in flood response and recovery activities, including providing information for comparative analysis and damage assessments. The FSDF supported multiple applications across government to collect and display critical information about flood recovery tasks from affected residents and in locating and mapping flood affected areas. This was used to validate government grantees as well as to update emergency service mapping tools to locate affected customers and infrastructure.

The data provided updated information for emergency services mapping tools to locate affected customers and infrastructure. This is critical in regional areas where other third-party solutions do not always have up-to-date and accurate addresses.

This application ensures that the social cost to affected communities is minimised. It ensures that damage assessments are well informed and emergency management mapping tools are updated.

Source: NSW Spatial Services

Case study – G-NAF in support of emergency management

The Geocoded National Address File (G-NAF) is a registry that indexes information on all street addresses in Australia, including geographic coordinates (latitude and longitude), state/territory, suburb, street, and number. G-NAF is administered by Geoscape Australia and funded by the Department of Industry, Science and Resources (DISR), with the dataset providing the coordinates of over 15 million addresses (Department of Industry, Science and Resources, 2023).

The ability to transfer address information into geographic coordinates is called geocoding. This capability is essential to effective response of emergency services such as ambulance, fire brigades, and police (Lateral Economics, 2022). G-NAF address data is an essential tool to support emergency management services. It is also used in a wide range of other applications such as commercial mapping tools and street navigation services. It supports a large number of other government and industry activities.

The following case study describes the value of G-NAF in support of emergency recovery processes along with other government and commercial activities.

Case Study 8 G-NAF supporting recovery actions

WHO BENEFITS: Emergency services, government, individuals and businesses impacted by disasters, the Australian Bureau of Statistics, Australia Post, the Australian Electoral Commission, banks, the insurance and property industries

CHALLENGE: During the 2019-20 Black Summer Bushfires, the Australian Government needed to promptly identify businesses that were most significantly impacted

SOLUTION: G-NAF information was drawn on, and used in conjunction with:

- Geoscience Australia’s satellite data to identify areas impacted by bushfires
- Emergency Management Spatial Information Network Australia (EMSINA) maps
- Australian Tax Office data
- The Department of Industry Science and Resources’ Business Grants Hub.

The digital mapping tools were utilised to assist the government in making informed and targeted decisions regarding the provisions of grant funding based on need (Department of Industry, Science and Resources, 2023).

G-NAF also supports the Australian Bureau of Statistics to improve the quality of their data, helps Australia Post optimise its delivery routes, supports the Australian Electoral Commission in managing the electoral role, and is used by the insurance and property industry to manage claims and property valuation respectively.



A calculation by Lateral Economics (2022) of net benefits estimates that the G-NAF has a current value of \$1.36 billion in NPV terms, and \$1.64 billion in NPV terms in a scenario in which G-NAF provides improved offerings.

Source: Geoscape

Case study – Severe wind assessment in Southeast Queensland

As a region, Southeast Queensland (SEQ) is particularly exposed to damaging winds caused by tropical cyclones and thunderstorms that pose a significant hazard to Queensland’s people and economy.

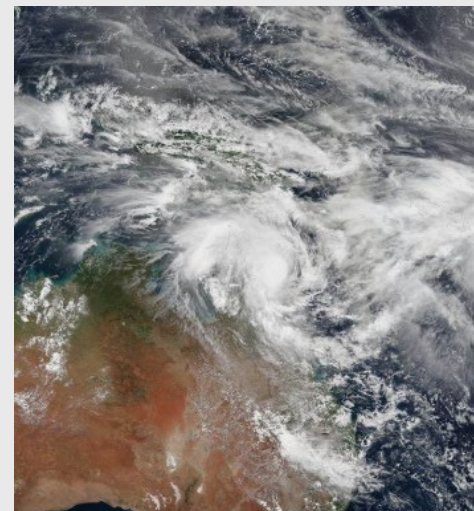
Geoscience Australia, alongside Queensland Fire and Emergency Services and other stakeholders undertook a wind assessment project to improve the understanding of wind risk and impact across SEQ’s 6 Local Government Areas (LGAs) and create actionable information that would contribute to better future decision making.

Case Study 9 Assessment of severe wind hazard in Southeast Queensland

WHO BENEFITS: Policy makers, researchers and people who live in high wind risk areas of Southeast Queensland

CHALLENGE: As a region, Southeast Queensland (SEQ) is particularly exposed to tropical cyclones and thunderstorms, which pose a significant hazard to its economy and people.

SOLUTION: The project examined Southeast Queensland’s vulnerability to damage caused by severe wind risk, producing valuable information to aid in the mitigation of damage caused by future winds.



The project modelled different scenarios to provide insight into which residential homes would best be suited to retrofit improvements. This will assist in future decision-making regarding damage mitigation across the most vulnerable homes in Queensland.

The project assessed risk to different groups by considering vulnerabilities in different characteristics, such as building structure and location in scenarios with differing wind severity (Geoscience Australia, 2022). This assessment is informed by the Australian Disaster Resilience Index (ADRI), working to highlight those who are at particularly high risk of damage caused by severe winds, informed by NEXIS data.

The project modelled programs that would see retrofit improvements to certain home types that would reduce the potential damage in severe winds, including a determination of which regions and house types would be most cost effective to retrofit.

Source: (Geoscience Australia, 2022)

2 Climate change, environment and natural resources

Introduction

Geospatial information systems have been supporting programs and activities related to managing the impacts of climate change, monitoring and managing the environment and our natural resources.

As scientific understanding of climate change increases, there is recognition of its complexity and urgency. The impacts of climate change are becoming more evident and severe, affecting communities, economies, and ecosystems worldwide.

Rising land and ocean temperatures are prompting shifts in rainfall distribution and the occurrence of severe weather phenomena, impacting the health of our soils, water sources, and vegetation, as well as the wide range of species dependent on these ecosystems (DCCEEW, 2021). The environment is humanity's most valuable asset. Approximately half of Australia's gross domestic product (GDP) is moderately to highly dependent on nature and its services (PwC, 2022).

The potential economic damages from climate change to Australia at current global emission levels have been quantified as \$584.5 billion in 2030, \$762 billion in 2050 and more than \$5 trillion in cumulative damages from now until 2100 (Kompas, 2019).

It is into this context that geospatial information can play a key role in providing vital information in the response to climate change and environmental protection. Geospatial information enables a greater understanding of both temporal and spatial dimensions of climate change and the environment, providing a holistic view of our planet. This becomes particularly crucial in understanding the dynamic nature of environmental shifts.

The following 11 case studies demonstrate some of these use cases across different geographical scales.

Climate change

Case study – National Greenhouse and Energy Reporting (NGER) Scheme

Geospatially sourced information supports evidence-based policy development for climate change and environmental protection. It provides policy makers with the information needed to design effective strategies and regulations. Interactive maps and data visualisation tools can help raise public awareness, promote behaviour change and enable ground-up advocacy.

The National Greenhouse and Energy Reporting (NGER) Scheme is playing a central role in his process. The Department of Climate Change, Energy, the Environment and Water (DCCEEW) have formal oversight of the NGER Scheme (DCCEEW, n.d.). The NGER is supported by geospatial systems and analysis.

Case Study 10 National Greenhouse and Energy Reporting (NGER) Scheme

WHO BENEFITS: Policy formulation and program management, climate change program management, reporting obligations of government

CHALLENGE: To maintain an efficient and reliable emissions reporting system to support policy and programs in the transition to net zero emissions by 2050



SOLUTION: The National Greenhouse and Energy Reporting (NGER) Scheme is a unified national framework for reporting company information relating to greenhouse gas emissions, energy production and energy consumption. These reporting requirements apply to companies which reach certain thresholds of emissions and energy use.

Geospatial information is crucial to the NGER Scheme as it enables mapping of emission sources, monitoring and compliance, risk assessment and response, as well as tracking spatial trends and patterns. The Department of Climate Change, Energy, the Environment and Water provides environmental and geospatial information products, advice, analysis and tools which allow for interactive mapping, reporting and analysis.

The greenhouse gas emissions data reported by the NGER Scheme serve as important inputs to the preparation of the National Greenhouse accounts.

The NGER scheme allows for a unified approach to emission and energy use reporting, reducing the costs and complications of accurate reporting. Geospatial information systems and analysis support mapping and reporting for policy makers and program managers.

Source: NGER reporting guides | Clean Energy Regulator (cer.gov.au) sourced on 18 June 2024

Case study – Monitoring emissions from commercial buildings

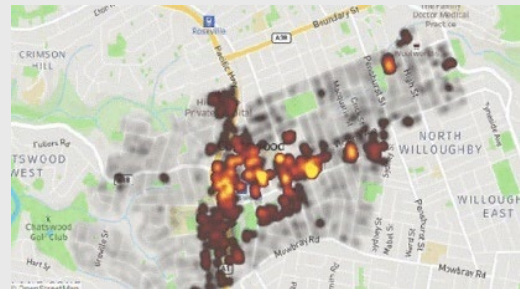
According to the Department of Climate Change, Energy, the Environment, and Water, buildings in Australia use about 19% of the country's energy and create 18% of its direct carbon emissions². In the effort to combat climate change, it's important to map emission characteristics of buildings and structures.

This case study shows how the data contained in Geoscape supports analysis of data to help policy and programs to promote the goal of net zero emissions of CO_{2-e} by 2050.

Case Study 11 Monitoring commercial buildings

WHO BENEFITS: Policy makers, planners, building owners and society in general

CHALLENGE: The journey to global net-zero carbon emissions requires structured and reliable data to support planning for the transition to net zero emissions.



SOLUTION: Improving the energy efficiency of buildings is crucial, as it leads to lower energy costs, improved health for occupants, and reduced carbon emissions.

To accurately measure emissions, data on energy use, building design, construction materials, and building conditions need to be combined. The Department of Climate Change, Energy, the Environment and Water undertook an update of the Commercial Building Baseline Study in 2022 to report on energy consumption and greenhouse gas emissions in commercial buildings. The study provided information on the number of non-residential buildings in Australia by type and region.

Location Intelligence helps to assess the environmental impact of buildings using indicators like size and potential for greenhouse gas emissions. The data was obtained from Geoscape Buildings and analysed by CSIRO. These data set are extremely valuable for its comprehensive coverage, for all geographies.

Geoscape Buildings comprises over 16 million buildings derived from satellite and aerial imagery. Geoscape Buildings provides statistics on the built environment of Australia at any level of aggregation, from a single address to the whole nation. The data base is continuously updated with new insights including solar installations, environmental shifts and building metrics.

The transition to net zero by 2050 will require authoritative information on energy use and emissions from buildings. Geoscape is a critically important data source supporting ongoing research and analysis for planners, policy makers and the property industry in the coming years.

Source: Geoscape

² <https://www.dcceew.gov.au/energy/energy-efficiency/buildings#:~:text=Data%20from%20the%20department%20shows,businesses%20and%20the%20wider%20economy> accessed pm 18 June 2024

Case study – Digital Earth Australia Coastlines (DEA)

The ability to track shoreline positions over time offers valuable insights into the impact of changes in weather patterns and how these will affect coastlines. Issues of concern include whether changes in coastlines will result from specific events or actions, or if they can be expected to occur gradually over time.

Case Study 12 Digital Earth Coastlines

WHO BENEFITS: Tourism, marine transport and recreation, real estate

CHALLENGE: Understanding the impact of climate change necessitates knowledge of coastal dynamics and sea level rise.

SOLUTION: Digital Earth Australia is a service provided by Geoscience Australia. DEA Coastlines have integrated satellite data with tidal modelling to chart the evolving contours of Australia's coastline since 1988. The resulting annual shorelines and detailed rates of change illustrate the dynamic processes at play: beaches expanding; sandspits shifting, river mouths altering; and tidal flats transforming over time.



The City of Gold Coast Council and Griffith University used DEA Coastlines tools and notebooks on the DEA Sandbox to quantify and describe the effects of coastal management actions at South Stradbroke Island. In 1986, the migrating and dynamic entrance to the Nerang River was stabilised with training walls and an artificial sand-bypassing system was established to maintain the natural flow of sand to South Stradbroke Island.

After the introduction of the sand-bypassing system, the southern shorelines of the island were seen to adjust and stabilise over the next 3 decades. The study from City of Gold Coast Council and Griffith University found the current sand-bypassing operations continue to maintain the natural flow of sand to South Stradbroke Island to this day, with no obvious mid- to long-term effects on shoreline position.

DEA Coastlines information empowers scientists, managers, and policy makers to assess the impacts of various drivers affecting our coastlines and potentially aids in planning and forecasting for future scenarios.

The product is made up of nearly 58,000 independent measurements to ensure accuracy. These inputs are supported by local councils, state governments, citizen scientists and academia.

The study highlights how DEA Coastlines can be used to inform future coastal management interventions planned for the region in 2023 and beyond. It shows how coastal engineering, artificial walls and sand-bypassing can have the desired effect of stabilising coastal land against erosion while maintaining natural water flows.

Source: Geoscience Australia

Case study – Coastal Climate Change Impact Assessment

The impacts of climate change on coastal zone environments are an issue of concern to local governments. This case study shows how the geospatial analysis supported analysis of the impact of climate change on the Victorian Coastline.

Case Study 13 Coastal Climate Change Impact Assessment

WHO BENEFITS: Society, Victorian coastal zone environment

CHALLENGE: It is crucial to understand the areas that will be most impacted by climate change in addition to areas where these impacts may threaten key coastal assets.

SOLUTION: The first stage of this work involved assessing the erosion vulnerability of the Victorian coast to climate change. This involved evaluating various factors such as exposure, sensitivity, and adaptive capacity along the coast. This approach also considered the elevation, distance and land cover surrounding the coast and assigned a coastal erosion vulnerability rating to the surrounding areas.

The second stage of the work involved the application of modelling datasets in relation to anticipated coastal inundation.

The final stage of this work involved taking the results of previous stages, along with projections of coastal inundation due to expected sea level rise and storm surge, to create specific impact profiles for key assets.

This work informed the prioritisation of the Victorian Coastal Monitoring Program.



This work provided insight into the coastal areas and assets in Victoria that are at risk from climate change.

These results aim to bolster the planning and execution of adaptation and mitigation efforts, create specific monitoring initiatives, and pinpoint areas for comprehensive local coastal hazard assessments.

Source: Spatial Vision. <https://spatialvision.com.au/news-coastal-climate-change-impact-assessment/>

Case study – Climate Risk Map

Spatial Vision worked with the Climate Council to develop a Climate Risk Map to identify the vulnerability of any address to climate change risk over different timeframes and emissions scenarios (Spatial Vision, 2022).

Case Study 14 Climate Risk Map

WHO BENEFITS: Homeowners and the residential building industry

CHALLENGE: Climate change is increasing the frequency and severity of extreme weather events. It is important for homeowners and the residential building industry to be able to assess the risk of fires, floods and extreme winds based on potential outcomes from the effects of climate change.



SOLUTION: This is a user-friendly web service which enables the general public to determine the risk of fires, floods and extreme winds in their suburb, local government area or electorate.

Spatial Vision developed an interactive map of Australia for the Climate Council that represents the vulnerability of any address to the effects extreme weather over different timeframes and emission scenarios.

The platform designates the percentage of risk to homes based on their postcode from the effects of extreme weather over coming decades. It is based on open-source web mapping application Mapbox application and allows users to determine the risk profile of their property, based on low, medium and high emissions scenarios and specified timelines.

The Climate Risk Map can inform policy makers and has the potential to mitigate welfare losses caused by severe weather events. Its integration into policymaking can lead to more effective strategies for climate resilience.

The Climate Risk Map assists Australian homeowners and the residential building industry to understand, and plan for the likely effects of climate change, particularly as these factors impact home insurability.

Source: Spatial Vision

Case study – Climate Change Adaptation Project

Climate change has the potential to impact all aspects of the Transport system’s operations, maintenance and construction, causing harm to assets, disruption of transport services, operations, maintenance and construction, disrupted access, discomfort to transport staff and users, and increased public safety hazards.

While Australia has committed to a long-term emissions reduction plan that aims to achieve net zero emissions by 2050, asset owners in government and the private sector and the community must plan for adaptation in response to the impacts of climate change.

This case study demonstrates how geospatial information and the development of a spatial digital twin in Victoria is assisting transport planners to assess the impacts of climate change on transport with specific focus on metropolitan rail transport.

Case Study 15 Climate change adaptation project

WHO BENEFITS: Victorian commuters, metropolitan rail operators

CHALLENGE: Climate change has the potential to affect all aspects of transport operations, maintenance and construction. The cost to the community of disruptions to public transport services is high. Transport planners need to assess priority impacts to mitigate these impacts.



SOLUTION: The Victorian Department of Planning is developing an evidence-based critical asset adaptation planning approach to enable the assessment of climate change adaptation risks at metropolitan train and tram locations and critical assets.

A key aim of the project is to build capability and competency in the Department of Transport and Planning to enable ongoing and greater climate adaptation planning. This includes the provision of a tool(s) that can be modified internally in the future to enable the evaluation of climate risk impacts for a broader range of transport assets/locations.

The Victorian Digital Twin Project is assisting the project to:

- a) provide a data visualisation platform to visualise the asset risks associated with the analysis from a third-party consultant
- b) integrate other public datasets like the Victorian Climate Projections data to assist in providing the team with context of other datasets being used around Victorian Government (which they would not have been able to access previously).

This project demonstrates the power of geospatial data organised in a spatial digital twin model. It enables spatial analysis of challenges faced by many organisations addressing adaptation to the impacts of climate change.

The current and projected climate impacts on rail will enable better asset risk assessment and enhance the resilience of public transport in Victoria by addressing climate risks.

Source: Victorian Government Department of Transport

Natural resource management

The sustainable management of our natural resources is fundamental to the future welfare of all Australians. Geospatial services support a wide range of activities in this field. The ability to map features such as vegetation, ground cover and water resources from earth observation satellites and to monitor ocean conditions, temperature and changes over time, are examples of how geospatial information services support natural resource management activities. The following 4 case studies illustrate how geospatial information is used to map vegetation, ground cover and the marine environment.

Case study – Monitoring mangrove location in response to climate change

Mangroves are a vital element of coastal areas and protect against extreme weather and natural disasters. Australian mangroves are spread across the nation’s coastline – over 35,900 km, excluding islands (Digital Earth Australia, 2019). This study using Digital Earth Australia supported by Geoscience Australia used geospatial information services to map mangroves across Australia in a consistent way.

Case Study 16 Monitoring mangrove location change in the face of storm events and climate change

WHO BENEFITS: Policy makers, state and local governments, environmental managers

CHALLENGE: Understanding the driving forces behind mangrove diebacks is crucial to managing the future implications that climate change will have on mangroves.

SOLUTION: Geoscience Australia’s Digital Earth Australia (DEA) program used a newly developed satellite data classification technique to create a series of maps that show how mangrove locations have changed over time in response to storm events and a changing climate. The new United States Geological Survey (USGS) Landsat data archive offered nationally consistent data that illustrated the extent of Australian mangrove forests every year between 1987 and 2016.



There was a significant mangrove die-back event in northern Australia in 2016 which affected mangroves along 1,000 km of coast. The cause of this event was not immediately understood.

The Landsat data archive has made it clear that this event was the result of drought, high temperatures and sea level-decrease associated with El Niño.

*“The mangrove dieback can be seen in the data.” Dr Leo Lymburne
Director of Digital Earth Australia Product Development and Landsat Science Team Member.*

These maps are informing better mangrove management for entities such as the Queensland Department of Environment and Science. This work has enabled a better understanding of Australian mangroves and also could lead to improved mangrove mapping worldwide.

Source: Geoscience Australia

Case study – eReefs

While the Great Barrier Reef is recognised as one of the best managed reef systems in the world, coral cover has declined over the last decades.

Case Study 17 eReefs forecasting and modelling program

WHO BENEFITS: Scientists, the Great Barrier Reef Marine Park Authority, natural resource managers

CHALLENGE: The vast size of the reef makes it difficult to monitor a growing number of threats, such as warming waters and poor water quality from sediment and nutrient run-off.



SOLUTION: eReefs is the world’s largest reef forecasting and modelling program that was developed by CSIRO in partnership with the Great Barrier Reef Foundation, the Australian Institute of Marine Science, the Bureau of Meteorology and the Queensland Government.

The program combines satellite technology with powerful models and machine learning to forecast the condition of the reef, including water quality and bleaching.

eReefs allows anyone to monitor and track the impact of factors such as rising water temperatures, cyclones, floods, and other stressors on the Reef in near real time. The system can forecast the combined impact of increased light, temperature and nutrients on coral reefs.

The system is capable of mapping water quality in 3 dimensions throughout the entirety of the Reef by utilising information gathered from satellites such as NASA and the European Space Agency Sentinel-3.

eReefs provides near real-time information and innovative tools, while promoting sustainable practices and informed decision-making. In 2017, ACIL Allen estimated that the value to the community of spatially enabled monitoring programs could be of the order of \$150 million to \$200 million to the communities that live contiguous to the reef. (ACIL Allen, 2017)

Source : <https://www.barrierreef.org/what-we-do/projects/eReefs>

Case study – Machine learned data augmenting geospatial analysis

Geospatial information systems and analytical techniques enables the integration of georeferenced environmental data with data on other sectors, such as agriculture, transportation, and urban planning. This case study demonstrates how the Victorian Spatial Digital Twin combined with AI enabled geospatial analysis helps with the management of fire risk arising from the use of waste tyres to hold down feed stocks on farms.

Case Study 18 Machine learned data augmenting geospatial analysis

WHO BENEFITS: Emergency respondents, environmental managers, society

CHALLENGE: Waste tyres are regularly used to anchor feed on livestock farms. When tyres are stored and managed inadequately, they pose potential hazards to the Victorian community and environment.



SOLUTION: Waste tyres are tyres that can no longer be used for their original purpose and have been removed from a vehicle. Farmers commonly repurpose these tyres on farms by utilising them in the production of silage for livestock. Silage requires long-term storage, which is often accomplished using bins, bunkers, or pits covered with tarpaulins. Tyres are used to weigh down the covers, preventing spoilage caused by oxygen exposure (Deloitte Access Economics, 2022).

Waste tyres pose several risks to the environment and public health when improperly stored and managed. Waste tyres pose a substantial fire risk when stored in large volumes, improperly stacked, or stored on top of long grass. Tyre fires emit toxic smoke and noxious gases containing carcinogens that pose greater risk to the environment than other types of building or bushfires.

The cost of preventing and cleaning up after fires involving waste tyres also results in significant clean-up costs, which are estimated to be 6 to 26 times greater than the cost of suppression. A recent example of improper storage is a \$4.5 million clean-up cost which was incurred by the owner of a one million tyre stockpile in Stanwell. It is estimated that 7,000 people would have been evacuated from the area should a fire have started. A separate fire in a Broadmeadows tyre yard with 150,000 tyres took several days to extinguish.

Land Use Victoria’s Data Science team has developed a repeatable Geo-AI approach using high-resolution aerial imagery to accurately locate silage production sites, identify individual waste tyres and detect large tyre storages. This program utilised machine learning and satellite imagery to identify more than one million tyres across Victorian agricultural land, demonstrating the efficiency of the method for government and regulatory agencies. The data has been shared with other government agencies to inform environmental compliance activities and emergency services for bushfire activities.

This program accurately locates silage production sites, identifies individual waste tyres, and detects large tyre storages across Victorian agricultural land. This approach not only enhances efficiency for government and regulators but also contributes to mitigating environmental risks associated with improper waste tyre storage and fire hazards.

Source: Victorian Government

Case study – Shared Environmental Analytics Facility (SEAF)

Access to shared environmental data to support shared environmental analysis and reporting is important to effective collaboration between government and industry for sustainable resource management. This case study demonstrates the future use of geospatial information systems to support shared environmental data and analysis in Western Australia.

Case Study 19 Shared Environmental Analytics Facility (SEAF)

WHO BENEFITS: Scientists, researchers, and policy makers

CHALLENGE: Government and industry need access to shared environmental information to improve decision making for sustainable environmental outcomes.

SOLUTION: The Western Australian Biodiversity Science Institute (WABSI) and the Western Australian Marine Science Institution (WAMSI), alongside other partners, are leading efforts to establish a Shared Environmental Analytics Facility (SEAF) in Western Australia.



The SEAF will be an innovative and independent data analytics facility to establish a sustainable environmental information value chain. Benefits of the SEAF include serving as a shared access point to environmental data that is equitable and transparent, providing dynamic cumulative impact assessment with independent regional assessment reports, as well as providing access to fit-for-purpose data and environmental reporting that enables holistic view of environmental conditions.

A five-year pilot program has been proposed in Western Australia. The SEAF would be underpinned by a single central geospatially enabled hub and initially feature 2 regional spokes, one in the Pilbara and another in Cockburn Sound.

The Pilbara regional spoke is expected to deliver \$1.4 billion NPV in quantified direct regional benefits over 10 years. The Cockburn Sound regional spoke is expected to deliver \$227 million NPV in quantified direct regional benefits over 10 years. These benefits arise from enhanced data, efficiencies for proponents and operators, reduced risks and a holistic view of the environment.

Source: (WABSI, WAMSI, 2023)

International collaboration

Responding to the challenges of climate change is a global as well as a national issue. International collaboration on climate change and environmental protection provides a common language and framework for sharing data and coordinating efforts across borders.

This study demonstrates how Australian geospatial professionals are collaborating with partners from the Pacific region to jointly address the challenges presented by climate change and through shared approaches to geospatial information analysis.

Case study – Open Source Geospatial Foundation (OSGeo)

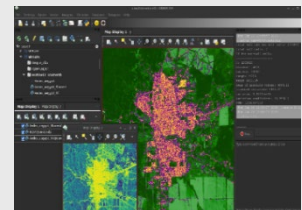
In February 2006, collaborative efforts among leading teams in the free and open-source geospatial community led to the establishment of the Open Source Geospatial Foundation (OSGeo). OSGeo aims to foster the development of open geospatial technologies and data, promoting their widespread adoption (Franceschi, 2019).

Case Study 20 Open Source Geospatial Foundation (OSGeo)

WHO BENEFITS: Policy makers, communities in Pacific Island States

CHALLENGE: There is a lack of training material and support for using geospatial data with open-source software.

SOLUTION: OSGeo supports the open-source geospatial community through financial, organisational and legal support.



The foundation also acts as an independent legal entity to which community members can contribute code, funding or other resources. This structure ensures that contributions will be maintained for the public benefit.

OSGeo Oceania are a local chapter of OSGeo. The broad goal of OSGeo Oceania is to support the open-source geospatial community in the region.

A core activity of OSGeo Oceania is their annual conference. This week-long event involves technical workshops from experts, presentations from leaders and developers in the field, as well as a community panel day that addresses the issues that affect open source geospatial in the region. The foundation also issues grants and microgrants for training. These grants are funded from surplus conference revenue.

‘GeoServer’ is an OSGeo project which disseminates critical data related to natural resources, climate patterns, and environmental changes. This data benefits environmental awareness, decision-making, and disaster response efforts in Australia and abroad.

The birth of OSGeo reflects the maturity of various open-source communities, recognising the need to synergise geospatial software development for enhanced interoperability. Simultaneously, the evolving internet landscape introduced new requirements and expanded the role of geospatial data and applications beyond their niche status. (Franceschi, 2019)

Source: Open Source Geospatial Foundation (OSGeo), <https://www.osgeo.org/>

3 Planning, government services, defence, development, construction and infrastructure

Introduction

Australia faces major challenges over the next decade providing the housing, buildings and infrastructure requirements to support a growing population. Insufficient housing supply, investment needs to support cities and regions, ongoing demand for investment in energy infrastructure and other imperatives such as investment in public transport, water infrastructure and support services, is creating pressure on prices and resources.

The property market and infrastructure underpin the financial welfare of many Australians. Housing affordability, energy and transport infrastructure are priority issues for the next decade.

The total value of residential dwelling stock in Australia was \$10.4 trillion in December 2023 (ABS, 2024). According to CoreLogic, Australians hold \$2.2 trillion in mortgage debt and the monthly value of new loan commitments for property is currently around \$26.4 million as at February 2024 (ABS, 2024).

In 2023, Infrastructure Australia observed that demand for new public infrastructure significantly outweighs supply and productivity growth remains stagnant compared to other industries (Infrastructure Australia, 2023). Productivity in the construction industry has also been flat or in decline over the past 10 years (Department of Finance, 2023).

Addressing these issues will be some of the big challenges for Australia in the years ahead. It will require authoritative data and evidence-based decisions for which geospatial information and services has an important role to play. The following case studies provide examples of how geospatial information services can contribute to meeting these challenges.

Planning, development and government services

Geospatial information and the census

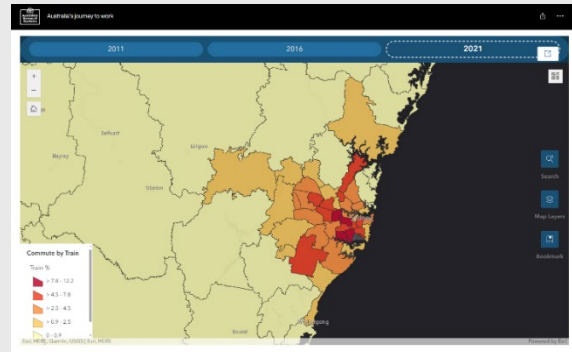
The Australian Bureau of Statistics' census informs government policy, funding allocation, and planning for public services, ensuring that resources are directed where they are needed most, and that communities' needs are accurately represented. Geospatial information services support the Australian Statistical Geography Standard (ASGS) that is a key component of the census.

Case study – Geospatial information and the census

Case Study 21 ABS’s role in defining and providing geographically categorised data

WHO BENEFITS: All areas of Australian society, governments, businesses, non-government organisations, demographers, planners, policy development

CHALLENGE: Sound public policy depends on reliable data on the nation’s population to inform decision makers at all levels for policy analysis, planning of public services and resource allocation.



SOLUTION: The Census of Population and Housing findings inform government policy, funding allocation, and planning for public services, ensuring that resources are directed where they are needed most, and that communities’ needs are accurately represented.

A key component of the Census is the categorisation and collection of data according to the Australian Statistical Geography Standard (ASGS), which is the classification of Australian geography into areas by population size, urban centres and localities, remoteness and more (ABS, Jul2021-Jun2026). The ASGS is a social geography, developed by the ABS every 5 years to reflect the location of people and communities. It is used for the publication and analysis of Australia’s official statistics and a wide range of other data.

ABS Census data are released in geospatially native formats on the geographic boundaries defined through the Australian Statistical Geography Standard, allowing governments and communities to interact with statistics from the neighbourhood to the national level. It was estimated that the Census generated \$6 for every \$1 spent on its activities (Lateral Economics, 2019). The report, Valuing the Australian Census, concludes that Census data plays a critical role in improving Australia’s economic and social infrastructure.

Source: Australian Bureau of Statistics

Case study – ABS Australian Census and Geoscape

The census also draws on the Geocoded National Address File developed and managed by Geoscape to assist in autocompletion of the census saving time for both citizens and the ABS.

Case Study 22 ABS Australian Census and Geoscape

WHO BENEFITS: Everyone participating in the 2021 Census of Population and Housing

CHALLENGE: In response to growing public expectations for accessible government services, the Australian Bureau of Statistics sought to improve the customer experience by making it easy to complete online and reduce demand for customer services.

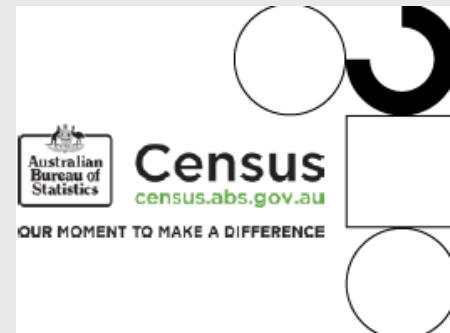
SOLUTION: The ABS required an address autocomplete service to be integrated into several Census self-service transactions. These self-service transactions enabled users to request a Census number, report “Not at Home”, request a physical form to be mailed, or login without a Census number.

The solution needed to meet Census requirements in data currency, security and scalability and integrate with ABS processes.

Geoscape employed its predictive Application Program Interface (API) to assist with the autocompletion of the address field in the online form. This ensured the address data sorted in the system was structured and verified against official sources using Geoscape’s Geocoded National Address File (GNAF).

With this API service, a total of 1.9 million self-service transactions were completed, with 700,000 self-service transactions completed on Census night.

The online self-service, supported by the Address API from Geoscape, contributed to a significant reduction in load on the Census Contact Centre and call wait times, delivering a much smoother experience for the public.



Source: Australian Bureau of Statistics, (Lateral Economics, 2019)

Case study – The Digital Atlas of Australia

The Digital Atlas of Australia was launched in 2013. It is the result of collaboration between geoscience Australia, the Australian Bureau of Statistics and other agencies. It brings together national data with easy access in one location.

Case Study 23 Digital Atlas of Australia

WHO BENEFITS: All Australians, including policy makers and analysts; researchers, academics and school students; general public; and the media

CHALLENGE: Providing reliable, trustworthy, curated data that is free and publicly available to all Australians.



SOLUTION: In May 2024, Geoscience Australia was excited to launch the [Digital Atlas of Australia](#), the Australian Government’s new geospatial platform. The Digital Atlas is transforming how we access and use data by providing hundreds of curated national datasets in a central platform. Using location as the connecting thread, the Digital Atlas brings together data on Australia’s geography, people, economy and the environment from trusted sources across government and increasingly industry and academia.

Powered by a digital ecosystem, the Digital Atlas seamlessly connects data across borders, systems and technology. It is moving us away from data silos, enabling seamless integration, sharing, and analysis of location data to foster collaboration, efficiency and innovation across government, businesses and communities – for smarter place-based decisions.

An example of this collaboration is the partnership between Geoscience Australia, the Australian Bureau of Statistics and the Department of Social Services that is improving the availability, transparency and use of place-based socio-economic data. This partnership has made income support recipient data available in the Digital Atlas, integrating it with demographic and socio-economic information in interactive applications. The applications allow users to explore patterns of income support at a local level, providing policymakers and stakeholders with the necessary insights to inform tailored policy interventions. (See: [Understanding Income Support Payment Recipients Application | Digital Atlas of Australia](#))

This partnership not only enhances policy effectiveness and community support but also sets a new standard for data-driven governance. It is just one of many partnerships driving the Digital Atlas towards realising its potential of creating a location-enabled Australia.

The Digital Atlas of Australia is a groundbreaking geospatial platform that is transforming the way data is accessed and used for smarter place-based decisions. By bringing together hundreds of curated, trusted national datasets in a single local source solution, the Digital Atlas is enabling users to explore, analyse and visualise data on Australia’s geography, people, economy and the environment by location.

Source: Geoscience Australia

Case study – The Foundation Spatial Data Framework

Geospatial information services have a major contribution to improving productivity in the construction and infrastructure value chain. This includes planning and design, development approvals and compliance, construction activities and asset management.

Underpinning all geospatial data is geodesy, measurement, surveying and mapping. Australia’s geodesy program is the foundation on which all mapping is based, including the Foundation Spatial Data Framework (FSDF). The FSDF is the authoritative source of fundamental geospatial information. It provides a common reference for the assembly and maintenance of Australian foundation level spatial data to serve the widest possible variety of users. It delivers national coverage of the best available, most current, authoritative source of foundation spatial data which is standardised and quality controlled.

There are 14 FSDF spatial data themes endorsed by the Australian and New Zealand Land Information Council (ANZLIC) and supported by the Commonwealth Government through Geoscience Australia and the States and Territories through a range of agencies (see Figure 3.1).³

Figure 3.1 FSDF Themes



Source : <https://link.fsdf.org.au/>

Governments are now considering, or implementing programs to digitise foundation geospatial data, including providing digital access to 3D and 4D data and sharing that data through federated systems. The next logical step in this process is to develop spatial digital twins of the build and natural environment, linking 3D data in Building Information Models (BIM) with 3D representations of infrastructure and other features.

³ Four of these data sets (buildings and settlements, geology and soils, physical infrastructure and population distribution) are still in the development stage.

Case study – The Foundation Spatial Data Framework in NSW

This case study of the application of FSDF data themes in New South Wales illustrates the value of the FSDF.

Case Study 24 Foundation Spatial Data Framework in NSW

WHO BENEFITS: Governments, industry, property owners, developers

CHALLENGE: To provide a geospatial infrastructure of authoritative foundation spatial data to support government services and national collaboration

SOLUTION: Along with the Commonwealth Government and other states and territories, Spatial Services in the Department of Customer Services supports the maintenance and development of FSDF themes, drawing on approximately 300 spatial datasets.



The cadastral system, in combination with the land registration system, is a powerful economic lever. It assembles, manages, and shares information that defines and reinforces property rights. In turn, these property rights translate into economic development, social stability, and physical well-being.

The system also supports the maintenance of electoral boundaries for the NSW Electoral Office and provides consistent geospatial information in support of emergency services and biosecurity response.

The cadastral and land registration systems allow people, businesses, and governments to leverage and manage property assets. There is over \$2.2 trillion in housing loans secured against real property in Australia with an estimated value of \$10.4 trillion in 2023. At the national level the authoritative and consistent data provided by the cadastre creates confidence and improved decision making for land management and development.

At the state and territory level it increases productivity by reducing transaction costs and eliminating duplication across the land and utility sectors.

Source: Department of Customer Services (2023) The NSW Foundation Spatial Framework Case studies

Case study – Victoria’s digital cadastral modernisation program

The following case study outlines the work that the Victorian Government is pursuing through its digital cadastre modernisation program. The Digital Cadastre Modernisation project will be a major component of the program and is expected to deliver significant benefits to government and industry.

Case Study 25 Victoria’s Digital Cadastre Modernisation (DCM) and Digital Transformation Program

WHO BENEFITS: Utility, construction and asset managers, property and land developers

CHALLENGE: Limitations of the existing Victorian cadastral mapping and its need to improve the accuracy of land parcels meeting spatial standards

SOLUTION: Victoria’s DCM undertook a labour-intensive innovation to address its current accuracy challenges. The project featured 4 stages: digitalisation; adjustment; integration; and automation. The scope required to collaborate, and the process of automation was challenging, however, the result of underpinning the new adjusted digital cadastre allows for a more efficient flow of data.



The project employed industry-leading software in survey adjustment in conjunction with a highly capable team to adjust 4.2 million land parcels over 3 years. This has helped address a series of complex challenges that were considered too hard to solve. The project succeeded in combatting issues such as: defining quality measures for output data, developing highly automated multistage processing, and delivering quality assurance verification into the production process. The project’s technical team worked in conjunction with local surveying experts to build the adjustment engine using open-source software components.

Additionally, the project has proven to be innovative to both the teams involved and the tools they used. The survey tool DynAdjust was implemented within their computer management systems, that was supported by the project team’s collaborative efforts.

Following the DCM project, the Land Use Victoria Digital Transformation Program (LDTP) is coordinating delivery of 7 workstreams, encompassing digital cadastre production and automation, a full legislative and policy review to support digital ways of working, tools and training to support digital examination, ePlan portal enhancements based on stakeholder feedback, open access to digital cadastral data, stakeholder engagement and harmonised standards for rendering digital cadastral surveying data.

The DCM project produced significant productivity gains across many sectors of the economy. This benefited property and land development, and also assisted in the utility, construction infrastructure and asset management sectors. There were also many social and economic benefits such as better and more integrated planning of land use. The value of such actions, if applied across Australia as a whole, is estimated to be around \$2 to \$3 billion per year based on research into similar activities elsewhere in Australia, that looked at benefits in online compliance for construction and mining and from virtual site visits (ACIL Allen, 2017).

Source: Victorian Department of Energy, Environment and Climate Action, Spatial Vision, 2023, ‘Victoria’s Digital Cadastre Modernisation: A case study’

Case study – The Geocoded National Address File (G-NAF)

Knowing the address of people and properties is often taken for granted in society. However, access to authoritative data is extremely important to just about everything that we do. It is of course fundamental to postal services, delivery services, emergency management, and the finance, insurance and property industries and to our administrative and electoral systems that underpin our democracy.

Maintaining an authoritative database of address and making that available to organisations and citizens sounds simple but in fact it involves advanced database technologies and cooperation between governments in Australia to maintain, update and protect. The following case studies illustrate how the Geocoded National Address File (G-NAF) is managed, maintained and shared.

Case Study 26 The Geocoded National Address File (G-NAF)

WHO BENEFITS: Land and property owners, businesses, government, general public

CHALLENGE: Providing an authoritative and nationally consistent record of Australian addresses and location data to support government, business and the community

SOLUTION: G-NAF is a solution that helps the open access to address data. It is constructed utilising data sourced from local governments, state, and territory government land administration agencies, as well as the Australian Electoral Commission (AEC), and other confidential commercial providers. Since it is a public domain data set (via data.gov.au), it is often re-sold by different Australian re-sellers after value adding. This broadens the scope of its application, being used across the public and private sectors. G-NAF live provides access to geocoded addresses that are updated daily or weekly (depending on the state or territory) through Geoscape APIs.



GNAF is managed by Geoscape. Geoscape is the trading name of PSMA Australia Limited, a public company owned by Australia's governments.

The solution that G-NAF poses to the Australian Government, the private sector and society at large is providing a trusted and compatible national address file. Its value is not in its unique nature, but in the social value it creates. Lateral Economics estimated that its value will continue to grow and is paramount in navigating the uncertain and intricate landscapes of the future.

A calculation by Lateral Economics (2022) of net benefits, estimated that the G-NAF has a current value of between \$1.4 billion and \$1.6 billion in NPV terms. There are numerous social benefits such as improved trust in the integrity and fairness of the system as well as the reduction of effort needed to build national address files.

Source: (Lateral Economics, 2022)

Case study – Keeping address data consistent

The Intergovernmental Committee on Surveying and Mapping (ICSM) is an organisation of Commonwealth, State and Territory Governments whose core function is to coordinate and promote the development and maintenance of key national spatial data including geodetic, topographic, cadastral, street addressing, tides & sea level, and geographical names.

Maintenance of the Geospatial National Address File involves many organisations and agencies across Australian governments. This requires consistency in standards and policies for maintaining the currency of the data, establishing process for data management and developing policies and standards for sharing and curating the address data held in G-NAF.

The following case study outlines the role of the ICSM in optimising the logistics of production of the data that is stored in G-NAF.

Case Study 27 Addresses and Place Names in Australia

WHO BENEFITS: Land and property owners, businesses, government, general public

CHALLENGE: Optimising logistics to produce more efficient, consistent and reliable format for Australian address data

SOLUTION: The ICSM Addressing Working Group (AWG) and Place Names Working Group (PNWG) undertake several roles in relation to address and place name services. The AWG solves the problem of standardisation, being responsible for the assignment, storage and exchange of addresses from a local to federal level across Australia and New Zealand. This supports the efficient delivery of address services. PNWG coordinates and communicates the consistent use of place names. This ensures that they meet the requirements of governmental bodies, emergency services and society at large. By improving address data, developers have more simplified address assignment procedures and more streamlined data flows.

Currently, the Geocoded National Address File (G-NAF) is the national addressing product, maintained by Geoscape. Since addresses are created by local government, and place names by local councils, state, and national agencies in Australia, the ICSM AWG is developing the Addressing 2035 Strategy. This aims to create a “singular point of reference for all Australian and New Zealand location-based addresses” which will eventually promote a standardised, integrated, and dynamic addressing system that is entirely governmental.



The benefits from the ICSM project are associated with administrative savings that come from improved address data. The Addressing 2035 Strategy will ensure that the value of G-NAF will continue, and the effectiveness and efficiency of its operations are improved through a streamlined data flow and more logistical efficiency within government and society at large.

Source: (ICSM, 2023)

Case study – NSW Point - address data in action

GNAF provides the underlying data platform on which value-added applications can be developed. The following case study demonstrates how NSW Spatial Services developed an address tool “NSW Point” in conjunction with Geoscape.

Case Study 28 NSW Point

WHO BENEFITS: General public, government service delivery

CHALLENGE: Having up-to-date, consistent, accurate and easily accessible address data for efficient and effective government service delivery

SOLUTION: The team at Geoscape created an address tool ‘NSW Point’ for the NSW state government and its agencies to use. It solves the challenge of inconsistent address data by allowing its users to find an accurate physical or mailing address in an online form. A critical part of this tool is Geoscape APIs, more specifically, Predictive API and Addresses API.



Both allow governmental users to verify addresses using reliable and authoritative national data. The API's help streamline government services, improving productivity of service delivery. The coverage spans the entirety of Australia and utilises consistent source data across different regions. It is updated daily through established agreements with each Australian state and territory.

Additionally, APIs are available to facilitate machine-to-machine verification of address data in real-time. NSW Spatial Services collaborated with Geoscape APIs to aggregate and map government service delivery locations to various administrative boundaries. These boundaries include Local Government Areas (LGAs), ABS Mesh Blocks, localities, and electorates. This comprehensive mapping enables efficient management and utilisation of government resources and services across different regions of Australia. Furthermore, ‘Service Point’ was developed using Geoscape APIs, to ensure privacy, allowing deidentification through geo-tagging, ensuring that no personal details are used. Together, both NSW Point and Service Point innovate governmental services and help inform better decision-making.

The benefits of work by NSW Spatial Services in developing NSW Point have been more efficient access to government processes and reductions in cost and effort associated with web applications that rely on address data.

Since the introduction of NSW Point, the tool has been used for many grants and programs. This has 2 benefits. It saves time for customers engaging with government and it creates a more efficient process of checks and controls. Programs like ‘Service NSW’ rely on NSW Point for their online forms.

Source: (Geoscape, 2024)

Case study – South Australia’s Planning and Land Use Services

The development of authoritative foundation spatial data stored in Geographic Information Systems (GIS) creates many options for development of value-added services. One of the opportunities that shared data provides is the ability to improve access to government services through a “one-stop shop” approach to service delivery. This is illustrated in the following case study of a One-Stop Shop for South Australia’s planning and land use services.

Case Study 29 Plan South Australia

WHO BENEFITS: General public, property owners and developers, government

CHALLENGE: Planning and land use requires the consideration of massive amounts of data, codes, and regulation, and can often present a major bottleneck in the development and planning processes. Additionally, the planning and development process can be elusive and lack transparency for the general public.



SOLUTION: PlanSA is South Australia’s online planning and development system, administered by the South Australian Department for Trade and Investment. The digitalisation of PlanSA involved the transfer of countless processes and information systems into a single digital system, enabled by geospatial technology. The single, digital approach has allowed South Australia to become the first state to operate “a single, comprehensive planning scheme” (PlanSA, 2022).

In 2018, PlanSA displayed the first iteration of a 3D Development Activity Tracker (PlanSA, 2018), which has since undergone significant advances. The tracker, which is publicly available, highlights 8 areas of interest in South Australia (CBD, Bowden, Port Adelaide, and more). The tracker allows users to see 3D models of developments that have been approved, commenced, and completed. Users are also able to access information on each development, such as the cost, height, land use (i.e., commercial, retail, residential).

The platform also includes the SA Property and Planning Atlas (SAPPA), map to display planning zone and subzone boundaries, with information that allows users to see which Planning and Design Codes apply to the selected area. PlanSA (2022) identified the uses of SAPPA as the ability to identify zoning for particular areas or properties, determine the overlays applicable to a property, and search land division applications.

The PlanSA platform allows South Australians to shape their community and have their say on development applications occurring in their local government area.

Planning and Land Use Services South Australia is also advancing the Regional Plans South Australia platform, which closely integrates geospatial data into the display of various points of interest, such as housing, transport, infrastructure, and the environment. (Planning and Land Use Services, 2024). This geospatial data is being used to create forward projections and inform future zoning and infrastructure needs.

PlanSA has utilised geospatial information in the creation of a unified development and land use ‘one-stop shop’ platform. The platform utilises geospatially enabled tools for developers and the public to monitor developments and define zoning boundaries and conditions more effectively, allowing for timelier, evidence-based decision making.

Source: South Australian Department for Trade and Investment

Case study – Great Ocean Road Survey

Geospatial data solutions provided the capacity to layer data over a map in 3 dimensions using geospatial information systems (GIS) technologies. The ability to capture large amounts of data using mobile LIDAR scanning techniques is a highly efficient way to record the state of assets such as roads, bridges, railway lines and other infrastructures.

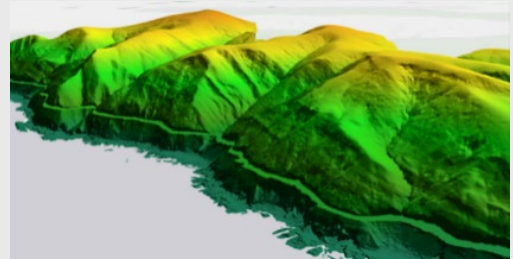
This case study demonstrates how satellite positioning combined with mobile LIDAR scanning enabled the Victorian Department of Land, Water and Planning to create a three-dimensional georeferenced model of the Great Ocean Road.

In the future, the use of artificial intelligence to analyse the state of road conditions can be expected to deliver further savings.

Case Study 30 Great Ocean Road Survey

WHO BENEFITS: Government, emergency services, policy makers, asset managers

CHALLENGE: Informing decision making for road management and the surrounding coastal area of the Great Ocean Road



SOLUTION: In October 2020, the Department of Land, Water, and Planning employed cutting-edge mobile laser scanning technology, commonly referred to as LIDAR, to conduct a comprehensive survey along the entirety of the road. This initiative aimed to establish a georeferenced repository of point clouds. Complementing this endeavour, high-resolution aerial photography with a pixel size of 5cm was integrated, resulting in the creation of a detailed 3-dimensional digital representation of both the road and the adjacent coastal region, often termed a digital twin ecosystem. Leveraging positioning technologies and the CORS network, LiDAR facilitated the acquisition of intricate topographical data across the surveyed area.

The survey aided the ongoing efforts by government to adapt the land management system to innovative technologies that deliver major productivity gains. The positioning technologies support spatial information users, particularly in the planning and management of key assets and delivery of services that support economic activity.

The 3D model was created using a gaming engine and was able to estimate functional and aesthetic factors that affect the existing environment. The model aids in analysis and the comparison of different environments over time, which can help inform decision making for various climates, months and seasons. The data was also used in the Victorian state-wide digital twin program, which was utilised by government, councils and emergency services.

The survey creates positioning technology-based mapping that benefits fire prevention, biodiversity conservation, road management, planning and development, urban development and research and community engagement.

Source: Land Victoria

Case study – Smart spaces accelerator program – envisioning in 3D

Planners in state and local government face growing challenges in meeting growing demand for housing and services, while at the same time considering issues such as transport, services, environment, visual impact, solar access, flooding risk and community expectations.

Geospatial information services are creating new and more effective processes for collaborative decision-making drawing on 3D data intelligence and physical, demographic and environmental factors. This case study demonstrates the impact of using 3D models for planning and public consultation purposes in a growing area in Southwestern Sydney.

Case Study 31 Smart Spaces Accelerator program

WHO BENEFITS: Council staff, developers and the community

CHALLENGE: Planning decisions have traditionally been made using two-dimensional maps. Ultimately, this means important decisions are being made with 2D information, impacting the efficiency of Council decision making processes.



SOLUTION: The NSW Department of Customer Service is developing a 3D model of 3 town centres across Camden Council, Southwest Sydney, after a successful 3D model pilot program of a town within the council. The NSW Department of Customer Service identified a wide array of anticipated benefits to the council's planning processes.

This includes increased community engagement with proposed developments by allowing community members to view a more complete and accessible 3D model of proposed developments. Similarly, the 3D nature of the model allows for improved assessment of visual impact, solar access and shadow impact of proposed developments. The impact on the approach to planning will be a significant shift towards data-driven, collaborative planning, in which multiple stakeholders can be included, and multiple sources and types of information can be superimposed on the model, such as regulatory, environmental and geospatial information.

The Council will also be able to use the tool for risk mitigation and cost optimisation when considering issues such as traffic congestion, public safety and environmental impacts. Ultimately, the tool will reduce the Council's time required to assess development applications, all while leading to a better-informed council, community and developer decision-making process.

The key benefits delivered through the use of geospatial data, in this case study, include reduced holding costs for business, reduced transaction time, improved visual impact and shadow impact assessment, data driven planning, risk minimisation and cost optimisation. Most important is greater collaborative planning through improved community engagement and a more comprehensive spatial understanding of proposals for change by council staff, applicants and the community.

Source: Transport for NSW

Towards a Digital Twin future

Case study – Western Australia Digital Twin Program

Digital twins or advanced digital representations of the real world have emerged as a powerful tool to harness and integrate 3D data to better understand our physical environment. The value of a digital twin can be realised when it is combined with underpinning spatial data to position digital twin models relative to each other and the physical world.

The Queensland, New South Wales and Victorian State Governments have been developing spatial digital twin models and some private companies have used similar models to better understand market potential where location and relationships with other data such as access to communications services are involved.

This case study discusses the recent announcement by the Western Australian Government of a program to develop an Advanced Spatial Digital Twin.

Case Study 32 Spatial WA

WHO BENEFITS: Government administration and services, developers and the community

CHALLENGE: The Western Australian Government through Landgate identified 6 key challenges including a lack of shared data between government agencies, requirements for agencies to modify data for shared use, siloed planning and approvals processes between agencies, limitations on IT systems to manage and represent assets and other data and missed opportunities to fully leverage 4D, smart city and digital twin technologies.

SOLUTION: In early 2024 the Government announced a 10-year program, Spatial WA, to deliver a Next Generation Spatial Cadastre (NGSC) and Advanced Spatial Digital Twin (ASDT). The objectives of the program are to improve the Government’s ability to “plan, design, test, and collaborate using a highly accurate virtual environment” (Government of Western Australia, Landgate, 2024).

The program aims to reduce information silos and create new spaces for secure collaboration across government agencies. Spatial WA identified 4 key areas to be addressed including:

- reducing costs and delays and improving outcomes for infrastructure projects and assets
- lowering costs and lengthy referral processes through digital approval workflows
- facilitating exposure modelling for emergency management
- improved utilisation of coordinated administrative boundary data for 4D.



The Spatial WA program is illustrative of the potential benefits for government, developers and the community for improvements in delivery of government services and for planning and development and coordination of infrastructure.

Source: (Landgate, 2024)

Case study – Bathurst integrated health project

The Bathurst Regional Council is considering a possible development of an integrated health project in the regional town of Bathurst. Provision of health care is a priority in regional cities and towns and building the proposed health project in the city centre will provide an important well-located centre to serve the region.

However, the location in the town raised many issues for the community for which extensive consultation has been necessary.

This case study demonstrates how a Spatial Digital Twin can facilitate consultation with the community and consideration of planning issues efficiently.

Case Study 33 Bathurst Integrated Medical Centre (BIMC)

WHO BENEFITS: Local residents, councils and developers

CHALLENGE: Significant proposed developments can cause uncertainty in communities, especially regarding visual and shadow impacts.

SOLUTION: Bathurst, one of NSW's fastest growing inland regions in NSW, is the proposed site for a new integrated medical centre. The medical centre will be a ~\$70 million state-of-the-art establishment, with a private hospital, general and specialist practices, medical training, radiology, pathology, and women's health facilities (Bathurst Region, n.d.). The development, which is planned to stand 6-storeys tall, attracted concern from residents regarding its visual impact in the town centre, which is populated by many buildings with historic appearances.



The NSW Department of Customer Service has developed a digital twin for Bathurst. It has included a visualising of the proposed BIMC, which will enable community members to view the proposed development in 3 dimensions. This allows the community to get a realistic sense of the scale and appearance, in comparison to traditional artistic impressions. A strength of the technology is the ability to engage the public, through an accurate 3D model that they can see and play with, rather than looking through pages of documents. Issues such as shadowing can be easily demonstrated using the 3D model, in a way that would be very difficult to convey on paper.

This model fits within a larger spatial digital twin of Bathurst, which includes various points of data of interest to the community, such as public transit information, accessibility information such as disabled parking spaces, fuel and housing prices, leisure activities, and EV charging facilities. The spatial digital twin covers 4 million square metres over the Bathurst town centre, with ~2cm resolution. (NSW Department of Customer Service, n.d.)

This case study demonstrates the power of Spatial Digital Twin Models as a tool for consultation with the community on major developments in metropolitan and regional areas where community consultation is a critical part of the planning and development process.

Source: (NSW Department of Customer Service, n.d.)

Case study – NSW School Infrastructure

Geospatial information services can reduce administrative costs for government through sharing of data in a structured way through Spatial Digital Twins. This case study demonstrates the savings for NSW School Infrastructure through automating the business cases that are prepared for management of school infrastructure.

This process draws on the NSW Spatial Digital Twin.

Case Study 34 NSW School Infrastructure (SINSW) due diligence pilot

WHO BENEFITS: Governments, schools, educators and students

CHALLENGE: Digitising and automating the business case process for school infrastructure to increase productivity and efficiency for SINSW.

SOLUTION: Combined with other technologies, the Live NSW Spatial Digital Twin (SDT) created a standardised approach to due diligence which was piloted with NSW School Infrastructure on 473 sites in just 4 weeks. SINSW estimates that this will lead to a 45% reduction in time to deliver a strategic business case, which eliminates the challenge of it previously taking twice as long as construction to complete. Additionally, the pilot program aims to achieve the following:



- a reduction in the number of procurement and consultants needed
- clear and well-informed procurement scopes which aim to increase reliability
- identification, development, and conversion to asset management of project information to aid in accelerating the project process
- supporting the development of project documentation of innovating construction methods
- focusing consultants on issues and risks rather than the project processes.

SINSW estimates savings of \$202 million over 10 years, in avoided strategic business case costs. This benefit will be generated by the SDT and realised by SINSW. From the pilot alone, the productivity benefits and avoided costs are an estimated \$4.4 million.

Source: NSW Department of Customer Service, 2021, Extract from 'NSW Spatial Digital Twin Program Final Business Case'

Case study – Hobart City Council Digital Twin

This study further demonstrates how a local government is using Digital Twin technology to support management of city assets and to facilitate engagement with the community and rate payers.

Case Study 35 Greater Hobart Digital Twin

WHO BENEFITS: Local residents and businesses, tourists and government

CHALLENGE: There have been growing community expectations for more accessible, decision ready, immersive applications. Additionally, increasingly accessible data from Smart city initiative and various other sources required need a single point of integration and delivery.



SOLUTION: The City of Hobart is developing a Digital Twin, which is a virtual representation of the city that integrates a range of data sources. The Digital Twin will give government, industry, and the public a more integrated and insightful understanding of the current and planned environment.

The Digital Twin will provide a 3-dimensional view of the city which combines base data with a vast number of other data and mapping resources. These include data from the Land Information System Tasmania, drone imagery, coastal erosion mapping and real-time car park status, among others.

Current applications of the Digital Twin include virtual art, solar panel analysis for maintenance and replacement, LIDAR imagery for coastal erosion mapping, integrated web cam images for transport and tourism, as well as 3D models of existing and planned developments. Future applications include virtual tourism, flood modelling and city planning.

The Digital Twin will enhance stakeholder understanding and transparency through enabling planners, developers and the public to inspect developments in a 3D environment. The project will also enable an immersive experience for tourists looking to find the location of public infrastructure and tourist locations. Economic benefits of the Digital Twin include efficiency gains in asset inspections and maintenance, growth in tourism, as well as greater climate resilience and impact mitigation.

Economic benefits of the Digital Twin are estimated to be in the order of several hundred million dollars over the next decade. These benefits arise from the efficiencies and economic development enabled by the Digital Twin.

Source: Tasmanian Spatial Information Council

Case study – Defence Estate

The Department of Defence manages \$33.8 billion in assets, comprised of 25,000 buildings and 6,000 other structural assets, making it the largest Commonwealth landholder. The Australian Defence Estate is required to manage and account for these assets, including those under construction. In these circumstances, they utilise geospatial information to track and compare construction progress, producing time and labour savings.

Case Study 36 OpenSpace Virtual Walkthroughs

WHO BENEFITS: Government, Department of Defence

CHALLENGE: As the Commonwealth's largest landholder, the Australian Defence Estate must manage various construction sites and projects across their 25,000 buildings. Conventional manual inspections of these sites are time consuming and provide limited insight.



SOLUTION: OpenSpace utilises a portable camera which can be used by a project manager to capture photos of a construction site. Images are automatically stitched together and overlaid upon the plan, creating a 3D environment that users can virtually walkthrough. Multiple walkthroughs can be captured at differing times throughout the construction schedule and overlaid with each other, thereby giving the viewer an indication of progression of construction works. Walkthroughs are made available online.

The use of virtual walkthroughs is 20x faster and more complete than manual solutions and has been proved to save on travel time and cost, generating carbon emission savings as a result.

Source: Department of Defence and OpenSpace

Design, construction and infrastructure in the private sector

Planning, design, development, construction and infrastructure services have been early adopters of geospatial information services.

Building Information Management (BIM) systems have been used for over 15 years by architects and engineers for design of major buildings. Three dimensional models of the digital built environment can solve the problem of coordinating new construction with existing infrastructure and other physical assets. The concept of a Digital Twin of the built environment encapsulates an extremely important development in planning design and construction of major building and infrastructure projects.

With 3D digital models, designers, engineers and constructors can realise major productivity savings from design to construction, speeding up construction processes, realising significant savings and safety improvements, and in turn delivering better outcomes for metropolitan and regional Australia.

These concepts have been extended into design of infrastructure, transmission and distribution systems, transport infrastructure and planning and design of open space precincts. Efforts are now being made to integrate design data with existing infrastructure in spatial digital twins of the natural and built environment.

Case study – Waterloo Integrated Station Development

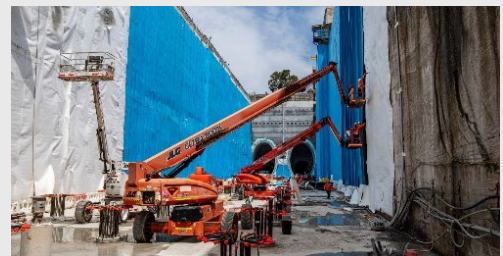
The need to understand the location of utilities and other developments is especially relevant in dense, urban areas, such as capital cities. The management of underground assets is a critical consideration in the delivery of major civil and infrastructure projects, as seen in the delay and additional cost of the delivery of the Sydney light-rail, caused by the need to relocate service utilities to make way for the track.

This case study below shows how these considerations have been implemented in the design and construction of Sydney Metro's Integrated Station Development (station and above-ground quarters, including residential, retail and office spaces) that is being delivered by John Holland and Mirvac. Veris were engaged by John Holland to provide surveying for the metro station and above ground development.

Case Study 37 Waterloo Integrated Station Development

WHO BENEFITS: Planning, development and construction

CHALLENGE: Sufficient knowledge of the location of pre-existing and new assets is integral to ensuring smooth delivery of infrastructure. This can be especially challenging in dense urban areas and with complex designs.



SOLUTION: Veris utilised an innovative 3D scanning technology to capture data within the station box, which was then georeferenced (related to coordinates). The solution allows for a complete accounting of the pre-existing characteristics of the site, and exact records of the changes made during construction. Not only does this ensure that the assets used for the construction in question are well organised, but also that assets and utilities can be located with certainty in the event of future infrastructure projects, delivering benefits for decades to come. Veris note the following outcomes of their innovative approach:

- Updating of the design model and a dynamic digital twin in Revit showing all locations of the 1000+ bolts
- Providing a comparison works of protruding bolts versus the maintenance and construction operations (MCO) line and the cutting required as highlighted by red and green items, to be then shown in a visualisation timeline format for programming
- Developing heatmap comparisons showing shore wall versus MCO to understand grinding and infill for quantities
- Submission of station-box as-built in 3D BIM, using Navisworks, which can be combined with upcoming construction works to develop a single BIM model for the project and minimise Digital Engineering processing requirements.

The geospatially enabled approach has delivered cost savings, as well as providing an increased degree of clarity, reducing programme risk. (Source: Veris)

The value of a such a geospatially enabled approach, if applied across all construction activities, could deliver productivity benefits of 1 to 2% (ACIL Allen, 2017). If applied at 1% over the construction sector this would amount to savings for the construction industry of the order of \$250 million per year.

Case study – eComply

Ensuring compliance with codes and standards is a time-consuming exercise for architects, engineers and developers. This case study submitted by Land Use Victoria, demonstrates how the compliance process for housing developments can be streamlined saving time and cost for Land Use Victoria as well as for planners and designers.

Streamlining the compliance process for housing development is a critical step in increasing the supply of housing which has been identified as one of the contributors to lack of access to affordable housing.

Case Study 38 eComply

WHO BENEFITS: Designers

CHALLENGE: Developing technology to address compliance and assessment regulations for builders, designers, and architects

SOLUTION: The eComply project has 7 live development sites as part of the final controlled release of the technology. The first eComply digital assessment solution ‘Archistar Comply’ allows builders, designers, and architects to pre-check 3D building designs against the Small Lot Housing Code. The building design and approval process is intensive. Archistar Comply minimises the difficulty and changes that occurs when a designer is ensuring changes are compliant with codes and regulations. The tool provides feedback on more than 90 complex checks in around 90 seconds. This means house designers can rapidly make changes before sending their plans to a building surveyor for final assessment, cutting up to 4 weeks off the approval process.

The solution is also continuing to develop with the ‘eComply Framework’ that will encourage the development of more useful digital assessment tools. This will also encourage a broader adoption of similar digital building processes across the sector.



Industry testers self-reported that the new tool could save up to 4 weeks off the approval process. They also noted that a benefit of the system was the iterative design and compliance test methodology which is helpful for the off-site modular housing sector.

The eComply pilot is already demonstrating the value that the Digital Twin technology can deliver to unlock regulatory red tape by taking weeks off current building approval times.

Source: Land Use Victoria

Case study – Kurloo movement detector system

Kurloo is an Australian developed innovation that draws on geospatial information services, wide area networks, cloud processing and data analytics to develop a fast and cost-effective technology to monitor land and structural movement.

Case Study 39 Early warning system to monitor land movements and structural displacement and manage risk

WHO BENEFITS: Geotechnical engineers, surveyors, dam engineers, structural engineers, asset managers

CHALLENGE: Billions of dollars in damage, loss of life and irreversible damage to the environment are caused each year as a result of land movements, landslides and structural displacement. A movement detector warning system is needed to monitor displacement and manager risk.

SOLUTION: Traditional surveying has always been constrained by the time, risk and cost involved. Developed by Kurloo Technology, the Queensland University of Technology and the CRC for Advanced Manufacturing, Kurloo a movement detection system is now manufactured in Australia and servicing clients.



Kurloo employs cutting edge technology, cloud computing, accurate three-dimensional displacement, fully automated processing and online access to results. It draws on low-medium Global Navigational Satellite sensors with low pow wide area networks. It is a fully integrated devise supported by cloud processing and data analytics. The product gathers critical data while the project team is offsite providing a safe data gathering and processing system with unlimited online access. It is a fast, precise and reliable technology to provide accessible, rapid, accurate, reliable and sustainable early warning system for monitoring displacement.

It has been applied by Queensland Rail to monitor the risk to their network of long-term slope stability in order to put in place maintenance and disaster response programs to ensure that the train network continues to operate safely. It has been employed by the Port of Brisbane to optimes the design and development through a critical understanding of settlement during and after construction.

Users report that Kurloo provides a cost effective, adaptable and highly accurate solution to enable control of high-risk locations and better plan development on site. The technology saves costs and increases on site safety.

Source: Monitum/Kurloo Technology

Case study – Virtual asset management

The challenges in the management of utilities are increasing with climate events, grid balancing, renewable energy integration, reliability and environmental expectations increasing every day. More is being demanded of asset managers that, in turn, is creating a need for more efficient and effective asset management techniques.

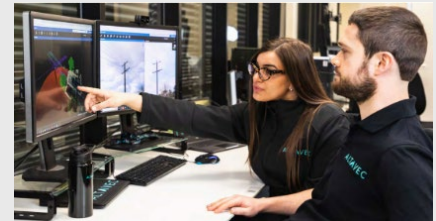
Geospatial data, augmented with artificial intelligence, can reduce the need for resource intensive on-site inspections, identify risks and maintenance requirements more efficiently, optimise maintenance strategies and increase the life span and value of infrastructure assets.

This case study demonstrates how geospatial information technologies save time and money and improve safety through virtual asset management.

Case Study 40 Virtual Asset Assessment

WHO BENEFITS: Asset owners in government and industry

CHALLENGE: Safe and reliable asset monitoring services are required to ensure the status of an organisation's infrastructure and assets are understood. Conventional methods of asset assessment are costly and sometimes dangerous.



SOLUTION: Altavec worked with an Australian energy company to deliver Virtual Asset Assessment solutions. The company, which operates transmission and distribution assets, would traditionally conduct ground inspection. A ground inspection requires an accredited team (engineers and technicians) to view the asset in person. As a result, the team must dedicate significant time and resources to visiting sites, many of which are isolated or in hazardous locations, making the exercise costly and dangerous. Finally, when the asset information is gathered, it may not be utilised to its full potential. Often the information collected is kept within the team.

The asset management module is a cloud-based platform that provides a streamlined process for capturing and analysing images of assets in the field. It uses images captured by aircraft, drones or field inspections and automatically associates them with each asset. Images captured are ready for review within 24 hours. The data and images are processed and fed through to an optimised workflow assessment that allows asset defects to be identified, recorded and audited before being made available to the asset managers for rectification. The system provides access to assessments via secure APIs providing potential for improved communication of site and asset conditions, maintenance requirements to the client as well as the public as required.

The company also noted a reduced risk of workplace injury, as inspection teams were not required to enter hazardous areas during asset assessment. Aerial collection of data opens the door for further exploration of AI and machine learning to increase efficiency of assessments, as well as more effective use of data to share insights internally.

Altavec reported that the energy company has experienced significant improvements including a 40% increase in the number of asset inspections, a 50% saving in asset maintenance programs', a 90% reduction in data management effort, and a 60% saving in time for inspection teams.

Source: (Altavec, 2023)

Case study – Before You Dig Australia

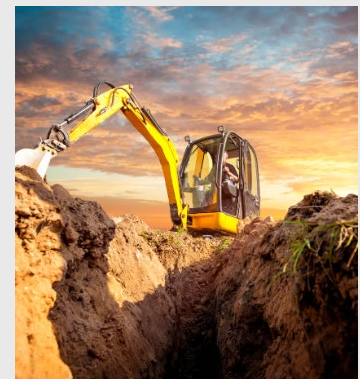
Before You Dig Australia (BYDA) is an organisation that facilitates the provision of asset plans and information to anyone working in and around infrastructure assets directly from owners of utility services. BYDA provides a service that is dedicated to preventing injury and reducing damage to the complex underground networks that provide essential services to Australians every day. Through partnerships with utilities, local councils, government agencies and private enterprises, BYDA provides a free referral service to the Australian community. This core service facilitates the sharing of vital safety information from our registered members with those looking to dig.

Case Study 41 Before You Dig Australia (BYDA)

WHO BENEFITS: Building, construction and infrastructure industries

CHALLENGE: Currently estimated at approximately 15,000 strikes per annum, third party damages to Australia’s utility infrastructure are driving significant cost to community in regard to repairs, disruption, and risk of injury.

SOLUTION: Considering the extraordinarily high costs of utility strikes, BYDA’s utilisation of geospatial infrastructure provides an essential service to individuals and organisations requiring critical information on the locations and characteristics of underground utilities.



BYDA provides free plans across Australia to allow all scales of development, from a DIY project to full-scale construction site to proceed without risking a utility strike. Their services, which are now offered digitally, utilise geospatial technology to fulfill 2.2 million plan requests per year – with each plan delivered promptly avoiding a potential utility strike. The efficient delivery and easy use of the platform ensures users are more likely to employ diligent and responsible practices, and also reap the benefits of reduced stand-by time, and reduced cost of damage to utilities. Increased application of GIS mapping in BYDA’s platform has potential to further increase the effectiveness of BYDA.

In addition to the impacts on productivity, utilisation of BYDA provides an added degree of safety to construction sites. BYDA estimates that regulators in QLD, NSW and Victoria are each receiving an average of 300 reportable utility strikes that presented imminent risk of harm per year. The use of BYDA works to significantly reduce the risk of injury as a result of utility strike.

BYDA will benefit from ongoing development of authoritative digital records of property and infrastructure assets through concepts such as spatial digital twins.

BYDA estimates that the cost of repairing utility strikes in Australia is over \$4 billion per annum, when considering labour, administration and material costs and the flow through cost of the impact on the community.

The benefits of BYDA include reduced time, effort and cost in design, as well as improved accuracy. It can also aid Utility Providers or BYDA in producing better informed projects in early stages, reducing damage during investigations, and improving the safety of those digging.

Source: Before You Dig Australia

Case study – Insurance – assessing for flood risk

The insurance industry is a significant user of geospatial information for monitoring and estimating risk and assisting property owners in obtaining insurance cover through improved assessment of property risk. The following case study illustrates the role of geospatial information services in development of a flood risk database for the industry.

Case Study 42 National Flood Insurance Data Base

WHO BENEFITS: Insurance industry, property owners

CHALLENGE: Flooding poses a significant risk to the community and property owners in particular. It can cause significant damage to property and infrastructure, physical and mental health impacts and loss of life. As climate change continues to influence weather patterns, the frequency and severity of flooding events are expected to increase. Property owners rely on flooding insurance to provide financial protection against flood risk. Accurately assessing flood risk for properties is critical for both property owners and the insurance industry.



SOLUTION: In partnership with state and territory governments, the general insurance industry has developed and licensed the National Flood Information Database (NFID) for use by insurers in determining the flood risk to individual properties. NFID is an address database containing 13.7 million property addresses, overlaid with the known flood risk according to government flood mapping.

Modern versions of this capability utilise precise national location data (e.g. address, land parcels and buildings) to support the development of sophisticated natural peril models. These models align a range of site-specific data describing the terrain, historic events, claims, assets characteristics, and mitigation measures and blend climate variables to enable the development high-quality site-specific risk scores.

Most insurers use NFID to determine the flood risk to individual properties, and calculate the premium based on this risk and other criteria including building type, location and claims history. Insurers may examine information from many sources to identify properties that are prone to flooding. These may include local government flood mapping, historical flood information, terrain data and insurance claims information.

The availability of geospatially enabled flood mapping data has increased the access of property owners to flood insurance. Where no flood risk data is available insurers will generally adopt a very conservative approach to setting premiums.

The average annual damage from flooding in Australia was estimated to be \$8.8 billion in 2017 (Deloitte Access Economics, 2017). An efficient and effective framework for assessing flood risk is fundamental to managing financial risk faced by property owners. Geospatial information and analysis underpin flood risk assessment by the insurance industry and increase access to flood insurance by property owners.

Case study – Under keel clearance in Port Hedland

Under Keel Clearance (UKC) is the distance between the seabed and a ship's keel. The measure can be used to ascertain the likelihood of a ship grounding (impacting the seabed). UKC requirements are determined and enforced by ports or regulatory authorities.

To determine UKC requirements, authorities must consider numerous factors, such as the waterway's depth, tide, waves and other hydrographic data. By incorporating accurate bathymetry (the depth of the water), authorities can create UKC requirements that increase shipping volume while maintaining safety of the vessels.

This case study demonstrates how geospatial information technologies have assisted Port Hedland increase productivity through a lowest astronomical tide model.

Case Study 43 Under keel clearance in Port Hedland

WHO BENEFITS: Resource industries involved in shipping from Port Hedland

CHALLENGE: Under Keel Clearance (UKC) requirements can be a limiting factor in a port's shipping volume, constraining the movement of goods in and out of Australian ports.



SOLUTION: Port Hedland is one of 3 major iron ore ports in the Pilbara, Western Australia, and the largest bulk export port in the world (Pilbara Ports, n.d.). The Pilbara Ports Authority developed a Hydroid, or Lowest Astronomical Tide Model, which is a model to better understand sea levels and depths of a particular area (Pilbara Ports, 2019).

The use of the Hydroid has delivered considerable improvements to the port's productivity:

"The Port Hedland Hydroid had a significant impact on the port's export capacity. Every additional 10cm of declared depth is equal to an extra 1,200 tonnes of cargo per vessel."

John Finch, General Manager Operations, Pilbara Port Authority (Pilbara Ports, 2019)

The use of the Hydroid extends the tidal sailing window by an hour (the times in which ships can travel through the port), with the port seeing potential to increase the number of vessels from 6 to 8 per tide, which equates to a 33% increase. The port also reports a reduced unit cost, by allowing ships to increase the volume of goods onboard, while maintaining safety. The success of the Port Hedland Hydroid has resulted in action for the creation of a national hydroid model, referred to as AUSHYDROID (Pilbara Ports, 2019).

The Port estimates that the technology delivers around \$240 million per annum in savings from increased ship movements in the Port.

Source : (Pilbara Ports, n.d.) (Pilbara Ports, 2019).

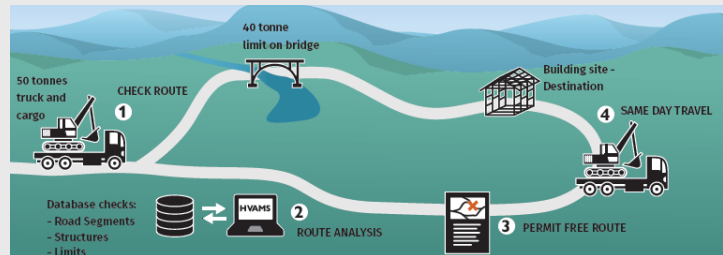
Case study – Heavy vehicle access

Geospatial information services have a major potential role to play in asset management. In this case study it is employed in a system to reduce administrative costs of management heavy vehicle movements and protecting transport assets.

Case Study 44 Heavy Vehicle Access Management System (HVAMS)

WHO BENEFITS: Heavy vehicle operators, transport departments

CHALLENGE: Heavy vehicle operators must apply for an access permit for a specific activity and route to navigate the road network and bridges safely and productively.



SOLUTION: The Tasmanian Department of State Growth introduced the geospatially enabled Heavy Vehicle Access Management System (HVAMS) to provide heavy vehicle operators with a self-service system to check which roads and bridges can be accessed without a permit and under what conditions given specific vehicle and load type. HVAMS helps prevent operators from driving outside allowed vehicle dimensions and axle masses, understand the constraints on bridges or structures and plan activities and routes without needing to apply for a permit.

The HVMS was built on a map layer compiled from Foundation Spatial Data contained in the Land Information System of Tasmania (LIST). The map aligns network and route information with the properties of structures and road segments and analysis each road segment to determine the allowable network for a given heavy vehicle activity.

The HVAMS has improved road access and reduced red tape for the heavy vehicle industry. As a result, 80% of Over Size Over Mass vehicle movements and 90% of special purpose vehicle movements are now undertaken permit free. This has led to reductions in waiting times and a decrease in road manager resources required to administer permits.

Source: Department of State Growth

4 Mining

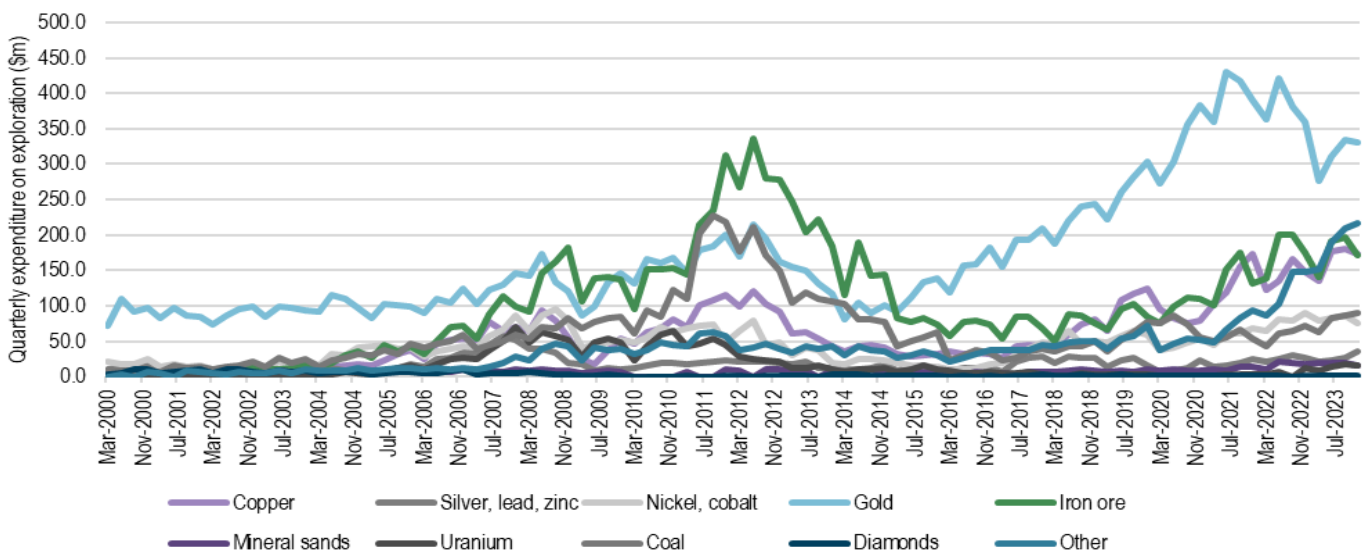
The mining industry is a significant component of the Australian economy, composing 13.4% of Australia’s GDP in 2022-23 (Department of Industry, Science and Resources, 2024). The number of people employed in mining in Australia has increased by 24.1% in the last 5 years, employing approximately 290,000 people as of February 2023 (Australian Government, 2023).

The mining industry comprises exploration and development, direct mining (extractive) activities, and exploration and mining support services. In 2022-23, the industry generated \$455 billion in export revenue (Minerals Council of Australia, 2023) and \$283.2 billion in value-added (Department of Industry, Science and Resources, 2024).

Exploration

Recent estimates of Australian expenditure on mineral and petroleum exploration totalled over \$4 billion in 2023 (ABS, 2024). Figure 4.1 highlights the historical changes in mineral exploration expenditure trends since 2000, seeing gold exploration rise above iron ore, copper, and other minerals since 2014.

Figure 4.1 Australian quarterly expenditure on mineral exploration (\$m)



Source: ACIL Allen, ABS (2024)

Australia has significant reserves of many of the most sought-after critical minerals (Geoscience Australia, 2022). The use of geospatial technology in mineral exploration is key to ensuring Australia can access the critical minerals the world needs in the coming decades.

A prime example of the potential in critical minerals is the rapid growth of the value of Australia’s lithium exports, which rose from \$1.7b in 2021 to \$12.1b in 2022 (Geoscience Australia, 2023).

Geospatial information services are deeply embedded in all aspects of mining industry operations. The following case studies offer examples of how these services support productivity in the mining industry.

Case study – Fleet Space Technologies

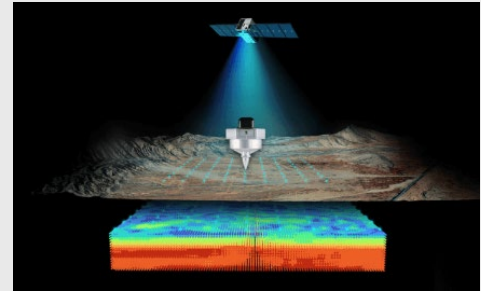
Fleet Space Technologies, an Australian space company, has been growing rapidly in recent years for their innovation in mineral exploration and space solutions, enabled by geospatial technology.

This case study demonstrates how innovation in the use of space and geospatial technologies is being applied in the search for critical minerals.

Case Study 45 ExoSphere in exploration

WHO BENEFITS: Mining industry, customers for critical minerals

CHALLENGE: Conventional mineral exploration involves a large amount of exploratory drilling, which is a costly, slow, and environmentally impactful process. As such, it limits productivity and agility in the sector, especially in its response to the critical mineral needs in coming decades.



SOLUTION: Launched in 2022, Fleet’s ExoSphere is the first to utilise satellites to gather data from their seismic sensors on the ground to assess the presence of minerals in a survey area. Fleet’s non-invasive Ambient Noise Tomography (ANT) method allows their Geodes (seismic sensors) to gather data. The Geodes are up to 10 times more sensitive than other seismic instruments on the market.

This geophysical data collection, combined with satellite connectivity and edge computing, allows for rapid collection and visualisation of data, with the final product being a 3D sub-surface model as deep as 2.5 kilometres. ExoSphere follows a three-step process:

1. The Geodes are laid out in a grid to capture data from the ground below. Data is gathered from the Geodes in real time.
2. The data is transmitted to Fleet’s global low power satellite network.
3. The data is received and visualised into a 3D model.

Fleet’s Exosphere technology allows for the creation of a 3D subsurface model in as little as 48 hours, in comparison to historical approaches to mineral exploration, a process which generally takes weeks or months.

Fleet’s Co-Founder and Chief Exploration Officer Matt Pearson explains: “We put them out in big arrays, usually anywhere from 40 to 100 geodes, which might cover 10 to 100 square kilometres. Then we can generate images of structures in the subsurface based on seismic velocity, usually down to about two kilometres depth – which is around the range of what is commercially viable to extract.” (Cosmos, 2023).

Fleet have demonstrated their technology for use across various minerals such as lithium, copper, gold, nickel and uranium, and have completed over 250 surveys for many of the industry’s top companies. Fleet is looking to the future with an aim of accelerating the discovery of critical minerals by 30x.

Fleet’s ExoSphere technology allows for fast-tracked, lower cost, and lower environmental impact exploration to inform real-time decision making.

Source: Fleet Space Technologies

Case study – Commonwealth Scientific and Industrial Research Organisation (CSIRO)

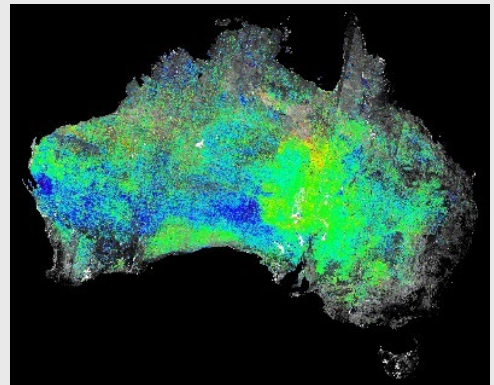
Although the use of multispectral imagery for mineral identification has been explored for a number of decades, CSIRO's creation of an Australia-wide mineral map demonstrates the use of satellite imagery for mineral mapping.

Case Study 46 Satellite technology for mineral mapping

WHO BENEFITS: Industry, researchers, government

CHALLENGE: Inconsistent mineral mapping technology hinders the ability for Australia to effectively identify and manage the location of minerals.

SOLUTION: CSIRO, utilising Japan's Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite data created the first continent-wide mineral map.



The formation of this expansive mineral map required CSIRO to combine over 3,500 images containing reflectance and emissivity data captured from the satellite. This marked the first ever continent-wide set of mineral maps upon its release in 2012.

ASTER uses a multispectral system, capturing 14 spectral bands, crossing visible light, near infrared, and thermal infrared (Geological Survey of Western Australia, 2012). Since the map's release, it has become the default base map for mineral exploration in Australia.

More recently, CSIRO have continued to utilise new data sets and new methodologies to map minerals. CSIRO accessed PRISMA (an Italian Space Agency satellite launched in 2019) imagery to characterise mineral groups/species. Since the project began in 2020, CSIRO has collected almost 450 scenes across the continent, using a similar mosaic approach to the method used for ASTER imagery.

CSIRO's innovation in the applications of satellite data for mineral mapping supports the industry's understanding of Australia's mineral composition and distribution and has played an important role in advancing the understanding of what can be achieved with satellite imagery.

Source: (CSIRO, n.d.)

Case study – AusAEM

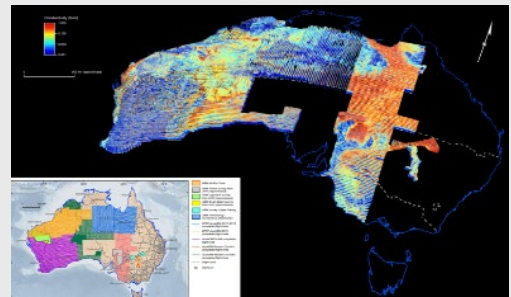
The AusAEM project, part of the Geoscience Australia’s Exploring for the Future program, comprises a sequence of national airborne electromagnetic surveying initiatives. Its objective is to survey the entire Australian continent with a line-spacing of approximately 20 kilometres. Since 2017, the program has undergone multiple acquisition rounds, progressively extending its coverage across the nation (Geoscience Australia, n.d.).

Case Study 47 AusAEM

WHO BENEFITS: Researchers

CHALLENGE: This AusAEM project aims to address the challenge of insufficient geological data by conducting airborne electromagnetic surveys.

SOLUTION: The AusAEM project utilises a non-invasive testing technique known as airborne electromagnetic (AEM) surveying. This enables the measurement of ground conductivity variations to depths of several hundred metres. The ground’s conductivity response primarily results from the presence of electrically conductive materials, including salt, saline water, graphite, clays, and sulphide minerals.



AusAEM data and its derived products play a crucial role in mapping the thickness and composition of sedimentary and regolith cover. Additionally, these survey results are utilised to evaluate the potential for groundwater resources in Australia’s arid regions, supporting remote communities within the surveyed areas.

AusAEM will transform Australia’s resource management, scientific research, and community well-being through:

- **Resource Discovery:** Mapping geological structures and mineral deposits contributes to efficient resource exploration, potentially uncovering valuable natural resources.
- **Water Security:** Assessing groundwater potential in arid zones aids in securing water supply for remote communities, which can foster sustainability and resilience.
- **Infrastructure Planning:** Detailed subsurface data informs infrastructure projects and ensures robust planning for energy, water, and transportation systems.

AusAEM is unlocking Australia’s hidden treasures, supporting communities, and shaping a sustainable future.

Source: (Geoscience Australia, 2023)

Case study – Hydrogen Economic Fairways Tool

The Department of Climate Change, Energy, the Environment and Water estimates that Australia’s hydrogen industry could generate \$50 billion in GDP and 16,000 regional jobs by 2050 (DCCEEW, 2021).

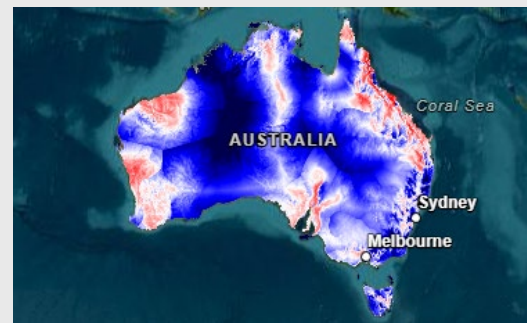
As with any major transition, there are many commercial and technical challenges for industry to capture the benefits that hydrogen could provide. These challenges, without sufficient tools and information, can reduce the uptake and investment of hydrogen.

Case Study 48 Economic Fairways Project

WHO BENEFITS: Policy makers, industry, researchers

CHALLENGE: Uncertainties surrounding the complexities of commercial viability of hydrogen production in Australia act as a barrier to investment and action.

SOLUTION: Hydrogen Economic Fairways Tool (HEFT) is a key tool of the AusH2 portal, made to support the 2019 National Hydrogen Strategy and Geoscience Australia’s report on Prospective Hydrogen Production Regions of Australia.



HEFT is a collaboration between Geoscience Australia and Monash University. The project focuses on the development and application of new resource economic modelling algorithms for mineral, energy and groundwater systems. It seeks to combine the geoscience knowledge and data sets of Geoscience Australia with world leading techno-economic modelling developed at Monash University to produce spatial maps to inform decisions about the location of resource or development projects.

HEFT is a publicly available tool that aims to assist prospective investors identify which regions are suitable for hydrogen production, and the factors that impact viability. The tool allows users to compare the viability of both renewable and non-renewable methods of hydrogen production.

At its core, the open-source nature of the economic model allows users to access a transparent and customisable experience.

Users are given the option of selecting a specific area they would like to model and are able to alter several criteria to assess the economic viability of hydrogen production in different regions. Based on the inputs that the user selects, HEFT will produce an output that displays the projected net present value (NPV), providing an overview of the viability of hydrogen production.

Deloitte (2023) estimate that the tool saves between \$30,000-\$50,000 per prospective project. These savings are due to reduction in time and due diligence required to investigate the eligibility of hydrogen projects. Cost savings could reach up to \$100,000 per project in large or complex cases.

Source: Geoscience Australia. Image source: HEFT, (Deloitte, 2023)

Mining projects and operations

Ensuring the Australian resource industry is operating at maximum effectiveness and safety is essential to the growth of the industry, especially in the areas that are integral to achieving our national targets and aspirations around energy security and transition. Geospatial technology is core to countless key products and services that improve the safety, efficiency and sustainability of the Australian resources sector's operations.

Case study – Improved mine safety and the role of positioning

A recent case study example of improved mine site safety is through a demonstration of SouthPAN-enabled active mine vehicle tracking operations, conducted by Wenco International Mining Systems and researchers from the Queensland University of Technology (QUT). (EY, 2019)

Case Study 49 Satellite-Based Augmentation System (SBAS) by Southern Positioning Augmentation Network (SouthPAN)

WHO BENEFITS: Mining industry and mine workforce

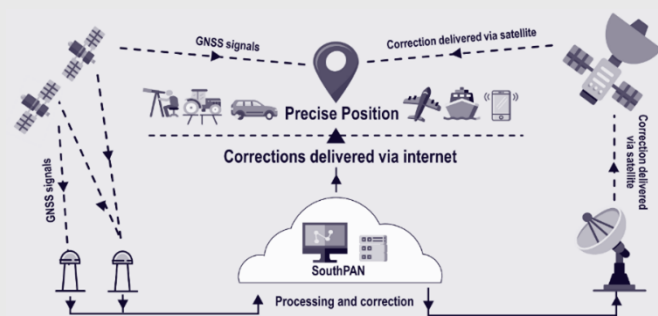
CHALLENGE: On a mining site, a lack of clear information regarding the location of vehicles and their relation to personnel poses significant risk of accident, human error and idle equipment.

SOLUTION: The project brought together experts from industry and academia to trial the SouthPAN signal and gain a greater understanding of how widely it could be used in the sector. Fitted onto fleet vehicles at a Middlemount mine site in Queensland, SouthPAN receivers tested proximity awareness using the approximate display of the Safety Fleet Management System. The demonstrated benefits proved that more accurate positioning would improve mining operations and safety:

“Testing SouthPAN on our trucks with the Safety Fleet Management System showed how it could improve safety on our mine sites. The system alerts operators to warnings and the more accurate and reliable the position of a vehicle or person, the better. The high precision positioning allowed our mine site mobile fleets to interact with a higher degree of confidence due to improved proximity awareness. This achieves our number one priority of operator safety”.

Wenco International Mining Systems Research and Development Manager

An economic benefit analysis of SouthPAN was conducted and found that SouthPAN has an expected value of \$7.6 billion over 30 years for Australia and New Zealand based on tested applications, with \$1.58 billion of this figure accruing to the resources industry. This includes an estimated PV\$577m saving on fuel and labour costs for haul trucks.



Source: (Geoscience Australia, 2023), (EY, 2019)

Case study – SafeAI

Positioning technology is key to enabling autonomous fleet functionality, an emerging capability in mining that has significant scope to deliver productivity and safety benefits to the industry through smarter path-planning and fleet control.

SafeAI and other autonomous heavy equipment systems are being adopted across the mining industry, with significant impact on productivity and operational costs (Mine Australia, n.d.).

Case Study 50 Autonomous Heavy Equipment

WHO BENEFITS: Mining industry, mining operations and mining workforce

CHALLENGE: Hauling costs constitute 38% of mining companies' total operative expenses and are a key constraint to increasing productivity of the sector.



SOLUTION: SafeAI have partnered with Position Partners to retrofit a large fleet of 100 haulage trucks operated by MACA, an international mining and construction contracting group.

The SafeAI Autonomous Framework (SAF) is an ASIL-D safety certified operating system that supports safer, more productive worksites. It is an interactive and customisable operating system that provides users with the ability to create and deploy autonomous applications in mining and construction. SAF allows individual vehicles to communicate with other vehicles sharing the road through 'vehicle-to-everything' (V2X) communication technology. By alerting autonomous vehicles to nearby vehicles (manned and autonomous) and surroundings, V2X is a key component in ensuring worksite safety.

SafeAI's autonomous management platform, ZENO, provides users with the ability to monitor and control fleets in real-time. Data is collected by vehicles and used to generate key insights into fleet operations, including pathing, task progression and the condition of particular vehicles, from speed to capacity and fuel levels. The platform enables both a streamlined workflow and enhanced collision avoidance and is thus an example of how connected and autonomous driving capabilities will improve fleet planning, tracking and control to improve productivity and worksite safety in heavy industries.

Autonomous vehicle technology can lower operating costs by up to 30%, reducing fuel consumptions and emissions by 10-15% and extending equipment lifespan by 50%. Productivity can be increased by 15-30% by reducing downtime, human error, and inefficiencies (SafeAI, 2024). BHP have noted a reduction in haul accidents by over 90% (Mine Australia, n.d.).

Source: (SafeAI, 2024), Position Partners

Case study – Autonomous Road trains in mining operations

Autonomous control of vehicles is emerging not only on the mine site, but also proving to be increasingly important in the future of mine-to-port transportation with road trains.

Case Study 51 Autonomous Road Trains

WHO BENEFITS: Mining companies, mining workforce

CHALLENGE: Mine-to-port transport from remote mines can be incredibly expensive for mine operators, and dangerous for drivers.

SOLUTION: Hexagon and mining services company Mineral Resources Limited (MinRes) are equipping a fleet of 120 road trains (triple-trailer vehicles) with a drive-by-wire autonomous driving system to enable road trains to travel from mine-to-port more efficiently and safely than ever before. MinRes, who operate iron ore and lithium mines, will be implementing this solution for transport from their Onslow Iron Project to the Port of Ashburton, Pilbara, Western Australia. This private route, which spans approximately 150 kilometres, has been specially sealed and fenced to accommodate the 330 tonne autonomous road trains – the world’s largest (MinRes, 2023). MinRes (2023) anticipate the following benefits from the project:



- remove risk of driver fatigue
- increase fleet availability
- lower operational costs
- reduce fuel use and emissions.

The autonomous road trains require 10cm accuracy from its GNSS positioning on-board the vehicles, as explained by Lee Baldwin, Segment Director for Core Autonomy, Hexagon:

“Obviously, autonomous platooning is heavily reliant on accurate and continuous positioning.”
(Hexagon, 2022)

MinRes is projecting to develop 140 automated prime mover trucks by mid-2024 and aims for full autonomy by 2025.

Hexagon (2022) estimate that a fleet of 100 road trains could save MinRes up to US\$236 million per annum or 50% of current trucking costs using their autonomous platooning system.

Source: Hexagon and MinRes. (Hexagon, 2022)

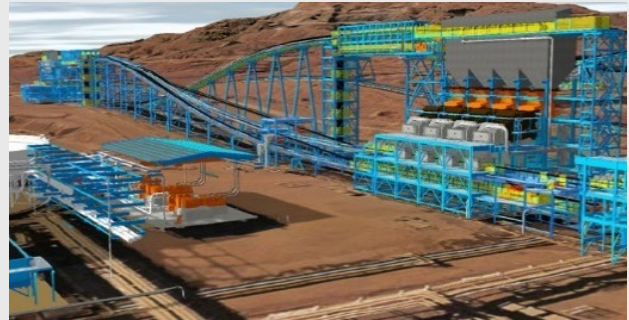
Case study – NGIS and Skyline’s common operating picture

The creation of a digital common operating picture (a platform that can be accessed across teams) allows mining companies to insert 3D data, such as assets, into a geospatial map of the site.

Case Study 52 Common operating picture

WHO BENEFITS: Mining industry

CHALLENGE: Mining production is a technically challenging and complex endeavour, requiring large sites and many moving parts. Managing this complexity is a key priority for mine site managers.



SOLUTION: Perth-based geospatial company NGIS have partnered with Skyline, a leading 3D technology company, to deliver an intelligent digital platform for the Australian mining industry. It allows the user to integrate unmanned aerial vehicle (UAV) data for dynamic terrain modelling with outputs from geological modelling and engineering designs, enabling a self-service approach to monitoring mine site production and compliance that drives operational awareness and efficiencies.

NGIS identify a range of key uses for their geospatially enabled common operating picture:

- risk management
- surveying
- business cases
 - line of sight scenarios
 - plant design logistics
 - floodplain analysis.

NGIS report 800 active users of the platform internally, with 18 business units utilising the platform in their day-to-day mining activities.

Geospatially enabled common operating picture advances planning, decision making, and day-to-day operations on site.

Source: (FrontierSI, 2021)

Case study – QMASTOR mine management

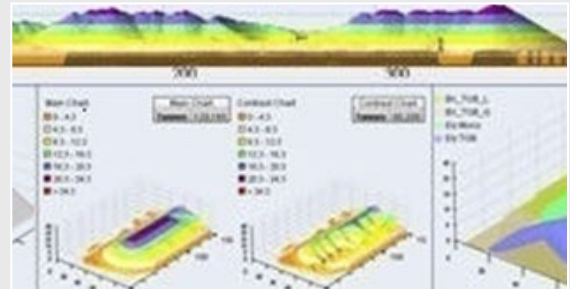
Geospatial information services also find applications in monitoring, tracking and reporting minerals production from pit to port.

Case Study 53 QMASTOR Mine Management Systems

WHO BENEFITS: Mining industry

CHALLENGE: After extraction, natural resources must be transported, stored and accounted for. Inaccurate or partial information to inform logistical decisions leads to significant inefficiencies.

SOLUTION: QMASTOR is a supply chain management system using positioning technologies to track the tonnage, quality and value of commodities in real-time. It was designed in the early 2000s to address the need for automated, real-time supply management systems. The system is used to optimise operations from “pit to port” in areas such as inventory management, mine planning and logistics scheduling. QMASTOR systems currently manage over one billion tonnes of bulk iron, coal and bauxite annually. Users include some of the world’s largest mining organisations. QMASTOR makes use of real-time position data and information relating to delivery tonnage and quality, a reclamation system for quality control in shipping scheduling, a display system for real-time stockpile and machinery data, reduced downstream sampling and analysis requirements, and a tonnage reconciliation system. QMASTOR simplifies and automates commodity supply chain management, delivering cost reductions through locationally accurate real-time monitoring. It reconciles the company’s three-dimensional inventory plan on a continual basis with actual data. The mine’s control system network provides the raw data regarding the commodity location, quality and volume needed for real-time management, which is then applied by QMASTOR to determine dispatch optimisation.



QMASTOR and mine control systems need continual innovation to optimise operations across their operations and supply chain. A key constraint is the spatial accuracy and reliability of various data inputs to the systems. Differences between the estimated and actual values for tonnage and quality limit opportunities for optimisation. Companies are also looking ways to update their mine models every 6-12 hours rather than daily to improve efficiency. This is often limited by some data inputs needing to be checked for spatial and temporal accuracy before being used. Improved sensors, linked to precise positioning infrastructure is key to addressing these constraints.

QMASTOR is part of ION Commodities’ comprehensive portfolio of solutions that digitalise the complete resource lifecycle from mining, beneficiation, smelting, refining, tolling, trading, and storage to logistics and distribution. As a leading provider of commodity management solutions, ION Commodities connects the entire value chain, offering customers a holistic view of their business operations to enhance risk management and maximise margins. NGIS report 800 active users of the platform internally, with 18 business units utilising the platform in their day-to-day mining activities.

QMASTOR allows for efficient transport and storage of commodities by providing the information that is essential to inventory management, mine planning and logistics scheduling. Satellite positioning is a key supporting technology to this system.

Case study – K2fly Natural Resource Governance

When mines cease production, mining companies must follow stringent guidelines that dictate the condition that the mine site must be left in. This necessitates a large array of data collection and analysis of various environmental considerations to ensure the site is sufficiently rehabilitated. Earth observation technology is contributing to this process thoroughly and efficiently.

Case Study 54 Natural Resource Governance

WHO BENEFITS: Industry

CHALLENGE: Upon cessation of resource extraction, mine sites must be closed and rehabilitated to minimise environmental damage. This requires the collection and monitoring of various data points relating to the sites' environmental impact.



SOLUTION:

K2fly provides enterprise Software-as-a-Service (SaaS) solutions for technical assurance, resource and mineral governance. K2fly's cloudbased platform assists environmental rehabilitation activities. The platform helps community, geotechnical, and management teams improve compliance. It provides the visibility to reduce risks and supports accurate disclosure in the dams and tailings space, as well as improvement in relinquishment, tracking of closure and achievement of the rehabilitation targets associated with rehabilitation and closure.

The K2fly platform allows mining operators to take a map-centric, visual and geospatial approach to their mine rehabilitation and tailings storage facility monitoring. The platform centralises EO data like radar, interferometric Synthetic Aperture Radar (InSAR), Light Detection and Ranging (LiDAR) and drone imagery data together with CCTV and inspections information in one location, making it easier and more efficient to monitor and manage sites and facilities remotely. K2fly's cloud solution based on InSAR detects land surface deformation over time to a precision of 1-2 millimetres. This data has historically been desktop-based in GIS and difficult to action.

A one- to 2-millimetre precision detection of land surface deformation over time using EO data allows for highly accurate monitoring and management of mine rehabilitation.

Source: (FrontierSI, 2021)

5 Agriculture

Australian agriculture plays a crucial role in the country's economy and national food security. With its vast landscapes and diverse climates, Australia can produce a wide variety of agricultural products, ranging from grains and livestock to fruits and vegetables. This diversity allows Australia to not only feed its own population but also to export a significant amount of food and agricultural products to other countries.

In terms of economic value, Australian agriculture is a significant contributor to the country's GDP. According to the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), the gross value of agricultural production in Australia is forecast to be \$80 billion in 2023-24.

Agriculture plays a crucial role in rural communities, providing employment and supporting local economies. According to ABARES, the agriculture, forestry, and fishing industries employed around 266,300 people in 2022-23, representing around 2% of Australia's total employment. In rural and regional areas, agriculture is often the primary source of employment and economic activity, making it essential for the livelihoods of many Australians.

Around 65% of Australia's total agricultural production is exported, reaching \$80.4 billion in 2022-23. This represented 12% of Australia's total goods and services exports, with beef and wheat exports both in the top 10 commodity exports.

In addition to its economic value, Australian agriculture also plays a crucial role in national food security. While Australia is a net exporter of food, domestic production still plays a vital role in ensuring a stable and secure food supply for the country. By producing a significant portion of its food domestically, Australia is less reliant on imports and less vulnerable to disruptions in global food supply chains.

Case study – Australian Citrus Orchards

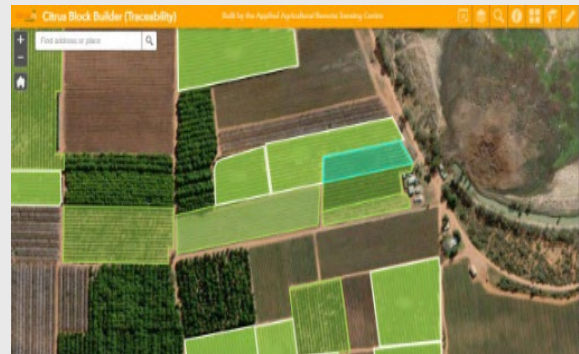
In 2022, Citrus Australia partnered with Agriculture Victoria and the Applied Agricultural Remote Sensing Centre (AARSC) to map Australian citrus orchards. Prior to this map, Citrus Australia recorded data from citrus orchards with the Citrus Tree Census, which recorded data in tabular format only.

Case Study 55 Australian citrus orchards

WHO BENEFITS: Citrus farmers and broader industry

CHALLENGE: Prior to this project, citrus orchard data had only been available in tabular form. Adding a spatial layer to the data is crucial to provide actionable insights to the industry.

SOLUTION: The National Citrus Map has now provided an additional spatial information set, assisting the industry to make more powerful and informed decisions across industry challenges and opportunities. It includes orchard level information such as tree age, variety, and management.



The Map has a number of benefits, such as:

- improvements in protecting the provenance, biosecurity status, and export markets of the industry's 1,150 orchards
- satisfying export traceability and certification requirements for high-value global markets
- enabling rapid responses to outbreaks such as citrus canker, varroa mite, and HLB
- helping with planning and recovery from bushfires, floods, and the effects of climate change
- providing industry data for carbon tracking, water usage, and avoidance of food wastage
- a richer course of live data for business decisions about further plantings and varietal changes.

Benefits of this map include improvements to traceability, biosecurity, exports, emergency response, sustainability and business planning.

Source: Citrus Australia, Agriculture Victoria, and the Applied Agricultural Remote Sensing Centre (AARSC)

Case study – Precision agriculture technologies in avocado production systems

The avocado industry has increased production significantly over the past 15 years. Bumper harvests and increased plantings have caused unit prices to decrease, with imports from New Zealand adding to the downward price pressure. These market dynamics is imperative that the industry has accurate forecasts of supply so it can plan for the future, such as finding new export markets.

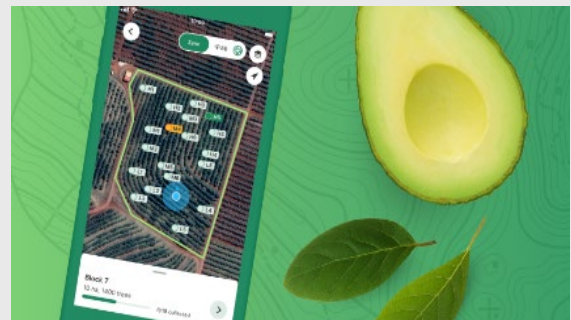
Accurate yield forecasts assist the industry to make informed decisions around forward selling and market access. At the orchard level, understanding crop loads allows growers to better plan harvesting logistics. Spatial mapping of yield at the block level can support decisions around variable rate application of inputs such as water, fertiliser, pesticides as well as improved response to plant disease such as Phytophthora.

Case Study 56 Precision agriculture technologies in avocado production systems

WHO BENEFITS: Avocado farmers and broader industry

CHALLENGE: To develop an accurate yield forecasting system for avocado growers to plan and explore new export markets

SOLUTION: The Applied Agricultural Remote Sensing Centre (AARSC) team developed a mobile application called Crop Count which utilises high-resolution satellite imagery to support avocado growers and enable them to forecast yields, map tree health, and mitigate the damage of natural disasters.



The previous method for yield estimation is a visual count of fruit grown on selected trees, then extrapolated to provide an average block yield. This method has poor accuracy as avocados are the same colour as leaves, it is time consuming and labour intensive and has a limited sample size therefore inaccurate at representing an entire block.

The creation of a time series yields forecasting methodology supports a more accurate measure of crop response, measured incrementally over an extended period. It identifies historic crop behaviour and the influences of seasonal environmental, climatic or management changes and its subsequent impact on seasonal yield.

Since 2020, this methodology has been evaluated in Australia, South Africa and New Zealand and has led to its adoption to now expand across 7 countries as well as additional commodities such as mango, citrus, tea tree and macadamia.

Crop Count is a world-first yield forecasting technology that offers avocado growers 93% accuracy.

Benefits of this innovation include cost and time savings, the ability to forward sell crops, and better plan for labour and storage requirements.

Source: The Applied Agricultural Remote Sensing Centre (AARSC), Horti novation, Geolmage

Case study – Benefits of Satellite-Based Augmentation Systems (SBAS)

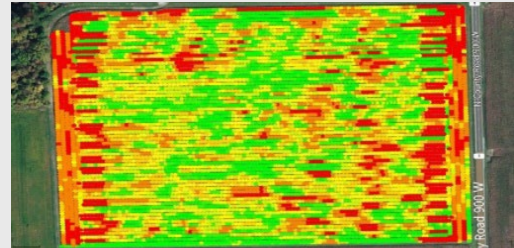
SouthPAN is a collaborative effort between the Australian and New Zealand Governments which delivers Satellite-Based Augmentation System (SBAS) services (Geoscience Australia, 2024).

Case Study 57 Benefits of Satellite-Based Augmented Systems (SBAS) across Australia and New Zealand to broadacre production

WHO BENEFITS: Farmers

CHALLENGE: Enabling positioning and navigation accuracy across vast regions, including rural areas used for broadacre cropping.

SOLUTION: Analysis was completed into the economic benefits of Satellite-Based Augmentation Systems (SBAS), including benefits to the broadacre sector. It incorporated data from 2 projects which surveyed farmers and conducted empirical research to estimate the benefits of implementing SBAS signals.



Efficient deployment of inputs, particularly in reducing overlaps in chemical spraying, is expected to save the broadacre sub-sector PV\$214 million over 30 years. This is based on survey data showing that 7% of a typical broadacre farm is subject to spray overlaps, with a reduction factor of 6% applied to calculate the total reduction in hectares subject to overlap.

The avoided cost of positioning technology, including capital outlay for RTK base stations and subscription costs, is anticipated to amount to PV\$7 million over 30 years. This benefit is derived from survey data suggesting that approximately 20% of broadacre farmers own their own base station, and 16% pay for subscription services for 10 to 20-centimetre level positioning accuracy.

The enablement of Variable Rate Technology (VRT) is expected to result in PV\$520 million worth of operating expenditure savings to the broadacre sector over 30 years. Research shows operational savings ranging from \$7 to \$22 per hectare, with a weighted average of \$14.50 per hectare used for the analysis. Approximately 50% of farms currently use some form of VRT, and it is anticipated that the deployment of SBAS signals will lower the cost barrier for the remaining 50%.

Enhanced uptake of non-RTK Controlled Traffic Farming (CTF) is projected to save the sector PV\$250 million in operating expenditure over 30 years. The deployment of Precise Point Positioning (PPP) within the broadacre sector is expected to reduce tyre tracking by 10 centimetres on average, resulting in a 35% reduction in yield loss, equivalent to \$8.80 per hectare. This benefit applies to 40% of total harvestable land that currently do not use CTF.

This analysis estimated the total benefit of SBAS to the broadacre sector of \$990 million over a 30-year period.

Source: Geoscience Australia, (EY, 2019)

Case study – SwarmFarm Program

The future of farming relies on sustainability, efficiency and productivity gains across the industry. Succeeding in this cannot be based on traditional practices or by simply adapting to current farming technology.

Case Study 58 SwarmFarm

WHO BENEFITS: Farmers

CHALLENGE: Farmers face significant challenges in managing weeds and optimising pesticide usage. Traditional methods often result in excessive chemical application, leading to environmental concerns and increased costs.



SOLUTION: SwarmFarm is an autonomous farming platform that uses precision technology (real-time kinematic (RTK) positioning) to guide robotic fleets whose functions are customisable by users and can be controlled remotely via any iOS device. Numerous lightweight and modular robots can operate on the same farm in unison with each other, acting as a ‘swarm’ to undertake large and complicated tasks autonomously.

Through the application of positioning technologies, SwarmFarm Robotics provides economic benefits and improved capabilities to farmers.

Precise, variably targeted application reduces the need to blanket entire fields of crops with chemicals or fertilisers, as robotic vehicles equipped with sensors and sprayers can specifically identify both weeds and the crop areas most in need of inputs such as water and herbicides.

If weeds are killed early when they are small, herbicide rates can be cut in half compared to traditional spot spraying.

Individual weed treatment is cost-effective and significantly reduces herbicide use, in addition to reducing the likelihood of herbicide resistance. In 2021, a client of SwarmFarm Robotics reported a chemical use reduction of 80%.

Reduced chemical usage is a positive for both the environment and the longevity of the chemicals, as they are removing small weeds and not building resistance to chemicals.

Source: SwarmFarm Robotics

Case study – Precise positioning for grain growers

In Australia precision agriculture has primarily been used to provide vehicle guidance (controlled traffic farming, or CTF) and for variable rate technologies and yield monitoring. Around 80% of grain producers are estimated to use geospatial services for these purposes. There is also growing interest and application in mapping technologies to better forecast crop yields and understand land dynamics. In-field sensors and surveillance technologies can inform decision-making in real time.

Case Study 59 Benefits of the precise positioning to grain growers

WHO BENEFITS: Grain farmers

CHALLENGE: Productivity is crucial to maintaining Australian agriculture's competitiveness in global markets. In agriculture, precise positioning services support technologies such as remote sensing, auto-steer and yield monitoring systems which deliver productivity benefits for agriculture enterprises



SOLUTION: Control traffic farming (CTF) is an important support for precision agriculture. CTF aims to achieve spaced permanent 'traffic lanes' for use in sowing and harvesting to minimise soil compaction and overlap of tyre tracks. CTF requires good guidance systems and relies heavily on precise positioning technologies.

Benefits of CTF include:

- **Enhanced Crop Productivity:** CTF leads to greater cropping frequency and reliability.
- **Resource Efficiency:** It optimises nutrient and water usage, improves soil health, reduces fuel and pesticide consumption, and minimises machinery expenses while aiding field management.

Precise positioning can also improve the application of farm inputs based on analysis of field conditions. This is known as variable rate technology (VRT), as inputs are applied at varying rates depending on field conditions.

Research on the benefits of precision agriculture has shown the following benefits:

- **Variable rate fertiliser application increased the economic benefits of wheat production by \$5-50/hectare due to cost savings of reduced agrochemical use. This was based on field data collected by sensors, maps, and GPS (Robertson, 2012)**
- **CTF generated increased profits of \$46.8/hectare due to avoiding unnecessary use of agrochemicals from reduced overlap, and labour reduced labour costs (Kingwell, 2011).**
- **CTF might be decrease the global warming potential of soil emissions by 30-50% (Tullberg, 2018).**

Source: ACIL Allen

Case study – Rural Intelligence Platform

Businesses, policy makers, and farmers often make decisions without reliable data or analytics. Despite the significance of food and agriculture to the Australian economy, an estimated \$128 billion in economic decisions in the nation annually are based on unreliable or incomplete data (CSIRO, n.d.).

These data gaps exist beyond Australia to many other countries. Existing rural data is typically patchy and fragmented, often packaged in a way which is inaccessible and uncondusive to informed decision-making.

CSIRO's Rural Intelligence Platform aims to bridge this gap by providing comprehensive and robust farm data and analytics.

Case Study 60 Rural Intelligence Platform

WHO BENEFITS: Agribusiness community

CHALLENGE: Tracking paddocks and their performance over time requires trusted geospatial data.

SOLUTION: CSIRO have partnered with a rural technology startup Digital Agriculture Services (DAS) in the development of a platform that combines artificial intelligence, machine learning and cloud-based geospatial technology to deliver reliable, independent and robust farm data and analytics.



This platform is the first of its kind to provide detailed monitoring and assessment of rural land anywhere in Australia. The platform draws on authoritative data sources on productivity, water access, yield, land use, crop type, rainfall, drought impact and more.

The platform utilises satellite imagery to monitor paddocks and their performance over time. Data from Australia's digital soil map is incorporated alongside climate information to show drought, frost, heat stress for livestock and other key risks. The platform incorporates an AI-initiated Automated Valuation Model that is capable of instantly valuing rural properties with up to 90% accuracy.

"The Rural Intelligence Platform will help the agribusiness community calculate the risks associated with certain investments or management decisions... which will make it easier to quantify risk and prepare for challenges like climate volatility and change."

Dr Michael Robertson, CSIRO Agriculture and Food Deputy Director

The Rural Intelligence Platform empowers farmers and land managers by providing actionable insights based on authoritative and robust data. The platform enhances productivity, sustainability, and informed decision-making across rural Australia.

Source: CSIRO

Case study – Horticulture industry maps

Improved disease and pest surveillance has been identified as a priority for the macadamia, avocado, mango, citrus, and banana as an industry priority. This has been due to suboptimal responses to Panama disease in banana plantations, citrus canker, and cane smut, among others. There has also been significant growth in the planting of tree crops in specific regions, which can both be impacted by, and hasten the spread of, pests and diseases.

Case Study 61 Horticulture industry maps

WHO BENEFITS: Horticultural farmers

CHALLENGE: Knowing where commercial crops are offers substantial time and labour savings when undertaking targeted surveillance and establishing exclusion zones, both of which are essential for containment and minimising spread.

SOLUTION: To deliver this fundamental data layer, the respective industry bodies worked with the University of New England’s Applied Agricultural Remote Sensing Centre (AARSC) to map all commercial orchards over one hectare, nationally. This layer was developed by digitising existing industry data, analysis of high-resolution satellite and airborne imagery, web searches for relevant site locational information, and field validation.



The maps are presented on the publicly available Australian Tree Crop Map Dashboard (ATCM). The dashboard has been viewed (opened) 17,235 times. Significantly the dashboard was awarded first place as ‘Best dashboard’ application in the map gallery at the 2021 ESRI International User Conference.

The national mapping of commercial orchards offers significant benefit to national plant biosecurity by identifying the location and distribution of all commercial orchards. In the event of an incursion, the map supports the rapid deployment of surveillance staff and the establishment of exclusion zones to prevent further spread. Satellite imagery allows classification of tree health across an orchard and can indicate individual trees that are underperforming or suffering from a pest or disease. This can direct growers and surveillance teams to undertake infield assessment to identify the cause.

As the imagery has a spatial context, GPS locations of sick trees can be extracted from the imagery to direct infield observation and similarly field observations can be linked back to the mapping layer to better understand distribution and spread of a particular threat. The time series analysis provides a historic seasonal measure of canopy vigour that can be used as a ‘benchmark’ of usual block, farm, and tree condition. Any variation from this benchmarked performance may indicate the onset of a biosecurity incursion. This method can be automated to better inform growers and biosecurity agencies of where and when to look for possible incursions.

These maps enhance decision-making, support traceability, and empower growers and biosecurity agencies to focus their efforts effectively.

Source: University of New England (UNE)

6 Biosecurity

Australia operates a complex biosecurity system with many different stakeholders. It has been estimated that damages from pests and diseases over the next 50 years would decline by approximately \$325.26 billion due the operation of Australia’s biosecurity system, at a cost of \$10.45 billion (Dodd, 2020).

Australia’s biosecurity activities encompass pre-border, border, and post-border measures to manage the risks associated with pests, diseases, and contaminants. Pre-border and border activities include risk assessments to identify potential biosecurity threats, import conditions that must be met by importers to mitigate biosecurity risks, and inspections upon arrival at ports to intercept biosecurity risks. These are undertaken by the Commonwealth Government. Post-border activities include surveillance and monitoring to detect and respond to any biosecurity threats, and eradication or containment programs as a response once an incursion has occurred. These are undertaken by state governments and affected industries such as agriculture. It is at this post-border stage where the benefits from geospatial information are largely realised.

Early detection of, and a rapid, effective response to biosecurity incursions can have a large impact on limiting their damage. Implementing effective and efficient surveillance and response programs is becoming increasingly difficult as exposure to biosecurity threats increases. For example, between 2012 and 2017, the annual number of interceptions of biosecurity risk materials at Australian borders rose by almost 50% to 37,014 (Inspector-General of Biosecurity, 2019). This is due to increased density of urban areas, increased levels of trade and travel, biodiversity loss, climate change, and agricultural intensification (CSIRO, 2020).

It has been identified that Australia’s system is largely reactionary, with investment and collaboration occurring during times of crisis but less so during stable periods. The future system will require enhanced data sharing, national coordination of activities, and investments in new technology applications. It was identified in the 2022 Commonwealth Biosecurity Priority Action Plan to “progress use of enhanced capabilities such as machine learning, anomaly detection, and geospatial mapping to assist with risk management”.

The uses of geospatial information for biosecurity purposes include:

- At the risk assessment stage, it can allow for the analysis of environmental factors that can influence the spread of pests and diseases. This helps in identifying high risk areas and prioritising resources for biosecurity detection and response efforts.
- As a platform for data sharing and information exchange across industry, government, and research. It could capture high-risk detections, pre-border risk notifications, trade volumes from partner countries, and climate data.
- At the detection stage, it can monitor changes in the environment, such as vegetation health or animal movements, for early signs of potential biosecurity threats.
- To create detailed maps and models that aid in planning and executing biosecurity responses. This includes identifying optimal locations for quarantine zones, treatment facilities, and surveillance activities.
- To optimise the allocation of resources by targeting areas with the highest risk or vulnerability. This ensures that limited resources are used efficiently to achieve maximum impact.
- To create visualisations and maps that communicate biosecurity risks and measures effectively to stakeholders, policy makers, and the public. This enhances awareness and understanding of biosecurity issues.
- For ongoing monitoring and evaluation of biosecurity measures and their effectiveness. This enables adaptive management practices to improve biosecurity outcomes over time.

The following case studies present a number of use-cases for geospatial data in supporting biosecurity efforts.

Case study – Red Imported Fire Ant

Red imported fire ant (RIFA) was first detected in Brisbane in 2001. In 2017, a cost-shared Ten-Year Plan was approved by all Australian governments, with \$411 million to deliver an expanded National RIFA Eradication Program (the Program). Additional funding has been announced to support the Program after detections were made in NSW in 2023, indicating that current efforts are merely slowing spread, rather than achieving containment or eradication. A review of the Program in 2021 estimated that impacts of uncontrolled spread to the economy would reach up to \$2 billion per year. These costs would include costs of \$300 million to the cattle industry, \$200 million to the wheat industry, \$130 million to other crops, \$150 million to schools and their students, \$508 million to telecommunications, and \$200 million to the tourism sector (Scott-Orr, 2021).

Case Study 62 Red Imported Fire Ant (RIFA)

WHO BENEFITS: Agricultural industry, tourism, telecommunications, schools

CHALLENGE: Developing a remote sensing solution to efficiently detect and destroy new RIFA nests to prevent further spread.



SOLUTION: RIFA has several methods of dispersion and can survive in almost any environment, so there is no real way of determining its existence or absence except through surveillance. Historically, surveillance has completely relied on ground surveillance methods that physically search areas, which is time consuming and expensive. Infestations can remain undetected for significant periods and accuracy of these methods is difficult to confirm. The continued spread has further increased costs and time taken for on-ground inspections.

As part of the setup of the Program, Biosecurity Queensland commissioned Outline Global to deliver a broad scale remote sensing solution to locate Fire Ant Nests more efficiently and effectively. The result was a world-first ultra-high resolution surveillance system that records the spectral signature of RIFA nests, distinguishing them from other features such as rocks, manure, wood, and bare earth. An associated AI model was developed to process and interpret the imagery, and ultimately increase accuracy by matching remote sensing images against validated field data.

A pilot was completed in 2020 where the system was successfully demonstrated and Outline Global continues to support the Program into 2024. The 2021 review of the Program stated:

“As has repeatedly been noted in reviews, the success of remote sensing surveillance remains critical to the success over the Program, even more so now that the infestation is very diffuse over a large area and anything other than broad-scale surveillance is not going to effectively detect ants to the level required for eradication, or even containment.”

The National Red Imported Fire Ant Eradication Program (NRIFAEP) estimates that if RIFA spread remained unchecked, annual impacts could amount to \$2 billion per year.

Source: Outline Global

Case study – Impact of the NSW Foundation Spatial Data Framework on Varroa mite response

The Varroa mite is a devastating pest of European honeybees. It feeds on bees at all life stages, aids viral infestations, and ultimately causes colony collapse. Australia was the only continent free of Varroa until June 2022 when it was detected in DPI surveillance hives at the Port of Newcastle.

Case Study 63 Impact of the NSW Foundation Spatial Data Framework on Varroa mite response

WHO BENEFITS: Bee industry, pollination-dependent crops

CHALLENGE: Geospatial data enables efficient and effective emergency response to the spread of Varroa mite.



SOLUTION: The response was the largest multi-agency biosecurity response in Australia's history, overseen by the National Management Group (NMG) with representatives from Commonwealth Government, every state and territory department, and executive from relevant industry bodies and Plant Health Australia.

On September 2023, the NMG made the decision that eradication of varroa mite was no longer achievable and to shift the focus of the response to management activities. This includes slowing the spread as much as possible.

The NSW Department of Primary Industries worked with the NSW Spatial Services Emergency Information Coordination Unit (EICU) to carry out spatial analysis to assist in the initial eradication program. The EICU prepared maps for emergency orders, modelled potential baiting locations, updated surveillance and eradication zones, and assisted with internal and public facing web maps.

The NSW Foundation Spatial Data Framework was utilised to develop public facing web maps which had significant benefits to consistency and communication across agencies. These maps also produced an accurate and up-to-date base of information for the external audience.

The NSW Foundation Spatial Data Framework contributed to the Varroa mite Response through mapping, risk assessment, and emergency coordination. The Department of Agriculture, Fisheries and Forestry estimate that an unhindered spread of Varroa mites could cause economic losses of \$1.3 billion over 30 years in Australia (ABARES, 2012).

Source: NSW Department of Primary Industries

Case study – Leafminer

The Agromyzidae are a well-known group of small, morphologically similar flies whose larvae feed internally on plants, often as leaf and stem miners. They include vegetable leafminer (VLM), serpentine leafminer (SLM), and American serpentine leafminer, (ALSM) all of which are pests of vegetable and ornamental crops and thus pose a significant biosecurity threat to Australia.

Case Study 64 Leafminer

WHO BENEFITS: Vegetable and ornamental crop farmers

CHALLENGE: VLM was detected in the Torres Strait Islands in 2008 and PNG in 2011, and then in the Northern Peninsula Area of Queensland in 2015.



SOLUTION: Eradication in the Torres Strait Islands and Northern Peninsula Area was considered not feasible, so containment measures were put in place. Finally, an incursion of SLAM was detected in NSW and Queensland in 2019, and again eradication was deemed not feasible.

Government and industry responses swiftly to these threats and incursions with a foundation of robust scientific research informing this response. Part of this research was mapping the risk profiles and spread pathways. A framework for population establishment, growth and spread was overlaid on the spatial distribution of susceptible horticultural productivity to estimate economic impacts through time under various incursion scenarios.

An online web map of VLM distribution, host plant distributions, VLM establishment risk predictions, and VLM spread risk predictions was created as a decision-making tool. This map also facilitated the communication of risk during extension activities via a depiction of the presence of plant hosts for VLM.

This project has led to an improved understanding of Australian VLM populations, development of cost-effective surveillance techniques and improved industry preparedness for incursions.

Source: NSW Department of Primary Industries

Case study – Khapra beetle

Khapra beetle is designated as Australia’s second most important priority plant pest by the National Plant Health Committee. Its establishment in Australia would cause large scale production losses, quality downgrades, and jeopardise exports for plant industries.

In mid-2019 there were several detections in rice from Thailand which highlighted that the threat of incursion had increased.

The early detection of khapra beetle will be vital for its eradication after incursion and avoidance of significant damage costs. These surveillance activities are labour intensive and costly to maintain. As such, efficient allocation of surveillance resources presents a challenge for the biosecurity system. Information on where, when, and how a new pest species is likely to arrive and establish in Australia assists in determining where surveillance resources should be allocated.

Case Study 65 Khapra beetle

WHO BENEFITS: Grain farmers

CHALLENGE: Khapra beetle incursion has the potential to cause large scale production losses, quality downgrades, and jeopardise exports for plant industries.



SOLUTION: A project by the Centre for Excellence for Biosecurity Risk Analysis (CEBRA) developed a framework for creating maps of pest establishment likelihoods to inform surveillance of pests not currently present in Australia. The key spatial layers for this exercise were land use (Australian Collaborative Land Use and Management Program), population density (ABS census), and the plant landscape (National Vegetation Information System). Population is used as khapra beetle is most likely to enter via imports, which arrive and are sent to populated areas. Land use and vegetation are required as khapra beetle is more likely to spread to areas where there is a food source for it.

This work is currently being expanded on through a GRDC project which is modelling the spread, detection, surveillance, treatment, and proof-of-freedom of a khapra beetle incursion.

On the back of this work, the Biosecurity Commons has been established to expand Australia’s biosecurity modelling capability through the creation of standard tools and resources to produce consistent and transparent models. One of these tools is risk mapping of a pest, which combines a series of datasets for abiotic and biotic suitability and pest arrival pathways to estimate the likelihood of a pest establishing itself.

CEBRA has established a pragmatic framework for creating defensible maps of pest establishment likelihoods, informing targeted surveillance efforts for pests not currently present in Australia, and enhancing our ability to model, detect, and manage khapra beetle incursions. It is estimated that it would cost the Australian economy \$1 billion over years (DAWE, 2021).

Source: NSW Department of Primary Industries

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Appendices



A List of all case studies

This table lists 167 case studies provided by government, industry or researchers, in response to a request from the Geospatial Council of Australia for case studies to support an investigation into the value of Geospatial Information in Australia.

Case Studies

Table A.1 Case Studies

Case study	Organisation	Principal Sector	Description	Impact
Emergency Management				
Early warnings of remote bushfires	Tasmanian Government	Public administration and safety	Integrated real-time satellite detection and notification, coupled with location data, enables rapid response teams to pre-emptively combat emerging fires, mitigating potential harm to communities and the environment. Heritage and Land Tasmania manages a 'Common Operating Platform' (COP) within the LIST framework, offering Tasmania's emergency services a unified, authoritative map-based interface for effective emergency planning and response.	<ul style="list-style-type: none"> – Rapid access to accurate situational awareness in Tasmania – Minimises impact of fires on health, economy, and environment – Saves millions of dollars in firefighting costs – Crucial with longer, more severe fire seasons – Enhances efficiency in deploying firefighting resources
Australian Government's National Joint Common Operating Picture (NJCOP)	ESRI	Public administration and safety	The NJCOP showcases crucial event data including floods, fire threats, cyclones, droughts, earthquakes, and tidal surge/tsunami alerts on a national scale. It integrates this information with key infrastructure details such as road closures, landmark building locations, biosecurity alerts, and pertinent space events.	<ul style="list-style-type: none"> – Near real-time data inputs boost confidence in displayed information – Facilitates prompt decision-making during active situations. – Enhances national overview by consolidating data from multiple hazards and jurisdictions. – Intuitive graphical interfaces enable swift and accurate risk assessments. – Establishes a roadmap for ongoing improvements. – Ensures continuous enhancement and refinement of system capabilities
Emergency services uses G-NAF for accurate address data	Geoscape	Public administration and safety	G-NAF (Geocoded National Address File) address data helps ambulance crews navigate to an address in an emergency. G-NAF is a solution that helps the open access to address data. It is constructed utilising data sourced from local governments, state, and territory government land administration agencies, as well as the Australian Electoral Commission (AEC), and other confidential commercial providers. Since it is a public domain data set (via data.gov.au), it is often re-sold by different Australian re-sellers after some value adding. This broadens the scope of its application, being used across the public and private sectors. G-NAF live provides access to geocoded addresses that are updated daily or weekly (depending on the state or territory) through Geoscape APIs.	<ul style="list-style-type: none"> – Validated and trusted system – G-NAF undergoing refinement to evolve at a pace that aligns with business needs – Widely used and respected data

Case study	Organisation	Principal Sector	Description	Impact
Enabling Emergency Flood Response	Deloitte	Public administration and safety	During flood incidents across NSW, hundreds of gigabytes of aerial imagery are captured and analysed. The Department of Customer Service (DCS) Spatial Services collaborated with AWS, Deloitte and Charles Sturt University (CSU) to test the extraction of geospatial information using the power of cloud technology, artificial intelligence and machine learning (AI/ML).	<ul style="list-style-type: none"> Transformed impact assessment reporting for emergency services Streamlined the process and cut down the required time to obtain crucial information from hours to minutes Enhanced the emergency service response, especially in evacuation planning, coordination of staff and the facilitation of recovery operations. Enabled the swift release of emergency funding
2022 NSW Floods Case Study	NSW Department of Customer Services	Public administration and safety	In this DCS Spatial Services Case Study, various programs are showcased, including Customer and Emergency Management Services (CEMS), Environmental Spatial Programs (ESP), Cadastral Spatial Programs (CSP), Business Technology Services (BTS), Administrative Spatial Programs (ASP), and Survey Operations. These programs collectively address a range of spatial challenges, such as customer service, emergency management, environmental monitoring, land parcel delineation, technological infrastructure, administrative data management, and survey operations.	<ul style="list-style-type: none"> The programs have achieved the following: Developed interactive dashboards and products to aid efficiency Developed mapping products and cartographic support Provided spatial analysis support and data sourcing Provided imagery download, processing and provision
National Exposure Information System (NEXIS) and the Australian Exposure Information Platform (AEIP)	Geoscience Australia	Public administration and safety	The National Exposure Information System (NEXIS) database and the Australian Exposure Information Platform (AEIP) are considered critically important to reducing the economic and social impact of natural disasters in Australia. This was recognised in the Royal Commission into National Natural Disaster Arrangements and is confirmed by the evidence available to this research. Data contained in NEXIS is highly valued by emergency management agencies and other organisations at all levels of government in Australia.	<ul style="list-style-type: none"> Implementing savings in FTE staff at Geoscience Australia (GA) Benefits emergency management agencies by providing timely exposure reports nationwide. Projected increase in natural disaster costs: \$38 billion annually in 2020 to \$73 billion per year by 2060 Initiative offers significant long-term savings. ACIL Allen calculated benefits from 2007 to 2033. Factors in costs for the National Exposure Information System (NEXIS) equivalent to the expenditure in 2022
Severe Wind Hazard Assessment for Southeast Queensland	Geoscience Australia	Public administration and safety	In December 2022, Geoscience Australia delivered an assessment of severe wind hazard impacts on Southeast Queensland (SEQ). In response to the assessment findings, the City of Gold Coast announced \$100m of funding over 5 years to address the recommendations and a new Gold Coast disaster management centre has also been operationalised.	<ul style="list-style-type: none"> City of Gold Coast allocated \$100 million over 5 years in response to assessment findings. Established a new Gold Coast disaster management centre. Project AIR (Advocacy, Information, Resilience) exemplifies Geoscience Australia's scientific application and impact. Aims to prepare the city for severe wind impacts from cyclones and storms. Enhances resilience of evacuation centres Safeguards critical infrastructure Boosts community readiness Advocates for building policy examination with State and Federal governments
Satellite Tasking	Land Victoria	Public administration and safety	Commercial Satellite Tasking Services were established to enhance support for emergency incidents and other natural and built environmental applications, by giving Victorian Government departments and agencies timely and on-demand high-resolution satellite imagery. Satellite service providers were selected based on minimum daily revisit frequency and rapid imagery delivery requirements.	<ul style="list-style-type: none"> Satellite data is delivered within a 12-hour window after successful capture Enables near real-time monitoring and decision-making, resource allocation, and damage assessment City of Melbourne is tasking monthly satellite captures at 30cm resolution for asset management, planning, urban design, vegetation management, event planning and disaster response. Multiple regions from Forest Fire Management Victoria are tasking image captures over planned burns for planning operations and evaluation.

Case study	Organisation	Principal Sector	Description	Impact
Machine Learned Data	Land Victoria	Public administration and safety	The Data Science team at Land Use Victoria's DTV program has devised a repeatable Geo-AI method leveraging high-resolution aerial imagery. This approach accurately pinpoints silage production sites, identifies individual waste tires, and detects large tire storages. Our findings revealed over one million tires scattered across agricultural land in Victoria, showcasing the effectiveness of our methodology for governmental and regulatory agencies.	<ul style="list-style-type: none"> Traditional methods provided estimates of silage mounds and tires across the state. New method offers highly accurate depiction of actual number of tires used statewide. Data shared with various agencies within Victorian government. Supports environmental compliance activities conducted by EPA. Assists emergency services like Emergency Services Victoria and Fire Rescue Victoria in conducting bushfire risk analysis
Forest Fire Management	Land Victoria	Public administration and safety	The group utilises satellite imagery procured through the Digital Twin Victoria program for planned burn operations, providing important data for planning, execution, and evaluation of the burn.	Use of the whole of Victorian Government Geospatial Data and Analytics Panel has allowed the procurement of satellite data across the state for a number of use cases including the planned burns use case. DTV's Satellite Tasking Service opens up a range of satellites for us to procure data from with a data delivery timeframe of between 2-12 hours making this a service that can be provided for emergency management when natural disasters occur.
Geospatial's role in government services	Spatial Source	Public administration and safety	The ACS serves two primary customers: the newly established NRRA and Emergency Management Australia (EMA). During the recent floods in Queensland and NSW, the ACS swiftly responded to data requests from these agencies. This rapid response assisted them in gaining a better understanding of the evolving situation on the ground.	<ul style="list-style-type: none"> Building geospatial data capabilities Being an active partner in Australian Climate Service ABS location capability shift
Consistent information in times of emergency	NSW Govt	Public administration and safety	The FSDF Geocoded Addressing data played a pivotal role as the authoritative source for a suite of address location web services integrated into government online platforms, aiding flood recovery efforts. These services facilitated the collection of vital information from affected residents and enabled the mapping of flood-affected areas across multiple government applications. Moreover, they verified individuals impacted by the floods, ensuring precise allocation of government grants. Additionally, the data was instrumental in updating emergency service mapping tools, particularly beneficial in regional areas where alternative solutions might lack accuracy in address information.	<ul style="list-style-type: none"> Critical infrastructure to support the NSW economy Using the Land, Parcel & Property theme to improve prosperity Consistent information in times of emergency Ensuring that there is appropriate representation in our political system Utilising the FSDF as a tool for national collaboration Utilising the FSDF for analysis to manage and protect our biosecurity
Emergency Information Coordination Unit (EICU)	NSW Spatial Services	Public administration and safety	The Emergency Information Coordination Unit (EICU) ensures that the emergency management sector, including over 162 agencies in NSW Government, has access to crucial intelligence and spatial data for dealing with various crises. Mandated under the State Emergency and Rescue Management Act 1989 (SERM Act), the EICU supports prevention, preparedness, response, and recovery efforts. By providing geospatial data and support services, it minimises duplication of efforts across agencies, saving lives, aiding community recovery, and protecting critical infrastructure. This centralised approach optimises resources, streamlining approximately 648 full-time equivalent (FTE) personnel across government.	<ul style="list-style-type: none"> EICU's efficient data processing overhead yields a significant \$97.2 million benefit to the NSW Government alone. Additional expenses like software, hardware fees, licensing, and other ICT costs streamlined across 162 agencies considered. Each agency has approximately 4 FTE at an estimated \$150,000 per person Natural disasters forecasted to cost Australia \$1.2 trillion over the next four decades. Investments in resilience, informed by EICU products, can lead to exponential reductions in these impacts. The World Bank estimates a 10-fold return on general investment in disaster prevention. Insurance Council of Australia reported a remarkable 77x return on investment in natural hazard resilience data and insights in 2022
Planned burns program	Victorian Department Environment Protection Branch	Public administration and safety	Identifying suitable locations for planned burns, especially assessing the dryness of specific areas, has traditionally been challenging without ground-level observation. The Forest Fire Management (FFM) team needed comprehensive data to inform planned burn decisions statewide. They came up with the solution of leveraging satellite imagery obtained through the Digital Twin Victoria program, the group now accesses vital	<ul style="list-style-type: none"> The Victorian Government Geospatial Data and Analytics Panel facilitates the procurement of satellite data across the state for various use cases, including planned burns. DTV's Satellite Tasking Service, accessible through the panel, offers access to a variety of satellites.

Case study	Organisation	Principal Sector	Description	Impact
			information for planning, executing, and evaluating planned burn operations, enhancing their effectiveness and efficiency	<ul style="list-style-type: none"> – The service provides data delivery within a timeframe of 2-12 hours, making it suitable for emergency management during natural disasters.
Capturing data during flood incidents	Spatial services	Public administration and safety	Faster data sharing	Lower damage costs
Telecommunications and utilities infrastructure	Spatial Services	Public administration and safety	DCS Spatial Services is currently developing a 3D spatial dataset of Government Radio Network (GRN) telecommunications towers and assets across NSW to assist with emergency management and response	<ul style="list-style-type: none"> – Improve the ability of Emergency Services Organisation (ESOs) to protect these vital assets through better understanding of their location, protection arrangements and interdependencies
Tsunami Modelling – The value of seabed mapping	Deloitte, Geoscience Australia	Public administration and safety	It delves into the intricacies of depth analysis aimed at enriching tsunami modelling methodologies. Moreover, it explores the significance of RV Investigator voyages in expanding Australia's maritime territory, providing insights into the broader context of tsunami research and maritime exploration.	<ul style="list-style-type: none"> – Environmental management, monitoring and research – Increasing traditional owners' understanding of Sea Country – Increasing the production of seabed mapping – The benefits and economic contribution of seabed mapping data will increase with a higher utilisation of data
Speeding disaster assessments for A1 Services	NearMap	Public administration and safety	Consulting to the building, insurance, and disaster sectors, A1 Services provides residential property and infrastructure inspections, assessments, and reports to support communities impacted by natural disasters. A1 Services leverages Nearmap content to help provide faster, more accurate disaster assessments.	<ul style="list-style-type: none"> – Measure and record details to create more accurate proposals – Making calculations based on the building footprint and other verifiable property details – Helps the team assess the extent of the loss – With the accuracy of the system, A1 assessors can provide a clearer outline of quantities and materials needed for replacement and repair
Disaster recovery	NearMap	Public administration and safety	Disaster Relief Australia operates in the recovery phase, as opposed to the response phase, says Richard Adams, National Director, Disaster Relief Australia. He says the organisation identified a gap between the emergency response stage and the assistance communities required post-disaster.	<ul style="list-style-type: none"> – Helps DRA a better idea of what is required for disaster relief efforts, especially in large areas – Being able to focus drone teams on smaller more appropriate tasks – Reducing the inefficiency of driving to each property to undertake initial impact assessments
Australian Red Cross	NearMap	Public administration and safety	With NearMap, Australian Red Cross were able to access high-resolution aerial imagery that was captured within days following the fires to visually assess whether damage was a factor present in those incomplete applications. "NearMap provided us another verification layer. We could actually see if there was any sign of fire near the area in question, and the exact distance from the property to fire damage so our grants team could determine eligibility". - John Santiago, Business Analyst, Australian Red Cross	<ul style="list-style-type: none"> – Able to verify and provide grants to nearly 6,000 people, with over \$200M in financial aid distributed
Digital Earth Australia Hotspots	CSIRO, GA	Public administration and safety	Featuring rapid access to NASA and other satellite data streams through Australian ground stations, data-processing algorithms and a customised interface, this continent-wide mapping system has revolutionised the way that fire information is visualised, and risk is understood. Launched in 2003 and now hosted by Geoscience Australia, Digital Earth Australia Hotspots provides daily, consistent, accessible, and actionable data to agencies and others monitoring fire risk. Using Sentinel Hotspots, fire agencies have been able to implement more effective pre-planning efforts as well as establish on-the-ground monitoring and warning systems to protect properties, livelihoods, and lives.	<ul style="list-style-type: none"> – Using Sentinel Hotspots, fire agencies have been able to implement more effective pre-planning efforts as well as establish on-the-ground monitoring and warning systems to protect properties, livelihoods and lives.

Case study	Organisation	Principal Sector	Description	Impact
Economic study into an Australian continuous launch small satellite program for Earth observation	Deloitte, Aus Space Agency	Public administration and safety	Avoided cost of storm, hail, cyclone, flood, bushfire, tomado damage. ACLUMP - biosecurity	<ul style="list-style-type: none"> – Calculated direct economic contribution and FTEs of EO sector, calculates return of investment in EO satellite and data.
Climate change, environment and natural resources				
Climate Change and Extreme Weather	Spatial vision	Public administration and safety	Data accessibility and the utilisation of spatial data for impact assessment were identified as key areas for improvement. Consequently, the first stage of the project involved collating suitable spatial datasets, including climate data, community datasets, and historical data. Additionally, extreme weather parameters, such as heat wave metrics derived from climate projection data, were determined to support asset impact assessments in later stages.	<ul style="list-style-type: none"> – Improve accessibility to the latest climate datasets, especially related to climate change projections. – Recognise how spatial data can enhance understanding of the impact of extreme weather events and associated consequences, including flow-through impacts. – Improve understanding and ability to incorporate likely event impacts on assets into planning processes. – Support lessons learned from past events through the collation and presentation of previous weather data. – Aid both short and long-term planning, considering social vulnerabilities, financial implications, etc. – Utilise project outputs as an advocacy mechanism to influence best practice policy and resource allocation.
National Greenhouse and Energy Reporting Scheme	Clean Energy Regulator	Public administration and safety	The National Greenhouse and Energy Reporting (NGER) Scheme is a unified national framework for reporting company information relating to greenhouse gas emissions, energy production and energy consumption. These reporting requirements apply to companies which reach certain thresholds of emissions and energy use. Geospatial information is crucial to the NGER Scheme as it enables mapping of emission sources, monitoring and compliance, risk assessment and response, as well as tracking spatial trends and patterns. The Department of Climate Change, Energy, the Environment and Water provides environmental and geospatial information products, advice, analysis and tools which allow for interactive mapping, reporting and analysis.	<ul style="list-style-type: none"> – The National Greenhouse and Energy Reporting (NGER) Scheme is a unified national framework for reporting company information relating to greenhouse gas emissions, energy production and energy consumption. These reporting requirements apply to companies which reach certain thresholds of emissions and energy use. Geospatial information is crucial to the NGER Scheme as it enables mapping of emission sources, monitoring and compliance, risk assessment and response, as well as tracking spatial trends and patterns. The Department of Climate Change, Energy, the Environment and Water provides environmental and geospatial information products, advice, analysis and tools which allow for interactive mapping, reporting and analysis.
Climate Risk Webmap	Spatial vision	Public administration and safety	Users can enter their suburb, local government area or electorate to determine the risk of fires, floods, and extreme wind, based on low, medium, and high emission scenarios and specified timelines (2030, 2050 and 2100).	<ul style="list-style-type: none"> – Provides all Australian homeowners and property developers a tool to assess the risk of extreme weather vulnerability by location – A compelling, graphic representation of the financial, insurability and societal implications of not committing to significant carbon emission reduction targets
SECCA	Spatial vision	Public administration and safety	Funded by the Minderoo Foundation and undertaken in collaboration with the South East Councils Climate Change Alliance (SECCCA), the Enhancing Community Resilience Project set out to help nine Melbourne municipalities better prepare for current and future climate changes by supporting the building of community resilience to climate impacts.	<ul style="list-style-type: none"> – Development of a holistic modelling framework linking spatial analysis with social science insights to map population climate vulnerability. – Implementation of a Vulnerability Assessment Methodology considering community assets, sensitivity factors, and existing mitigating factors. – Improved community-led responses and government decision-making, including provision of new or improved services and facilities for communities before, during, and after extreme weather events. – Creation of a Project Process Guideline to support replication of vulnerability analysis in different geographic areas across Australia.

Case study	Organisation	Principal Sector	Description	Impact
Embedding climate adaptation in Agriculture in North East Victoria	Spatial vision	Public administration and safety	Report impacts of climate change and the critical factors which will impact on the performance of six agricultural sectors under current and projected climate change	<ul style="list-style-type: none"> Increased capacity of agriculture systems, related communities and local government to adapt to significant changes in regional climatic conditions Regionally specific climatic data available for six agricultural industries to support strategic planning for agriculture
Dashboard for Environmental mapping	Spatial vision	Public administration and safety	A dashboard that allows for mapping of reference layers with information on maritime boundaries, sedimentary compartments, socioeconomic factors, catchment areas, environmental information (protected areas, regions, carbon stock)	<ul style="list-style-type: none"> Create community engagement
Geoscape Australia Leveraging Property Intelligence for a Net Zero Future	Geoscape	Public administration and safety	Geoscape is collaborating with several financial services organisations to provide location data solutions to help them solve environmental problems.	<ul style="list-style-type: none"> Directly measuring climate emissions through blending data on energy consumption/creation, building design, construction materials and their condition will logically result in the highest quality results
South Stradbroke Island shoreline stabilisation	Geoscience Australia	Public administration and safety	The City of Gold Coast Council and Griffith University used DEA Coastlines tools and notebooks on the DEA Sandbox to quantify and describe the effects of coastal management actions at South Stradbroke Island.	<ul style="list-style-type: none"> The study demonstrates how DEA Coastlines can inform future coastal management interventions planned for the region in 2023 and beyond. It illustrates how coastal engineering, artificial walls, and sand-bypassing can stabilise coastal land against erosion while preserving natural water flows.
The Superbank and sand-dredging infrastructure at the Tweed River mouth	Geoscience Australia	Public administration and safety	The compilation of more than three decades of EO data demonstrated how the engineering process – a two-kilometre sand bypass pumping system – saved a popular Gold Coast beach from washing away entirely while at the same time creating the right conditions for surfers to ride 20-second barrels. The DEA products comprehensively demonstrated how erosion and sand build-up problems were solved while creating a perfect surf break.	<ul style="list-style-type: none"> Surfer Today magazine described the Superbank as "sensitive to subtle changes," noting that if the surf break shuts down, tourism in Coolangatta will be affected. Utilising DEA Coastlines and Sandbox products, changes over several years can be measured and used to monitor ongoing management of river and coastal systems.
Australian Marine Information System (AMSIS)	Geoscience Australia	Public administration and safety	The Australian Marine Spatial Information System (AMSIS) is the Australian Government's digital geospatial platform for accessing and visualising official information, including existing use, rights, restrictions, and responsibilities in the maritime jurisdiction. It is designed to support effective marine planning and management by enabling users to understand and manage interactions between activities and make informed decisions that maximise sustainable use of Australia's oceans.	<ul style="list-style-type: none"> AMSIS provides direct economic, environmental, and social benefits to Australia Since 2022, AMSIS has been critical to the development of Australia's offshore wind industry which forms a key component of Australia's transition to net zero AMSIS improves transparency and supports all stakeholders make informed decisions AMSIS has been a fundamental tool supporting community consultations in Gippsland, Hunter, Southern Ocean, Bass Strait and Illawarra regions. Presenting information in a simple, easily consumed and understood form that helps increase transparency and public confidence, diffuse tensions between competing interests and increase understanding of existing use, rights, restriction and environmental considerations.
Australian Hydrological Geospatial Fabric	BOM	Public administration and safety	They are an active partner in the Australian Climate Service, or ACS for short. The ACS was established last year as a virtual partnership, bringing together expertise and data from the ABS, the Bureau of Meteorology, CSIRO, and Geoscience Australia. The role of the ACS is to help the government, and the community better understand the threats posed by natural disasters, including those that have been intensified by climate change, and limit their impacts now and in the future.	<ul style="list-style-type: none"> The Australian Hydrological Geospatial Fabric (Geofabric) is a specialised Geographic Information System (GIS). It identifies the spatial relationships of important hydrological features such as rivers, lakes, reservoirs, dams, canals and catchments. By detailing the spatial dimensions of these features, models can be developed to show how water is stored, transported and used through the landscape.
Coastal Climate Change Impact Assessment	Spatial vision	Public administration and safety	The approach evaluated the exposure to anticipated change, sensitivity of the coast to these exposures and the adaptive capacity of the coast based on engineered and natural features that mitigate potential impacts.	<ul style="list-style-type: none"> The outputs of this work provided a spatial representation of the Victorian coast and associated coastal assets at risk from climate change.

Case study	Organisation	Principal Sector	Description	Impact
				<ul style="list-style-type: none"> – Areas of higher potential impact from coastal erosion vulnerability and inundation factors were highlighted to support the assignment of vulnerability and risk ratings to coastal assets. – These results aim to support planning and implementation of adaptation and mitigation activities. – They also facilitate the establishment of targeted monitoring programs and identify regions for more detailed and focused local coastal hazard assessments.
AquaWatch	CSIRO	Public administration and safety	353An integrated ground-to-space water quality monitoring system Together with our partners, we are co-designing and building the AquaWatch system of technologies to monitor water quality with real-time data and predictive analysis. The system will use an extensive network of Earth observation satellites and ground-based water sensors to monitor the quality of Australia's inland and coastal waterways. Data from both the in-situ water sensors and sensors on the satellites, will then be integrated at a central data hub where CSIRO's capability in data analysis and predictive modelling can provide forecasts a few days ahead.	<ul style="list-style-type: none"> – AquaWatch will support better water quality management across Australia and the world with accurate monitoring and forecasts providing early warning of harmful events such as toxic algal blooms, blackwater and runoff contamination.
Drones	MPDI	Public administration and safety	Sea cucumbers (Holothuroidea or holothurians) are a valuable fishery and are also crucial nutrient recyclers, bioturbation agents, and hosts for many biotic associates. Their ecological impacts could be substantial given their high abundance in some reef locations and thus monitoring their populations and spatial distribution is of research interest. Traditional in situ surveys are laborious and only cover small areas but drones offer an opportunity to scale observations more broadly, especially if the holothurians can be automatically detected in drone imagery using deep learning algorithms. We adapted the object detection algorithm YOLOv3 to detect holothurians from drone imagery at Hideaway Bay, Queensland, Australia	<ul style="list-style-type: none"> – Successfully detected 11,462 out of 12,956 individuals over 2.7 hectares. – Achieved an average density of 0.5 individual per square meter. – Tested various hyperparameters to determine optimal detector performance, resulting in 0.855 mean Average Precision (mAP), 0.82 precision, 0.83 recall, and 0.82 F1 score. – Found that as few as ten labelled drone images were sufficient to train an acceptable detection model, achieving 0.799 Map. – Results demonstrate the potential of using small, affordable drones for direct implementation in operations.
Environment water and climate change	CSIRO	Public administration and safety	AquaWatch	<ul style="list-style-type: none"> – Water quality monitoring
Shared environmental analytics facility (SEAF)	WA Marine Science	Public administration and safety	Shared data on environmental metrics including a spatial dimension	<ul style="list-style-type: none"> – Monitoring – Savings to government regulators and better environmental regulation
Regional and National Scale Airborne Electromagnetic (AEM) Data for Groundwater	Geoscience Australia	Public administration and safety	At national and regional scales, there is limited information available to understand the hydrogeology of a groundwater systems to inform the system behaviour and subsequent management practices to be adopted. The cost of drilling and acquiring data from additional bores is cost prohibitive	<ul style="list-style-type: none"> – Apt governance and management of a natural asset like a regional groundwater system may not have a direct economic impact. – However, improved understanding of a groundwater system's hydrogeology contributes to greater economic clarity and certainty by appreciating the costs of utilising, managing, and not depreciating a natural resource asset. – Accurate positioning of hydrogeological data, such as through AEM data, helps inform the spatial distribution and understanding of the groundwater system. – Inferences made from AEM data can increase understanding of how a groundwater system behaves, including potential impacts from groundwater use that could depreciate the groundwater asset for all users. – This improved understanding facilitates cost-effective responsible management of the groundwater asset by both users and asset managers.

Case study	Organisation	Principal Sector	Description	Impact
Robe coastline	Council of Robe	Public administration and safety	As part of an evidence-based approach to make long term decisions that positively impact the community, the District Council of Robe has been engaging with a number of different stakeholders to conduct a wider research program around coastline management. Veris were engaged as part of the program to perform LiDAR mapping of approximately 48 hectares of coastline. The project aimed to develop an accurate spatial model to provide new insights and a foundational dataset for the Council to monitor change over time and better manage the risks associated with erosion, sea level rise, and the interaction with both public and private assets.	<ul style="list-style-type: none"> The resulting spatial model provides a baseline data set that is being used by local government and other key stakeholders to monitor change overtime and make informed decisions that ultimately protect the coastline for the community and future generations, in addition to identifying key risks to the public.
Climate change adaptation project - Public Transport Asset management	Victorian Department of Transport and Planning	Public administration and safety	DTP's Public Transport Division is looking to detail current and projected climate impacts at specific high-risk metropolitan rail public transport sites/locations (20 sites) and their effects on critical asset performance.	<ul style="list-style-type: none"> The project will establish the ability of the group to visualise and update the risk analysis of the 20 locations with a view to expanding the analysis to other sites into the future. In addition, work is underway to look at risk mitigation strategies associated with the risk analysis including the design and implementation of flood walls and other preventative measures.
ELVIS	Geoscience Australia	Public administration and safety	NLIB's Elvis infrastructure, developed by NLIB within GA, is a cloud-based system which allows users to easily discover elevation and bathymetry data for your area of interest. It brings together open data from Commonwealth, state, and territory governments, making it accessible from a convenient central source.	<ul style="list-style-type: none"> Geoscience Australia regularly surveys Elvis users to assess benefits to the economy, society, and environment. Users report financial benefits from their last Elvis elevation order. Statistically relevant benefit estimate gained from user feedback. Elvis's elevation delivered 145,000 orders in 2023. Financial benefit to users estimated at \$621 million annually for the Australian economy. Orders on Elvis Elevation growing at approximately 20% each year (based on average of last 4 years)
Unravelling the mysteries of Norfolk Island's tiger sharks	ESRI	Public administration and safety	<p>Research to find out how tiger sharks and waste management interrelate around the waters of Norfolk Island.</p> <p>In this study, acoustic tracking was used to answer these questions:</p> <ul style="list-style-type: none"> How much do sharks use Norfolk Island and Headstone Bay? Do they remain around the island year-round - or do they move to other regions? How are their movements related to organic waste dumping? <p>To answer these questions 16 acoustic receivers were deployed around Norfolk Island. A total of 42 tiger sharks (so far) were tagged with acoustic transmitters.</p>	<p>This research will allow the assessment of:</p> <ul style="list-style-type: none"> the importance of the Norfolk Island to the tiger shark population. if and how much tiger sharks rely on organic waste (i.e. cows) for their diet. whether dumping influences tiger sharks' movements and distribution. For example, if their movements have altered since dumping was reduced and the likelihood of future change, if organic waste dumping ceases entirely.
eReefs forecasting and modelling program	CSIRO	Public administration and safety	eReefs is the world's largest reef forecasting and modelling program that was developed by CSIRO in partnership with the Great Barrier Reef Foundation, the Australian Institute of Marine Science, the Bureau of Meteorology and the Queensland Government. The program combines satellite technology with powerful models and machine learning to forecast the condition of the reef, including water quality and bleaching.	<ul style="list-style-type: none"> eReefs provides near real-time information and innovative tools, while promoting sustainable practices and informed decision-making. In 2017, ACIL Allen estimated that the value to the community of spatially enabled monitoring programs could be of the order of \$150 million to \$200 million to the communities that live contiguous to the reef.
SavBat	Spatial vision	Public administration and safety	Savanna Burning Abatement Tool, is a web-based application that automates the calculations required to estimate carbon credits for savanna fire management projects conducted under the Emissions Reduction Fund.	<ul style="list-style-type: none"> States there is a significant time and cost reduction however does not specify any amount
K2Fly natural resource governance	Frontier SI	Public administration and safety	K2fly provides enterprise Software-as-a-Service (SaaS) solutions for technical assurance, resource and mineral governance. K2fly's cloud-based platform assists environmental rehabilitation activities. The platform helps community, geotechnical, and management teams improve compliance. It provides the visibility to reduce risks and	<ul style="list-style-type: none"> A one- to 2-1-2-millimetre precision detection of land surface deformation over time using EO data allows for highly accurate monitoring and management of mine rehabilitation.

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			supports accurate disclosure in the dams and tailings space, as well as improvement in relinquishment, tracking of closure and achievement of the rehabilitation targets associated with rehabilitation and closure.	
Victoria Unearthed	Victoria Department of Environment, Land Water and Planning	Public administration and safety	Using DELWP's MapShare infrastructure, the web-mapping site was designed to display historical land uses and assist with the identification of potentially contaminated sites. The development included refining the map layers, configuring Geocortex tools and developing an ongoing system administration document.	<ul style="list-style-type: none"> – Providing comprehensive historical contamination data from government agencies is crucial to increasing community awareness of environmental issues. – Empowers people to access information on past business activities and potential contamination. – Sharing public data supports government transparency and keeps individuals informed and involved. – Integrating spatial data overlays, such as up-to-date data from the Environment Protection Authority Victoria (EPA) on land and groundwater contamination, along with planning Scheme Overlays and Sones, offers a complete picture. – This approach aids in identifying potentially contaminated sites and enables proactive measures for environmental protection and cleanup.
Government services, health and social services				
ABS's role in providing geographically categorised data	Australian Bureau of Statistics	Public administration and safety	The Census of Population and Housing findings inform government policy, funding allocation, and planning for public services, ensuring that resources are directed where they are needed most, and that communities' needs are accurately represented. A key component of the Census is the categorisation and collection of data according to the Australian Statistical Geography Standard (ASGS), which is the classification of Australian geography into areas by population size, urban centres and localities, remoteness and more (ABS, Jul2021-Jun2026). The ASGS is a social geography, developed by the ABS every 5 years to reflect the location of people and communities. It is used for the publication and analysis of Australia's official statistics and a wide range of other data	<ul style="list-style-type: none"> – ABS Census data are released in geospatially native formats on the geographic boundaries defined through the Australian Statistical Geography Standard, allowing governments and communities to interact with statistics from the neighbourhood to the national level. It was estimated that the Census generated \$6 for every \$1 spent on its activities (Lateral Economics, 2019). The report, Valuing the Australian Census, concludes that Census data plays a critical role in improving Australia's economic and social infrastructure.
Digital Atla of Australia	Geoscience Australia/Australian Bureau of Statistics	Public administration and safety	In May 2024, Geoscience Australia was excited to launch the Digital Atlas of Australia, the Australian Government's new geospatial platform. The Digital Atlas is transforming how we access and use data by providing hundreds of curated national datasets in a central platform. Using location as the connecting thread, the Digital Atlas brings together data on Australia's geography, people, economy and the environment from trusted sources across government and increasingly industry and academia.	<ul style="list-style-type: none"> – The Digital Atlas of Australia is a groundbreaking geospatial platform that is transforming the way data is accessed and used for smarter place-based decisions. By bringing together hundreds of curated, trusted national datasets in a single location, the Digital Atlas is enabling users to explore, analyse and visualise data on Australia's geography, people, economy and the environment by location.
Mapping Indigenous place names in West Wyalong	ESRI	Public administration and safety	A project running across the Bland Shire Council is reconnecting the community with traditional Wiradjuri language and custodians of the area. Large interactive signs were installed at four sites to share the traditional name and meaning of the area. The signs connect users to digital maps and interactive StoryMaps developed using Esri's Geographic Information Systems (GIS) technology.	<ul style="list-style-type: none"> – The signs are expected to strengthen our relationships in the community and give us pause to recognise and celebrate the Wiradjuri history of the land, give us an idea of what the area is traditionally valued for, to connect on and link all of us with the traditional meaning of the land, as well as giving context and meaning to Wiradjuri language across the Riverina region.
City of Sydney Tree Mapping	ESRI	Public administration and safety	The street tree master plan consists of several key components. The main element is the interactive map, where you can select a street and drill down to find the species proposed for footpaths, constrained areas, potential planted traffic islands and medians. It also links to wider precinct information that gives you more detail on the environment and characteristics of that local area	<ul style="list-style-type: none"> – The map and tree plan aim to ensure: – support improvements in our community's health and wellbeing are resilient, valued, and attractive places. – contribute to sustainable outcomes and mitigate urban heat island effects. – help to conserve, support, complement and restore our natural environments. – help to minimise energy consumption and reduce emissions.

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Mapping emergency medicine and hospital network	Spatial vision	Public administration and safety	A customisable, geographic map of Emergency Medicine and Training Program hospital network	<ul style="list-style-type: none"> Provides a cost effective, customisable geographic visualisation of hospitals involved in the EMET program across Australia
1800 My Options	Spatial vision	Public Administration and safety	An interactive map displaying women's health service provider locations around Victoria and its state borders	<ul style="list-style-type: none"> User-friendly online application for women's health services Ensures safe and discreet access to health information Centralised repository of comprehensive service information
City of Kingston	Spatial vision	Public administration and safety	Development of a geospatial strategy for Kingston Council Victoria - "to deliver the vision of Geospatial capabilities efficiently to support strategic, operational and community-orientated services and inform decisions across Council."	<ul style="list-style-type: none"> Check with the council
Cohga Case Study Cultural Heritage	Cohga	Public administration and safety	Aboriginal and Torres Strait Islander Cultural Heritage Database and Register that is easier to use, more secure and more efficient.	<ul style="list-style-type: none"> \$2,000,000 saving in development costs Saving of 2.5 FTE 70% improvement in processing time Greater access, security, and efficiency
Women's health atlas	Spatial vision	Public administration and safety	Map based presentation of health outcomes by gender in Victoria	<ul style="list-style-type: none"> Transforms static data into a dynamic and engaging resource User-friendly for a non-technical audience Accessible on desktop PCs and tablet devices Standardised views provide reliable data on women's health services
Watchit Demonstrator	Numaps	Public administration and safety	The system will be cloud-based and will integrate data from several remote sources. Users will interact with the system via a browser-based application which gets downloaded from the NuMaps application server into the user's browser of choice (browser support TBD). Access to the remote resources will be via a variety of standard and/or public program interfaces (APIs). The system will also be developed in a mix of server-side and client-side software languages and platforms. All NuMaps held data will reside in a standard and/or open-source Relational Database platform.	<ul style="list-style-type: none"> Provided a real-time weather event alert system. Initially targeted towards the private sector Insurance Broker industry Helps determine insured assets in jeopardy of damage during weather events. Allows users to replay saved predictions post-event. System to be interfaced with user's data resources securely. Enables analysis of risk o property assets associated with each weather event
Local government Planning approvals	Land Use Victoria	Public administration and safety	Automated planning certificates and modelling for future development through ePlan and eComply	<ul style="list-style-type: none"> The tool could halve plan assessment timeframes.
Using Geoscape's predictive AI to assist responders self-serve when responding to the census online.	Geoscape	Public administration and safety	Geoscape Predictive API service, an address verification service that embeds in online forms. The Predictive API helps with the autocompletion of the address field in the form, ensuring the address data stored in the system is structured and verified against official sources. It reduces the number of keystrokes required, speeding up form completion and reducing customer dropout. Geoscape Predictive API service, an address verification service that embeds in online forms. The Predictive API helps with the autocompletion of the address field in the form, ensuring the address data stored in the system is structured and verified against official sources. It reduces the number of keystrokes required, speeding up form completion and reducing customer dropout.	<ul style="list-style-type: none"> To help the ABS achieve its goals, Geoscape provisioned and deployed a secure, tested, single-tenancy Address Auto-suggest API service in a sovereign AWS environment. Geoscape partnered with PwC for the form integration and built a proof-of-concept for Census Readiness deployment, providing a service that could scale at a moment's notice with security safeguards in place in the case of a potential distributed denial of service (DDoS) event.

Case study	Organisation	Principal Sector	Description	Impact
Address API provides accurate addresses to EWON, improving service delivery	Geoscape	Public administration and safety	Geoscape's Predictive Address API seamlessly plugged into EWON's new online complaints form, which launched in November 2018. With predictive text and auto-complete functions, the new form suggests possible address matches from verified data as customers type. The API also prevents customer data entry errors from entering the system.	<ul style="list-style-type: none"> – Significant reduction in the number of address errors entered in EWON's online form – Addresses are more accurate and mapped to a location – Opens the door to easier analysis and more robust reporting – Better targeted service delivery can now be conducted
COVID border pass	Geoscape	Public administration and safety	Enabling a rapid COVID border pass solution. This involved developing new pipelines to conflate and prepare addressing data while integrating it with G-NAF. It was a new way of moving from scaled on-premises solutions to cloud-based solutions, so the APIs would work seamlessly with new cloud-based Border Pass application platforms for the public to use directly.	<ul style="list-style-type: none"> – Made it easier for the public to apply for border passes – The National location data enabled people to interact better with governments – More than 500,000 permits had been issued with a customer satisfaction rating of 96.9% (2020)
Australian Analytical Statistics	ASA	Professional services	Employment of Neurodiverse people	<ul style="list-style-type: none"> – Social opportunities for neurodiverse people in the geospatial field
Exploring heritage listings online	Tasmanian Government	Professional services	The Tasmanian Heritage Register contains a range of examples of many different types of heritage. Sharing this information online has been a long-term strategic goal for the Tasmanian Heritage Council. It provides better service and increases public awareness to the community. This model could be applied to other Tasmanian government registers. The LIST allows users to view and create maps from hundreds of authoritative spatial datasets and incorporating a Tasmanian Heritage Register layer on this platform will be invaluable for many of our clients. - Brett Torossi, Tasmanian Heritage Council chair	<ul style="list-style-type: none"> – Improved awareness, transparency, and public education – Online, self-service access to the Register allows property owners and managers to understand why a place is heritage listed, the extent of the listing, and the features needing protection, increasing transparency and appreciation.. – Better, more accurate and more consistent Heritage information – Digitalisation of the Heritage Register improved spatial accuracy from 20% to 95% and eliminated manual processes, ensuring consistent search results. – Efficiency gains – The online Register reduced the response time for conveyancer requests from over 20 minutes to less than 5 minutes per request, a 90% improvement, freeing Heritage staff for other priority tasks.
Flood Awareness Online - Brisbane	ESRI	Public administration and safety	Brisbane City Council is providing the latest available flood maps, tools and information to ensure residents and visitors are safe, confident and ready.	<ul style="list-style-type: none"> – Easier for people to visually understand flooding and how it may affect where they live – Digestible flood maps, tools and information to ensure residents
A study of the economic value of G-NAF	Geoscape, Lateral Economics	Public administration and safety	To understand how users apply G-NAF data, the value they derive from it, and any improvements they would find beneficial, LE asked Geoscape to identify a representative sample of major user types. Some of these users, such as AEC and the Queensland Department of Resources, were also providers of G-NAF source data. Given the project's timeframe and budget, surveying all users was infeasible.	<ul style="list-style-type: none"> – A net benefit of G-NAF of \$1.4-1.6 billion over 15 years (1.4 is base and 1.6 is under optimal)
Sensing Value uses Geoscape location data to design smart cities for Greater Launceston	Geoscape	Public administration and safety	Geoscape partner, Sensing Value, delivers powerful 2D and 3D digital modelling, including new simulation capabilities, to provide strategic insight for the four local councils participating in the project – a collaborative endeavour of the Tasmanian Government, the University of Tasmania and the cities of Launceston, Meander Valley, West Tamar and Georgetown.	<ul style="list-style-type: none"> – New simulation capabilities – Provide strategic insight for the four local councils participating in the project – Helps tackle long-term issues concerning social equity, education attainment and economic opportunity
Data on demand simplifies noise modelling	SLR Consulting, Geoscape	Public administration and safety	Specialised environmental consultancy, SLR Consulting, requires reliable data on building outlines and heights for noise and air quality modelling, as well as visual amenity assessments, to forecast the impact of major facility and infrastructure projects. To achieve this, SLR Consulting accesses Geoscape's ready-to-use spatial data on demand through a flexible data plan.	<ul style="list-style-type: none"> – Subscription access to Geoscape spatial data simplifies noise modelling for SLR Consulting.

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NSW Point makes finding your local council easy	NSW	Public administration and safety	DCS Spatial Services, a division of the Department of Customer Service, provided NSW Point Address validation API services as a solution to the Office of Local Government's (OLG) 'Find My Council' online search facility.	<ul style="list-style-type: none"> 30000 users per month using the search tool
DCS Spatial Services	Geoscape	Public administration and safety	Geoscape APIs streamline Government's service delivery in NSW. The data encompasses all of Australia and is derived from consistent sources across all jurisdictions, with daily updates through established supply arrangements with each Australian state and territory. The APIs facilitate real-time machine-to-machine verification of address data.	<ul style="list-style-type: none"> Reduction in cost and effort associated with the development and maintenance of web applications Enables trends to be identified better to inform decision making De-identifies data so that no personal details are used
How address verification technology helps ACT Government reduce costs	Geoscape	Public administration and safety	The Australian government built Geoscape's address verification APIs into its online forms. The Predictive API uses predictive text and auto-complete functions and suggests possible address matches as people type. Customers don't need to complete their full address. They simply choose from the "Do you mean this address?" suggestions.	<ul style="list-style-type: none"> Reducing operating costs through interdepartmental integration Creating and producing trustworthy data Fast development and transition to automation
Defence				
Capability demonstrator	SmartSat CRC	Defence	The Indo-Pacific Connector (IPC) mission outlines a vision for incorporating SmartSat technologies into a comprehensive system capable of providing advanced communications and situational awareness.	<ul style="list-style-type: none"> The 2020 Defence Strategic Update emphasised the increasing congestion and contestation in space. Australia plans to introduce new space capabilities from 2025, including enhanced communications, earth observation, and space domain awareness. These updated space capabilities aim for greater control by the Department of Defence in partnership with Australian industry.
GEO INT	Dept of Defence	Defence	By 2030, Defence will operate within a well-balanced ecosystem of GEOINT partnerships that allows it to draw on the best available data, technology, and expertise to deliver leading-edge GEOINT capability. Defence will strengthen internal relationships to improve the use of GEOINT in Defence capabilities. Closer engagement with partners will be enabled through Defence's delivery of physical and ICT infrastructure that allows for data sharing and collaboration across multiple security classifications.	<ul style="list-style-type: none"> Benefits to industry engagement
Quantum-assured position, navigation and timing	Dept of Defence	Defence	Position, navigation and timing data are essential for the command and control of deployed forces. These systems enable the sharing of real-time operational and logistical information and for the placement, navigation and synchronisation of Defence assets. The ADF and coalition partners must have assured position, navigation and timing (PNT) capabilities that would enable uninterrupted operation in GNSS-degraded or denied conditions. This includes in contested environments and complex terrain where obtaining satellite reception is challenging.	<ul style="list-style-type: none"> The ADF's assured PNT capability will integrate emerging quantum technologies with conventional solutions to provide sensitivity, accuracy and precision over extended timeframes and under a range of operationally relevant conditions in the absence of GNSS signals <p>Opportunities include:</p> <ul style="list-style-type: none"> Develop and miniaturise quantum clocks, accelerometers, magnetometers, and gravimeters to enhance precision and accuracy. Advance classical technologies to improve sensitivity, accuracy, and reduce drift over long durations. Combine quantum and classical approaches for better timing and navigation systems.
Open space virtual walk through for Defence Estate	Dept of Defence	Defence	As the Commonwealth's largest landholder, the Australian Defence Estate must manage various construction sites and projects across their 25,000 buildings. Conventional manual inspections of these sites are time consuming and provide limited insight.	<ul style="list-style-type: none"> The use of virtual walkthroughs is 20x faster and more complete than manual solutions and has been proved to save on travel time, cost and generate carbon emission savings as a result.

Case study	Organisation	Principal Sector	Description	Impact
Planning, construction, and digital twins				
Greater Hobart Digital Twin	Hobart City Council	Public administration and safety	The Digital Twin will support the Hobart City Deal's objectives by providing a platform where the Greater Hobart councils' data sets are combined into a single borderless environment. There have been growing community expectations for more accessible, decision ready, immersive applications. Additionally, increasingly accessible data from Smart city initiative and various other sources required need a single point of integration and deliver.	<ul style="list-style-type: none"> Integration of a visual, 3D immersive environment for planners, developers, and the public Facilitates enhanced understanding and transparency regarding existing and proposed developments. Leads to increased community engagement and acceptance. Shortens planning timelines. Benefits tourists by offering a game-like experience to locate infrastructure, plan routes, and explore destinations. Digital Twin initiative delivers significant economic advantages. Efficiency gains in asset management Boosted tourism. Improved resilience to climate impacts
SmarterWX	ESRI	Professional services	<p>Technology to streamline and optimise the lodging, management, and response to dig enquiries.</p> <p>Using the BYDA API, you can automate the process of submitting jobs to the referral service, improving productivity and accuracy.</p>	<ul style="list-style-type: none"> SmarterWX Sentinel provides users with real-time dig and enquiry activity dashboards. Integration of all key Before You Dig (BYDA) data with existing GIS is seamless. Settings can be self-configured to define areas of interest. Users can update contact details and manage enquiry reception. Facilitates exploration of new integration methods for BYDA into services
Queensland Globe	ESRI	Professional services	Mapping and data online interactive tool, to explore Queensland maps, imagery, and other spatial data.	<ul style="list-style-type: none"> Imagery Spatial data Land valuations. Bore reports. Watercourse identification in Queensland
NSW Digital Connectivity Index	ESRI	Public administration and safety	<p>NSW Digital Connectivity Index (Connectivity Index) is a state-wide measure designed to assess digital connectivity experience, providing reliable and consistent data to government agencies, businesses, and communities.</p> <p>The Connectivity Index is a visualisation tool that measures the quality of digital connectivity across NSW through three key elements: access, affordability, and demographics.</p>	<ul style="list-style-type: none"> The tool assesses connectivity using metrics like coverage, speeds, and affordability. Utilises both public and commercial data. Evaluates connectivity in specific areas, considering social factors and affordability relative to income. Indicates possible digital activities on mobile and fixed networks. The Connectivity Index provides reliable data to government agencies and communities. Aids in decision-making regarding priorities, digital inclusion initiatives, and investments in digital infrastructure at the state level

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FSDF Case Studies	NSW	Public administration and safety	Critical infrastructure benefits various sectors including cadastral systems, emergency services, electoral districts, national collaboration, and biosecurity. It reduces costs, improves consistency, enhances decision-making, fosters innovation, and facilitates communication. For example, cadastral systems boost investor confidence and productivity while reducing transaction costs. Emergency services use critical infrastructure for flood mapping, grant validation, and locating affected areas. Electoral districts benefit from boundary redistribution for fairness. National collaboration, like during the 2019/20 bushfires, improves disaster management. Critical infrastructure also aids biosecurity efforts by surveying and eradicating invasive species through mapping technologies.	For Land, Parcel, and Property - Best use of cadastral system could bring benefit of 4.7 billion
Victorias DCM and Digital Transformation program	Land Use Victoria and Spatial vision	Public administration and safety	Digitisation and alignment of the Australian state of Victoria's property boundaries to produce a more accurate "single source of truth", reducing costs and boosting productivity across both the public and private sectors, as well as increasing information accessibility.	<ul style="list-style-type: none"> - A clear plan and business case for digital enhancement of cadastral mapping - Technical methodology and architecture for transformation - Large-scale delivery of cadastral adjustments from common data standards format plan and survey data to create an adjusted, integrated cadastral fabric - Future-ready for automation and rapid updates with common data standards format plan representation of the cadastral fabric - Provide a stronger foundation for emerging 3D and 4D visualisation in modern geospatial applications - Ensure a coordinated and consistent approach to planning future policies, legislation, standards, models, and research
GIS in energy systems	ESRI	Professional services	Energy Queensland's adoption of Esri Australia's ArcGIS Utility Network Model (UNM) in August 2019 marked a significant milestone in the company's modernization efforts. By integrating Energex and Ergon data using this cutting-edge technology, Energy Queensland embarked on a transformative journey towards enhancing its geospatial capabilities. The UNM represents a departure from traditional data frameworks, offering a robust foundation for navigating the evolving landscape of renewable energy technologies. This strategic move positions Energy Queensland at the forefront of innovation, poised to effectively manage the complexities of a rapidly changing energy sector.	<ul style="list-style-type: none"> - Savings in integrated solutions, unified data sets, process, and workflows
Ambient Maps Geoscape Buildings	Geoscape	Public administration and safety	Ambient's new national 3D transport noise map relies on the accuracy of Geoscape Buildings data.	<ul style="list-style-type: none"> - Ambient aimed to provide actual noise exposure levels rather than simplistic estimates. - Geoscape Buildings data derived from satellite and aerial imagery offered greater accuracy, incorporating building areas, heights, land zoning, and addresses on a consistent, national scale. - With this increased accuracy, the 3D noise map supports various use cases: - Guides automatic valuation models (AVMs) in property pricing - Allows health studies to attribute exposure levels to noise - Guides government planning in constructing new, noise-sensitive developments

Case study	Organisation	Principal Sector	Description	Impact
Buildings data increases efficiency in wind modelling by reducing manual drawings	Geoscape	Public administration and safety	Buildings data increases productivity in wind modelling	<ul style="list-style-type: none"> Producing data that fits and improves WindTech's processes.
Geoscape spatial data reduces cost of noise modelling by 50% for GHD	Geoscape	Public administration and safety	Geoscape helps GHD reduce cost of noise modelling by 50%	<ul style="list-style-type: none"> Geoscape to be used in future GHD noise modelling projects, especially in dense urban settings where thousands of buildings may need to be analysed.
The University of Queensland	Geoscape	Public administration and safety	The University of Queensland leverages Geoscape Custom Data to research land use.	<ul style="list-style-type: none"> Postprocessing to take the digital Cadastre and Queensland valuation and sales database into a single product gives researchers quick access to ready-to-use data, saving time and effort.
Altavec White Paper	Altavec	Public administration and safety	Energy utility asset inspection program	<ul style="list-style-type: none"> The cost of inspections was reduced by up to 30% compared to traditional methods due to the reduced need for specialised personnel and equipment and 40% increase in the number of assets inspections and improved safety outcomes.
DPLXML to SCIMS	NSW	Public administration and safety	DCS Spatial Services' project to capture and store registered Deposited Plans in the LandXML format started in 2015 and to date, has captured over 1 million Deposited Plans (DP's) including over 4.4 million land parcels.	<ul style="list-style-type: none"> Improved accuracy of the Digital Cadastral Database (DCDB) More accurate survey marks to better enable infrastructure development (large and small) Improved positioning of utilities and underground services Reduced turn-around times from lodgement of plans to availability of data through SCIMS Enablement of easier compliance with the Surveying and Spatial Information Regulation 2017, thus reducing time and cost of acquiring datum for preparation of Deposited Plans, in turn reducing cost to the general community
Gravity Model	NSW	Public administration and safety	A new gravity dataset will significantly improve on the previous, outdated dataset which had distinct limitations, and included a combination of land-based, satellite and airborne gravity data collected over several decades. Many of these datasets predate GNSS positioning (pre-1992) and are of low spatial accuracy. The Live NSW Gravity Model covers the entirety of NSW and ACT with a geographic extent of over	<ul style="list-style-type: none"> Having the highly accurate gravity dataset will also positively impact and improve: Exploration and management of groundwater stores Bushfire and natural disaster recovery efforts Large infrastructure projects Property, construction, agriculture, mining, and surveying Flood mapping Future resource investment opportunities, potentially aiding regional jobs and economic growth across NSW Expand discoverability of high-value minerals such as gold and copper Reduce risks associated with new mine sites
School Infrastructure	NSW	Public administration and safety	Combined with other technologies, the Live NSW Spatial Digital Twin (SDT) program will support the digitisation and automation of the business case process	<ul style="list-style-type: none"> 45% reduction in time SINSW estimates savings of \$202m over 10 years, in avoided strategic business case costs. The productivity benefits and avoided costs in this pilot alone are an estimated \$4.4m
Addressing data and Place Names in Australia	ICSM	Public administration and safety	Important for search and rescue, government planning and to society in general	<ul style="list-style-type: none"> Identified opportunities from the outcomes include: Administrative savings from improved address data Correct address data can save lives. Simplified address assignment procedures for developers Streamlined address data flows, with a need to only enter an address once, simplifying:

Case study	Organisation	Principal Sector	Description	Impact
				<ul style="list-style-type: none"> – buying a home, and – updating your address for government payments and services.
Visualising big construction	Here	Professional services	Using Lidar data to visualise big construction projects	<ul style="list-style-type: none"> – Better project control – Less disputes – Lower costs of compliance
Economic impact of NPIC	Geoscience Australia	Public administration and safety	Agriculture, construction, mining, surveying, and mapping	<ul style="list-style-type: none"> – Many case studies
Economic impact of SouthPan	Geoscience Australia	Public administration and safety	Agriculture, aviation, construction, consumer, maritime, rail, resources, road, spatial, and utilities	<ul style="list-style-type: none"> – PV\$820m in feed and fertiliser savings for farmers due to enhanced pasture utilisation from SBAS-enabled virtual fencing. – PV\$577m in fuel and labour savings for mining haul trucks due to faster speeds enabled by more accurate collision avoidance systems
PlanSA portal	Dept of Trade and Investment SA	Public administration and safety	Plan SA incorporates an online policy library that queries data against geospatial rules and planning layers, online lodgement, and integrated development application processing systems to deliver the only single comprehensive planning scheme in Australia.	<ul style="list-style-type: none"> – Provides central access to information through registers, geospatial mapping and subscription services – Allows customers to receive direct notifications about developments occurring in their local government area (LGA) – Allows SA to shape their community and have their say on proposed changes to planning policies or development applications
Digital twin Victoria	NPIC Report, Land Victoria	Public administration and safety	Digital Twin Victoria captures the dynamics of natural and built environments through an accurate digital representation of the state. It is designed to replicate Victoria's topography in a three-dimensional model that uses highly accurate spatial data obtained from precise positioning technologies. Drawing on multiple datasets, including a massive aerial library provided by the Coordinated Imagery Program, trillions of datapoints are combined into a single ecosystem	<ul style="list-style-type: none"> – Government agencies use geospatial analysis to inform urban planning and services policies. – Real-time monitoring and scenario modelling, facilitated by digital twin technology, assess development proposals, and optimise investment timing. – Introduction of a novel program to capitalise on advanced technologies like Digital Twin, AI, and sensor data to transform planning processes. – Program aims to streamline regulatory processes, reduce red tape, and expedite regulatory compliance for developments. – eComply pilot program demonstrated significant benefits, cutting building approval times, and generating over AU\$30 million in savings. – Digital twin technologies provide environmental insights for managing bushfires, conserving habitats, and mitigating natural disasters. – Real-time data integration allows detailed analysis of areas affected by disasters like the 2011 floods in Northern Victoria. – Digital modelling of vegetation and surface changes aids forestry and habitat management.

Case study	Organisation	Principal Sector	Description	Impact
Great Ocean Road Survey	NPIC report	Public administration and safety	The Great Ocean Road Survey utilised positioning technologies to spatially map the road and its surroundings, forming part of the Coordinated Imagery Program. Completed by the Department of Land, Water, and Planning in October 2020, the survey employed mobile laser scanning (LiDAR) techniques to generate a georeferenced point cloud database along the entire road. This data, combined with high-resolution aerial photography, created a 3D digital model known as a digital twin ecosystem. LiDAR, reliant on positioning technologies and the CORS network, provided detailed topographical information for the survey area. The resulting data was visualised through a gaming engine, generating a 3D model capable of assessing functional and aesthetic factors impacting the built environment, aiding urban planning efforts. Additionally, the model facilitates analysis and comparison over time, enabling insights such as flood effects. Integrated into Victoria's statewide digital twin program and the Vicmap database, this data serves government, councils, emergency services, and other users.	<ul style="list-style-type: none"> NPIC upgraded geodetic networks along the Great Ocean Road, enhancing spatial data accuracy. Improved cadastral information supports property assessments, surveying, and advisory services. NPIC-enabled surveys provide precise mapping for fire prevention, biodiversity conservation, and urban development. Road realignment using this data improves infrastructure management efficiency. Initiative ensures up-to-date information for planning decisions, including 3D road view models for community consultation. Great Ocean Road Survey highlights the value of GPS-guided scanning and contributes to Victoria's cadastral database modernisation.
Professional services	NPIC report	Public administration and safety	In the past, many industries needed to employ spatial experts, typically surveyors or other specialists in the application of positioning technology. With greater access to national positioning infrastructure and improved accuracy, this has changed. Many industries now leverage location as transparently as their other specific professional expertise. This has been made possible not only by important advances in GNSS technologies, but also by access to national positioning infrastructure. The infrastructure is underpinned by the National Positioning Infrastructure Capability (NPIC) program providing free access to a high precision location correction service. Innovations in the GNSS industry range from cheaper, better, easier to use and more accurate receivers, to new positioning infrastructure National Positioning Infrastructure Capability (NPIC) program, allowing users access to higher precision location correction service for free.	<ul style="list-style-type: none"> NPIC caters to diverse professional applications requiring location accuracy. Provides unified correction source for both sub-meter and centimetre-level accuracy needs. Accommodates users' GNSS equipment for various applications. Pipeline engineers utilise GNSS receivers for fault location, while arboriculturists map trees with sub-meter precision. Enhances asset management efficiency. Supports compliance with legislation and aids local councils in precise asset mapping at low costs. Sub-surface utility companies benefit from accurate mapping capabilities. Challenges persist in environments with limited sky visibility. Despite emerging technologies, NPIC remains essential for accurate infrastructure pinpointing amidst evolving landscapes.
Digital transformation program	Land Victoria		<p>LDTP is coordinating delivery seven workstreams, encompassing digital cadastre production and automation (following the completion of the digital cadastre modernisation project), a full legislative and policy review to support digital ways of working, tools and training to support digital examination, ePlan portal enhancements based on stakeholder feedback, open access to digital cadastral data, stakeholder engagement (discussed below), and harmonised standards for rendering digital cadastral surveying data.</p> <p>In recent weeks, LUV has published its intention to introduce mandatory digital lodgement, phased over four years, beginning with requiring surveyors to submit digital cadastral data for Plans of Consolidation from 1 July 2024. Effort across the workstreams is focused on ensuring that LUV will achieve the requisite systems functionality and stakeholder support for this important and pivotal change to the way we handle cadastral information. The Victorian Government is co-developing world-leading technology to help ease the pressure on the Victorian building industry. Through the eComply project, Digital Twin Victoria (DTV) program has partnered with prop tech-startup Archistar to co-develop world-leading, digital building compliance assessment technology.</p>	<ul style="list-style-type: none"> Building design and approval process is paper-intensive and understanding building and planning codes can be complex. First eComply digital assessment solution, Archistar Comply, allows builders, designers, and architects to pre-check 3D building designs against the Small Lot Housing Code. Tool provides feedback on more than 90 complex checks in around 90 seconds. House designers can rapidly make changes before sending plans to a building surveyor for final assessment, cutting up to four weeks off the approval process. Technology helps build future digital workforce capability for building professionals. Immediate visual feedback and compliance reports improve understanding of Code requirements and increase adoption of 3D digital Building Information Modelling (BIM).

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Intelligent water networks	Position magazine		The ArcGIS Utility Network Model (UNM) integrates Energex and Ergon data, employing a novel data framework superior to previous geospatial solutions. It is hailed as the industry standard for transitioning to renewable technologies, offering enhanced functionality across extensive datasets at various resolutions. The company prioritised an adaptable solution to minimise long-term costs and eliminate the need for customisation. According to Connolly, focusing on highly configurable solutions rather than custom development was essential to mitigate technical debt. As a government-owned entity, the investment in replacing GIS systems encompassed considerations for the entire product lifecycle, including initial deployment, ongoing maintenance, and version upgrades to ensure ongoing product stability.	<ul style="list-style-type: none"> – GIS enhances sharing and collaboration capabilities for utilities. – Utilities across the globe are embracing Web GIS and the ArcGIS Utility Network – Provides quick access to a centralised source of truth. – Empowers anyone to retrieve crucial information within seconds. – Significantly boosts efficiency and safety of field crews
GIS Energy Networks	Position Magazine		The model, based on a significantly different data framework compared to previous geospatial solutions, is regarded as the benchmark for the inevitable shift towards renewable technologies. It offers superior functionality across extensive datasets at all resolution levels. The company aimed for a scalable solution that minimised long-term investment costs and avoided the need for customisation. Connolly emphasised prioritising highly configurable solutions over custom development to mitigate technical debt. As a government-owned corporation, the investment in GIS system replacement was approached holistically, considering the entire product lifecycle, including deployment, maintenance, and version upgrades, to ensure ongoing stability.	<ul style="list-style-type: none"> – Before the upgrade by Energy Queensland, GIS systems and components ranged from four to 23 years old. – Outdated systems were internally developed solutions at Energex and Ergon – Lacked support for upgrades or alignment with unified datasets, processes, or workflows. – Integration was difficult without extensive customisation and cost – Did not facilitate the level of automation necessary for efficiency improvements. – Implementation of Esri's Utility Network Model standardised workflows across the enterprise for Energy Queensland
Planning and Land use studies	Dept of Trade and Investment SA		Plan SA is Australia's only comprehensive planning scheme, integrating an online policy library with geospatial rules and planning layers, online lodgement, and application processing systems. Acting as a 'one-stop shop,' it enables South Australians to access planning information and processes independently, facilitating timely decision-making. Through registers, geospatial mapping, and subscription services, users can stay informed about local developments. Plan SA also encourages community involvement in shaping policies and development applications.	<ul style="list-style-type: none"> – Planning and Land Use studies play a crucial role in guiding development decisions and shaping communities. – They provide insights into various aspects of land use, including zoning regulations, infrastructure planning, environmental considerations, and socioeconomic impacts. – By analysing existing land use patterns and projecting future needs, planners can identify opportunities for growth and development while mitigating potential challenges such as congestion, environmental degradation, and social inequities. – These studies help ensure that development aligns with broader goals such as sustainability, resilience, and community well-being. – - Through comprehensive analysis and stakeholder engagement, Planning and Land Use studies facilitate informed decision-making and foster more sustainable and inclusive urban environments.
Cadastre NSW Stakeholder Analysis Report	NSW Land and Property		The Cadastre NSW Stakeholder Analysis project has several key objectives. Firstly, it aims to collect information and thoroughly document an assessment of the present condition of cadastral and related datasets, along with their creation, upkeep, and utilisation. Secondly, the project seeks to attain a comprehensive understanding of the challenges and prospects inherent in managing the New South Wales (NSW) cadastre and its associated datasets. Finally, it endeavours to explore the potential advantages that could be realised by addressing the identified issues and opportunities within the NSW cadastre system.	<ul style="list-style-type: none"> – Building more infrastructure and making it more cost-efficient, reliable and safer – Ensuring housing is affordability by reducing land and property development costs – Facilitate the development of a location enabled digital economy for NSW – Strengthen strategic planning, decision making, compliance, enforcement and prosecution – Improved efficiency of council operations

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Gunditj Mirring Traditional Owners Aboriginal Corporation LIDAR Capture	Victoria Department of Environment, Land Water and Planning	Public administration and safety	By working with Land Use Victoria (specifically the Digital Twin Victoria team), the Department has been able to use the LIDAR data within the DTV Platform so that the Gunditj Mirring Traditional Owners Aboriginal Corporation can explore the area and connect the current terrain with the past.	<ul style="list-style-type: none"> Cost savings associated with procuring data visualisation capability for this specific purpose and access to the project team to connect history with current data techniques which would not have been possible any other way
Smart Places Acceleration program	Camden Council, NSW Department of Customer Service, Department of Planning and Environment, Live.NSW, NSW Spatial Services, Aerometrex, Giraffe Technology	Public administration and safety	The NSW Department of Customer Service has developed a 3D model of 3 town centres across Camden Council, South-West Sydney, after a successful 3D model pilot program of a town within the council. Planning decisions have traditionally been made using two-dimensional maps. Ultimately, this means important decisions are being made with limited information, impacting the efficiency of Council decision making processes.	<ul style="list-style-type: none"> Includes increased community engagement with proposed developments by allowing community members to view a more complete and accessible 3D model of proposed developments The Council will also be able to use the tool for risk mitigation and cost optimisation when considering issues such as traffic congestion, public safety and environmental impacts. The tool will reduce the council's time required to assess development applications, all while leading to a better informed council, community and developer decision-making process.
Cardinia Tree Location positioning	Veris	Public administration and safety	When Cardinia Shire Council embarked on upgrading their town centre and road infrastructure, they faced a dual challenge: enhancing the urban landscape while ensuring the preservation of numerous trees' ecological and aesthetic value. This challenge was compounded by the intricate underground root systems of these trees, intricately intertwined with the proposed road designs. Addressing this complexity necessitated a holistic solution that integrated road design modifications with tree conservation efforts, optimised expenses, facilitated community involvement, and upheld environmental sustainability. This is where the advanced spatial technology and expertise of Veris proved invaluable.	<ul style="list-style-type: none"> 60 per cent reduction in Construction Costs
Hobart Rivulet	Veris	Public administration and safety	The Hobart Rivulet is a major stormwater asset that lies directly under the Hobart CBD. It is a confined space that is difficult to access and is prone to flooding, impacting asset management. This is further affected by the risks associated with internal defects, where a previous catastrophic wall collapse resulted in damage to adjacent infrastructure and buildings.	<ul style="list-style-type: none"> Engineers and contractors can use mobile devices for real-time retrieval and updating of defect information, seamlessly integrating with the Digital Twin. Offers a secure and efficient method for Rivulet management without physical site entry. System features robust modelling and analytics capabilities. Enables precise simulation of water flows and prediction of future inundation scenarios.
Transport for NSW M6 Stage 1 project	Veris	Public administration and safety	Transport for NSW's \$3.1 billion M6 Stage 1 includes the construction of twin four-kilometre tunnels, exit/entry ramps, shared pedestrian and cyclist pathways and tunnel stubs for a future stage of the M6. It will connect Sydney's south to the city's wider motorway network and will improve journey times, reduce congestion, and remove trucks from local streets. Veris was engaged by the design and construct contractors for the project, CGU, a joint venture between CPB Contractors, Ghella and UGL, to provide Project Network Control and Survey for tunnel excavation.	<ul style="list-style-type: none"> As part of the approach, 3D laser scanning was a key part of the excavation cycle for the tunnels, providing significant value. Using the Leica MS60 multi-station unit and Inspect Surfaces app, our surveyors provide shotcrete thickness to nozzle man in almost real-time. The survey team typically performs a series of scans, including initial excavation, mid spray and final shotcrete, up to six times daily. Compared to traditional surveying methods, this innovative approach has reduced re-work and improved quality and provides volumes to estimate future shotcrete needs accurately.

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Mount Crosby Pumping Station Digital Twin	Veris	Public administration and safety	<p>The Mount Crosby Pumping Station is located on the Brisbane River in the City of Brisbane, Queensland, Australia. It is located on both sides of the river at Mount Crosby on the east bank and at Chuwar on the west bank. The facility supplies water to Brisbane and nearby cities and towns within the SEQ Water Grid. Over the duration of the project, over 500 terrestrial laser scans were captured of buildings and MEP areas, all access roads within the facility were scanned with our mobile mapping system to a global accuracy of +/-20mm. Our sub-surface locating team identified all underground services using ground penetrating radar (GPR) and electromagnetic locating techniques to Quality Level B standard.</p> <p>A federated 3D digital-twin of the facility was developed by our digital engineering team which involved the creation of as-built 3D CAD assets for all above-ground and sub-surface assets with the final product delivered on both traditional desktop formats (Navisworks, AutoCAD and Inventor) and also via web-based platforms for consumption by stakeholders.</p>	<ul style="list-style-type: none"> - A federated 3D digital-twin of the facility was developed by our digital engineering team which involved the creation of as-built 3D CAD assets for all above-ground and sub-surface assets with the final product delivered on both traditional desktop formats (Navisworks, AutoCAD and Inventor) and also via web-based platforms for consumption by stakeholders.
MTMS Central Station	Veris	Professional services	<p>The project provided an end-to-end spatial data solution to Next Rail. These included a terrestrial laser scanning of the site, development of a 3D Revit model, including as-built MEP structures and accurate rail and OHW extraction.</p>	<ul style="list-style-type: none"> - The 3D model provided a powerful visualisation and collaboration tool supporting the design and construction stages of the project.
North West Coast Underwater Bridge Inspections	Veris	Construction	<p>The 3D model provided a powerful visualisation and collaboration tool supporting the design and construction stages of the project.</p>	<ul style="list-style-type: none"> - The 3D model provided a powerful visualisation and collaboration tool supporting the design and construction stages of the project.
Paradise Gorge	Veris	Construction	<p>How could spatial data and intelligence be used to inform, assess, and protect against the risk of a rock fall? Working closely with the Department of State Growth and engineers Pitt&Sherry, we were initially engaged to support a detailed survey of the area to assess the risk. Once the decision was made to close the road and remove the rock, we worked closely with stakeholders to monitor the stability of the site and perform daily surveys to plan and track progress of the remediation works.</p>	<ul style="list-style-type: none"> - The project demonstrated successful collaboration between government, consultants, and contractors under pressure with short time frames and public scrutiny. - Outcome delivered efficiently and safely. - Improved knowledge basis and risk predictability of the site. - Informed public understanding of the risks and value of the project.
Waterloo Integrated Station Development	Veris	Construction	<p>Veris was contracted by John Holland to provide comprehensive surveying services for the metro station and over station development project. Their involvement extended from conducting feature surveys of the site and its surroundings to overseeing the construction works of the Waterloo Station ISD. This encompassed utilising advanced 3D laser scanning technology to capture detailed information such as underground utilities, boundaries, and stratum. Veris also carried out construction surveys for the Waterloo metro station, including assessments of the station box, services, platforms, and vertical supports. Additionally, they implemented monitoring surveys to track changes and ensure project integrity while managing the entire survey process on behalf of the client. Their survey works supported various project activities, contributing to the successful execution and management of the overall project.</p>	<ul style="list-style-type: none"> - A single data capture exercise and offsite analysis provided a comprehensive understanding of the work needed on site. - Approach was innovative, using Digital Engineering (DE) technology. - Veris utilised scanning and modelling techniques to solve a construction problem. - Resulted in savings on program and delivery costs. - Provided greater clarity on costs earlier and reduced program risk compared to conventional methods. - Overall benefit of reduced safety risk for the project.

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JLL and ESRI Australia	ESRI	Professional services	For JLL Australia, location intelligence is used by collating their extensive catalogue of data together with business and spatial analysis using Esri technology, to deliver new insights specific to a commercial site. This is then applied to crucial communications and decisions for their clients and property professionals.	<ul style="list-style-type: none"> Centralised platform for selling, leasing, managing, and valuing assets. Interactive story maps use data to identify potential new sites, considering demographics, acquisition history, land use, public transport, and competitor activity. Detailed insights into commercial leasing and future competition for new developments. Themes like sector, lease expiry, and rate per square metre are displayed in 3D floor representations. Location-based property investment and occupier advice. JLL Australia uses ArcGIS to find optimal locations, visualising data on a single map to instantly narrow potential sites, showing current and future availability against key metrics.
Neighbourhood development plans	Fyfe	Professional Services	In 2021, Fyfe successfully executed a Large-Scale Cadastral Boundary and Control Survey within the NDP2 Extents, comprising several integral components. These included initiating and obtaining approval from the Department of Resources, which encompassed establishing a horizontal control network, reinstating boundaries, and integrating the survey data with the state control database. Additionally, Fyfe conducted an extensive investigation and reinstatement process covering a distance of 15 kilometres for the cadastral surround, culminating in the lodgement of an Identification Survey Plan. The project also involved the installation of 15 Datum Control Marks and their incorporation into the State Control Database, along with setting up over 70 internal intermediate survey control points. Fyfe coordinated the entire cadastral surround operation and facilitated its delivery to the Department of Resources, ensuring comprehensive and accurate survey outcomes.	<ul style="list-style-type: none"> Demonstrated the savings possible for developers and priority infrastructure providers from collaboration on cadastral surveys.
SmartNSW Case Study	NSW Government	Public Administration and Safety	In 2021-22, NSW local councils reviewed over 30,000 complying development applications, ranging from home extensions to new construction and industrial projects. Many of these applications are processed manually, causing slow turnaround times, inconsistent processes for acceptance and assessment, and a lack of clarity on eligibility criteria. These challenges impact applicants, council officers, and the state government, necessitating streamlined processes for improved efficiency and transparency.	<ul style="list-style-type: none"> Streamline the CDC assessment process by leveraging existing data in the e-Planning portal and using AI to assess compliance with complying development as a test case. Provide applicants with a quick 'first pass' for initial assessment, enabling them to lodge full applications after initial feedback. Offer future extensions with real-time pre-lodgement feedback for applicants to amend proposals before submission. Implement a data-driven approach to quickly filter out non-compliant CDCs, facilitating more effective use of council planning resources and delivering efficiencies within the Department of Planning. Strengthen the State's e-Planning platform, increasing customer engagement and improving application quality via the NSW Planning Portal. Deliver a proof of concept and a 12-month pilot program for the City of Parramatta and Georges River Council.
TechnologyOne "OneCouncil" Property and Ratings database	Queanbeyan - Palerang Council	Public administration and safety	Certificates are ordered online through the Council's eServices portal and issued directly to the applicant. At QPRC, certificate generation is automated via the Regulatory Applications module in the TechnologyOne "OneCouncil" Property and Ratings database. The certificate content is based on nearly 500 land attributes registered to a land record, generated by SQL statements. These attributes are generally location-based, derived from 44 spatial datasets. Complex components of the planning certificate,	<ul style="list-style-type: none"> A total of 3,000 certificates were issued by QPRC in 2023. Assuming 30 minutes for initial land attribution and 2 hours for generation and verification at £50 per hour, the total annual cost for generating planning certificates was £375,000 per annum. In contrast, certificates are now generated instantly as required. Assuming initial land attribution takes 5 minutes on average for each land parcel to verify and upload to P&R, and the initial validation is completed by junior staff (10 minutes) before being finalised by a Senior Strategic Planner (20 minutes), certificates now take approximately 35 minutes to

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			such as complying development provisions, are determined by database stored procedures maintained by QPRC.	complete. At the same simplified rate of £50 an hour, this totals £87,500 per annum, potentially saving QPRC around £287,500 per annum in staff costs.
Digital twin white paper	Standards Australia	Public administration and safety	The white paper argues that Australia has much to gain from Digital Twin Technologies. The opportunity to advance the digital twin agenda is strong. Building on the work of the New South Wales, Victorian and Queensland state governments, Australia has an opportunity to develop global leadership in this area.	<ul style="list-style-type: none"> Increased national productivity from higher-performing and resilient infrastructure operating as a connected system is a vision for the nation. This can result in improved measurement. Granular data in real time can offer less disruption and waste in the supply chain and in our consumption patterns. Digital Twin capability can support reuse and greater resource efficiency – a key enabler of the circular economy in the built environment. And seeking to achieve a net zero economy is going to require an interconnected approach to information management and decision making. The white paper argues that A DTw Standards Roadmap should be developed to help identify current and future standards that are required to deliver on the vision of a national DTw program.
NSW Foundation Spatial Data Framework	Department of Customer Services, Spatial Services	Public administration and safety	To provide a geospatial infrastructure of authoritative foundation spatial data to support government services and national collaboration. Along with the Commonwealth Government and other states and territories, Spatial Services in the Department of Customer Services supports the maintenance and development of the fourteen FSDS themes	<ul style="list-style-type: none"> A powerful economic lever Assembles, manages, shares information that defines and reinforces property rights Translate into economic development, social stability and physical wellbeing Supports the maintenance of electoral boundaries for the NSW Electoral Office Provides consistent geospatial information in support of emergency services and biosecurity
NSW Point	Spatial Services and Geoscape	Public administration and safety	The team at Geoscape created an address tool called 'NSW Point' for the NSW state government and its agencies to use. It solves the challenge of inconsistent address data by allowing its users to find an accurate physical or mailing address in an online form. A critical part of this tool is the Geoscape APIs, more specifically, Predictive API and Addresses API. Both allow governmental users to verify addresses using reliable and authoritative national data.	<ul style="list-style-type: none"> Streamlining government services making them more efficient Data coverage spans across the entirety of Australia and utilises consistent source data across different regions It is updated daily through established agreements with each Australian state and territory APIs are available to facilitate machine-to-machine verification of address data in real-time
Before You Dig Australia (BYDA)	Before You Dig Australia	Public administration and safety	Allowing users to access information about public utility plants located underground whilst aiming to prevent injury and reducing damage to the network of emergency services in the area they intend to dig.	<ul style="list-style-type: none"> Reduction in utility strikes Further damage to utility network Improves efficiency across the planning, design and construction of transport infrastructure projects
eComply	Land Use Victoria, Archistar	Public administration and safety	The eComply project has seven live development sites as part of the final controlled release of the technology. The first eComply digital assessment solution 'Archistar Comply' allows builders, designers, and architects to pre-check 3D building designs against the Small Lot Housing Code.	The building design and approval process is intensive, therefore, Archistar Comply minimises the difficulty and changes that occurs when a designer is trying to get a design compliant. The tool provides feedback on more than 90 complex checks in around 90 seconds. This means house designers can rapidly make changes before sending their plans to a building surveyor for final assessment, cutting up to four weeks off the approval process.
Virtual Asset Management	Tech Mahindra - Altavec	Public administration and safety	Safe and reliable asset monitoring services must be delivered to ensure the status of our infrastructure and assets are understood. Conventional methods of asset assessment are costly and unnecessarily dangerous.	<ul style="list-style-type: none"> 40% increase in number of asset inspections 50% savings in asset maintenance programs 90% reduction in data management effort 60% time savings for inspection teams

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Western Australia Digital Twin Program	Government of Western Australia, Landgate	Public administration and safety	Western Australia is a leading state in the delivery of a broad, capable spatial digital twin. The program, called Spatial WA, will be delivering an Advanced Spatial Digital Twin (ASDT). Spatial WA identified key challenges, such as the need to better navigate information silos and manage data between agencies, and avoid duplication, which creates unnecessary cost and complexity.	<ul style="list-style-type: none"> – Reduce information silos through a centralized location for datasets – Creating new spaces for secure collaboration
Bathurst Integrated Medical Centre (BIMC)	NSW Department of Customer Service, Spatial Services, Bathurst Regional Council	Public administration and safety	The NSW Department of Customer Service has developed a digital twin for Bathurst. It has included a visualising of the proposed BIMC, which will enable community members to view the proposed development in 3 dimensions. This allows community to get a realistic sense of the scale and appearance, in comparison to traditional artistic impressions. A strength of the technology as the ability to engage the public, through an accurate 3D model that they can see and play with, rather than looking through pages of documents. Issues such as shadowing can be easily demonstrated using the 3D model, in a way that would be very difficult to convey on paper.	This case study demonstrates the power of Spatial Digital Twin Models as a tool for consultation with the community on major developments in metropolitan and regional areas where community consultation is a critical part of the planning and development process.
GeoServer	OSGeo Oceania	Public administration and safety	OSGeo Oceania is a community-driven group that supports and grows the open geospatial community in Australia, New Zealand, and the Pacific Islands ¹ . It organizes events like the FOSS4G SotM Oceania conference to foster collaboration and innovation in the region.	The impact of OSGeo Oceania includes enhancing regional collaboration for on open geospatial projects and providing grants to support community initiatives. This has led to a stronger, more connected geospatial community across Oceania
National Flood Information Data Base	Insurance Council of Australia and State Governments	Public administration and safety	In partnership with state and territory governments, the general insurance industry has developed and licensed the National Flood Information Database (NFID) for use by insurers in determining the flood risk to individual properties. NFID is an address database containing 13.7 million property addresses, overlaid with the known flood risk according to government flood mapping.	The average annual damage from flooding in Australia was estimated to be \$8.8 billion in 2017 (Deloitte Access Economics, 2017). An efficient and effective framework for assessing flood risk is fundamental to managing financial risk faced by property owners. Geospatial information and analysis underpin flood risk assessment by the insurance industry and increases access to flood insurance by property owners.
Resources mining				
SafeAI (collision avoidance systems)	ACIL Allen	Resources Minerals	SafeAI is driving adoption in autonomous fleet management and control by retrofitting heavy mining and construction vehicles with connective and autonomous technology. Info gathered by the sensors generates a dynamic map of the surrounding environment and is used by an AI system to provide advanced perceptual and path-planning capabilities to all vehicles in real-time.	<ul style="list-style-type: none"> – Work-related injuries or illnesses cost the Australian economy \$29 billion each year in lost GDP. – Construction and mining industries account for around 13% of economic loss from injuries and illnesses. – It's estimated that 60% of all workplace fatalities are vehicle related. – Over the four years from 2016 to 2020, there were 52 deaths in the construction industry associated with vehicle collisions, being hit by moving objects, or being trapped between stationary or moving objects. – This represented 33% of all fatalities over this period. – Reducing collisions in the construction and mining sectors is a high priority.

Case study	Organisation	Principal Sector	Description	Impact
Automated road trains	Hexagon	Resources Minerals	Hexagon and mining services company Mineral Resources Limited (MinRes) are equipping a fleet of 120 road trains (triple-trailer vehicles) with a drive-by-wire autonomous driving system to enable road trains to travel from mine-to-port more efficiently and safely than ever before. MinRes, who operate iron ore and lithium mines, will be implementing this solution for transport from their Onslow Iron Project to the Port of Ashburton, Pilbara, Western Australia. This private route, which spans approximately 150 kilometres, has been specially sealed and fenced to accommodate the 330 tonne autonomous road trains	<ul style="list-style-type: none"> Hexagon (2022) estimate that a fleet of 100 road trains could save MinRes up to US\$236 million per annum or 50% of current trucking costs using their autonomous platooning system.
Economic Fairways project	Geoscience Australia	Public administration and safety	The Economic Fairways project is a collaboration between Geoscience Australia and Monash University. The project focuses on the development and application of new resource economic modelling algorithms for mineral (including critical commodities), energy (including hydrogen), and groundwater systems. Our approach seeks to combine the geoscience knowledge and datasets of Geoscience Australia with world-leading techno-economic modelling developed at Monash University to produce spatial maps to inform decisions about the location of resources for development projects.	<ul style="list-style-type: none"> Hydrogen Economic Fairways Tool (HEFT): found to enable timely and informed decision-making and lower the risk of investing in, and entering, the hydrogen industry. Specifically, the tool provides significant efficiencies for hydrogen companies, saving \$30,000 to \$50,000 per prospective project in time and reduced due diligence costs. Cost savings could be as high as \$100,000 for particularly large or complex projects. Hydrogen gas producer BOC has reported the tool to have 90% accuracy, highlighting the rigour and usefulness of the tool. The techno-economic assessment of green steel production: GA's research identified cost-effective locations for green steel production, which could be competitive with conventional steel at a carbon price of \$148 per tonne of carbon dioxide.
Identifying critical minerals	CSIRO	Public administration and safety	As the world moves closer to a clean energy transformation, identifying the critical minerals that enable these technologies is more important than ever. A key challenge for industry has been managing inconsistent mineral maps, which hamper efforts to target exploration. Using data from Japan's Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite, we created a comprehensive dataset that combined 3,500 images into one continent-wide mosaic. This data has provided an important baseline for explorers to retrieve the minerals needed for batteries, solar panels, and other renewable technologies.	<ul style="list-style-type: none"> The resulting maps show information about rock and soil mineral components, allowing users to view details from thousands of kilometers wide to just a few kilometers wide. The ASTER mineral maps are already changing the way that geoscientists look for mineral deposits by providing more accurate and detailed information than ever before.
Exosphere	Fleet	Professional services	ExoSphere by Fleet revolutionises exploration technology. It combines 3D subsurface mapping, AI insights, and seismic data for mineral exploration. ExoSphere's ANT imaging reaches 2.5 km depth. Key applications include mineral discovery, lunar seismic tech, and enhanced defense communication.	<ul style="list-style-type: none"> ExoSphere technology has been used for over 250 surveys across five continents by more than 40 industry-leading exploration companies. It accelerates mineral discovery and provides critical insights for mining companies.
Blinman mines	Geoff Sandford	Resources Minerals	The Flinders Ranges town of Blinman put together a group of volunteers of ex-mining employees to resurvey the old Blinman copper mine. This helped digitise the abandoned mine and confirm the accuracy of the final plans from 1907. The project had assistance from a premier survey firm from South Australia.	<ul style="list-style-type: none"> Ensuring the safety of the mine, allowing for more operations Avoiding the negative effects of the mine closing Successful surveying and digitising of the mines and old records
Fairways project	Geoscience Australia	Resources Minerals	The Economic Fairways project is a collaboration between Geoscience Australia and Monash University. The project focuses on the development and application of new resource economic modelling algorithms for mineral (including critical commodities), energy (including hydrogen), and groundwater systems. Our approach seeks to combine the geoscience knowledge and datasets of Geoscience Australia with world-leading techno-economic modelling developed at Monash University to produce spatial maps to inform decisions about the location of resources for development projects.	<ul style="list-style-type: none"> Hydrogen Economic Fairways Tool (HEFT) enables timely and informed decision-making, lowering the risk of investing in the hydrogen industry. Provides significant efficiencies for hydrogen companies, saving \$30,000 to \$50,000 per prospective project in time and reduced due diligence costs. Cost savings could be as high as \$100,000 for particularly large or complex projects. Hydrogen gas producer BOC reports the tool to have 90% accuracy, highlighting its rigour and usefulness.

Case study	Organisation	Principal Sector	Description	Impact
				<ul style="list-style-type: none"> – Techno-economic assessment of green steel production by GA identified cost-effective locations for green steel production, competitive with conventional steel at a carbon price of \$148 per tonne of carbon dioxide.
AusCope infrastructure program	Lateral Economics	Resources Minerals	The AusCope infrastructure program uses GNSS meteorology to better predict severe storms in Victoria, reduces costs and loss of life. It also aids in creating advanced scientific understanding of geoscience and geospatial data - geodynamics, composition, continental deformation, geochronology, early life, geodetic analyses.	<ul style="list-style-type: none"> – Calculated economy-wide impact of productivity improvements and cost savings because of additional infrastructure, with focus on mining
Agriculture				
LCAT - ESRI	ESRI	Professional services	Queensland's smart mapping survey for sustainable land management	<ul style="list-style-type: none"> – Enabling streamlined field mobility – Consistent data collection – Unprecedented insight
Swarm farms	SwarmFarm Robotics	Agriculture	SwarmFarms aims to provide a range of specialised services to clients through an autonomous farming platform that use precision technology (real-time kinematic (RTK) positioning) to guide robotic fleets whose functions are customisable by users and can be controlled remotely via an iPad. Numerous lightweight and modular robots can operate on the same farm in unison with each other, acting as a 'swarm' to undertake large and complicated tasks without the use of human labour or large, heavy tractors.	<ul style="list-style-type: none"> – SwarmFarm Robotics utilises positioning technologies to provide economic benefits and improved capabilities to farmers. – The future of farming relies on sustainability, efficiency, and productivity gains across the industry, necessitating a departure from traditional practices. – Precise, variably targeted application reduces the need to blanket entire fields with chemicals or fertilisers, as robotic vehicles equipped with sensors and sprayers can identify weeds and crop areas most in need of inputs. – Early weed detection allows for reduced herbicide rates, resulting in substantial cost savings and environmental benefits. – Individual weed treatment is cost-effective and reduces herbicide usage, minimising the likelihood of herbicide resistance. – For example, in 2021, a client of SwarmFarm Robotics reported an 80% reduction in chemical usage, contributing to environmental sustainability and prolonging the effectiveness of chemicals.
Precision agriculture	US Congress GAO	Public administration and safety	GAO reviewed scientific literature and other key reports; interviewed officials and representatives from government, industry, academia, and associations; conducted two site visits to observe technology operations and obtain stakeholder perspectives; and convened a 3-day virtual expert meeting in collaboration with the National Academies of Sciences, Engineering, and Medicine. GAO is identifying policy options in this report.	Precision agriculture technologies can improve resource management through the precise application of inputs, such as water, fertilizer, and feed, leading to more efficient agricultural production. Precision agriculture can be implemented through a suite of technologies that can be used in isolation or in conjunction with other technologies. Examples of emerging precision agriculture technologies are in the table below.
Rural intelligence platform	CSIRO	Agriculture	CSIRO have partnered with a rural technology startup Digital Agriculture Services (DAS) in the development of a platform that combines artificial intelligence, machine learning and cloud-based geospatial technology to deliver reliable, independent and robust farm data and analytics.	Access to information

Case study	Organisation	Principal Sector	Description	Impact
Australian citrus orchards	Citrus Australia, Agriculture Victoria, and the Applied Agricultural Remote Sensing Centre (AARSC)	Agriculture	Prior to this project, citrus orchard data had only been available in tabular form. Adding a spatial layer to the data is crucial to provide actionable insights to the industry. The National Citrus Map has now provided an additional spatial information set, assisting the industry to make more powerful and informed decisions across industry challenges and opportunities. It includes orchard level information such as tree age, variety, and management.	<ul style="list-style-type: none"> – improvements in protecting the provenance, biosecurity status, and export markets of the industry's 1,150 orchards – satisfying export traceability and certification requirements for high-value global markets – enabling rapid responses to outbreaks such as citrus canker, varroa mite, and HLB. – helping with planning and recovery from bushfires, floods, and the effects of climate change. – providing industry data for carbon tracking, water usage, and avoidance of food wastage. – a richer course of live data for business decisions about further plantings and varietal changes.
Precision agriculture technologies in avocado production systems	AARSC	Agriculture	To develop an accurate yield forecasting system for avocado growers to plan and explore new export markets. The AARSC team developed a mobile application called Crop Count which utilises high-resolution satellite imagery to support avocado growers and enable them to forecast yields, map tree health, and mitigate the damage of natural disasters.	<ul style="list-style-type: none"> – The creation of a time series yield forecasting methodology supports a more accurate measure of crop response, measured incrementally over an extended period. – It identifies historic crop behaviour and the influences of seasonal environmental, climatic or management changes and its subsequent impact on seasonal yield – Since 2020, this methodology has been evaluated in Australia, South Africa and New Zealand and has led to its adoption to now expand across 7 countries as well as additional commodities such as mango, citrus, tea tree and macadamia.
Benefits of Satellite-Based Augmented Systems (SBAS) across Australia and New Zealand to broadacre production	Geoscience Australia	Public administration and safety	Enabling positioning and navigation accuracy across vast regions, including rural areas used for broadacre cropping. Analysis was completed into the economic benefits of Satellite-Based Augmentation Systems (SBAS), including benefits to the broadacre sector. It incorporated data from two projects which surveyed farmers and conducted empirical research to estimate the benefits of implementing SBAS signals.	<ul style="list-style-type: none"> – Efficient deployment of inputs, particularly in reducing overlaps in chemical spraying, is expected to save the broadacre sub-sector PV\$214 million over 30 years. – The avoided cost of positioning technology, including capital outlay for RTK base stations and subscription costs, is anticipated to amount to PV\$7 million over 30 years. <ul style="list-style-type: none"> – The enablement of Variable Rate Technology (VRT) is expected to result in PV\$520 million worth of operating expenditure savings to the broadacre sector over 30 years. – Research shows operational savings ranging from \$7 to \$22 per hectare, with a weighted average of \$14.50 per hectare used for the analysis. – Approximately 5 percent of farms currently use some form of VRT, and it is anticipated that the deployment of SBAS signals will lower the cost barrier for the remaining 50 percent. – Enhanced uptake of non-RTK Controlled Traffic Farming (CTF) is projected to save the sector PV\$250 million in operating expenditure over 30 years. – The deployment of Precise Point Positioning (PPP) within the broadacre sector is expected to reduce tyre tracking by 10 centimetres on average, resulting in a 35 percent reduction in yield loss, equivalent to \$8.80 per hectare. This benefit applies to 40 percent of total harvestable land that currently do not use CTF.

Case study	Organisation	Principal Sector	Description	Impact
Benefits of the precise positioning to grain growers	Geoscience Australia	Public administration and safety	Productivity is crucial to maintaining Australian agriculture's competitiveness in global markets. In agriculture, precise positioning services support technologies such as remote sensing, auto-steer and yield monitoring systems which deliver productivity benefits for agriculture enterprises.	<ul style="list-style-type: none"> Enhanced Crop Productivity: CTF leads to greater cropping frequency and reliability. Resource Efficiency: It optimizes nutrient and water usage, improves soil health, reduces
Horticulture industry maps	The University of New England (UNE)	Agriculture	Knowing where commercial crops are offers substantial time and labour savings when undertaking targeted surveillance and establishing exclusion zones, both of which are essential for containment and minimising spread. To deliver this fundamental data layer, the respective industry bodies worked with UNE's AARSC to map all commercial orchards over 1 hectare, nationally. This layer was developed by digitising existing industry data, analysis of high-resolution satellite and airborne imagery, web searches for relevant site locational information, and field validation.	<ul style="list-style-type: none"> The dashboard has been viewed (opened) 17,235 times. Significantly the dashboard was awarded first place as 'Best dashboard' application in the map gallery at the 2021 Esri International User Conference. As the imagery has a spatial context, GPS locations of sick trees can be extracted from the imagery to direct infield observation and similarly field observations can be linked back to the mapping layer to better understand distribution and spread of a particular threat.
Biosecurity				–
Red Imported Fire Ant (RIFA)	Outline Global	Biosecurity	Developing a remote sensing solution to efficiently detect and destroy new RIFA nests to prevent further spread. RIFA has several methods of dispersion and can survive in almost any environment, so there is no real way of determining its existence or absence except through surveillance. Historically, surveillance has completely relied on ground surveillance methods which physically search areas, which is time consuming and expensive. Infestations can remain undetected for significant periods and accuracy of these methods is difficult to confirm. The continued spread has further increased costs and time taken for on-ground inspections.	<ul style="list-style-type: none"> The result was a world-first ultrahigh resolution surveillance system that records the spectral signature of RIFA nests, distinguishing them from other features such as rocks, manure, wood, and bare earth. An associated AI model was developed to process and interpret the imagery, and ultimately increase accuracy by matching remote sensing images against validated field data.
Leafminer	Hort Innovation in partnership with Cesar Australia	Agriculture	VLM was detected in the Torres Strait Islands in 2008 and PNG in 2011, and then in the Northern Peninsula Area of Queensland in 2015. Eradication in the Torres Strait Islands and Northern Peninsula Area was considered not feasible, so containment measures were put in place. Finally, an incursion of SLAM was detected in NSW and Queensland in 2019, and again eradication was deemed not feasible.	An online web map of VLM distribution, host plant distributions, VLM establishment risk predictions, and VLM spread risk predictions was created as a decision-making tool. This map also facilitated the communication of risk during extension activities via a depiction of the presence of plant hosts for VLM.
Khapra beetle	CEBRA		A project by CEBRA developed a framework for creating maps of pest establishment likelihoods to inform surveillance of pests not currently present in Australia. The key spatial layers for this exercise were land use (Australian Collaborative Land Use and Management Program), population density (ABS census), and the plant landscape (National Vegetation Information System). Population is used as khapra beetle is most likely to enter via imports, which arrive and are sent to populated areas. Land use and vegetation are required as khapra beetle is more likely to spread to areas where there is a food source for it.	This work is currently being expanded on through a GRDC project which is modelling the spread, detection, surveillance, treatment, and proof-of-freedom of a khapra beetle incursion
Impact of the NSW Foundation Spatial Data Framework on Varroa mite response	NSW Government	Public administration and safety	Varroa mites are the most serious pest of honeybees worldwide. They are tiny reddish brown external parasites of honeybees. The National Varroa Mite emergency response has been working tirelessly towards the agreed goal of eradication since June 2022. The focus of the response has now shifted to transitioning to management of Varroa Mite. Biosecurity Emergency Orders were developed as part of a state-level response. The EICU deployed resources to the Biosecurity State Coordination Centre to prepare maps for emergency orders, modelling potential baiting locations, hotspot analysis, updating surveillance and eradication zones, and assisting with internal and public-facing web maps	The FSDF was used to produce these public-facing web maps, which improved consistency and communications across agencies and provided an accurate, up-to-date base of information for the external audience.

Case study	Organisation	Principal Sector	Description	Impact
Transport				
Road Management Information System (ARAMIS)	Qld Department of Transport and Main Roads Investment Program (QTRIP)	Public administration and safety	The Department of Transport and Main Roads draws on both Queensland Transport and Roads Investment Program and a Road Management Information System to support its management and planning of roads in Queensland. These systems depend on the support of the CORS network and the NPIC program.	<ul style="list-style-type: none"> – Cost savings – Time savings increased confidence and reliability. – Access to new types of data
ARTC – Inland Rail Project	Qld Department of Transport and Main Roads	Public administration and safety	The Australian Rail Track Corporation maintains and operates one of the largest rail networks in the country, spanning over 8500km and across five states. The ARTC relies on satellite positioning services throughout much of its organisation for the design and construction of rail track and related infrastructure, asset management, maintenance, and for Automated Train Management Systems.	<ul style="list-style-type: none"> – Savings from positioning services: – Survey control: up to 75% – Engineering surveys: up to 50% – Machine guidance: up to 20% – Queensland project section: – Extension of CORS network with NPIC support. – Estimated savings: around 2% of a \$100 million construction budget.
Cooperative and Automated Vehicle Initiative	Here and the Queensland Department of Transport and Main Roads	Public administration and safety	The Cooperative and Automated Vehicle Initiative (CAVI) is a Queensland Government initiative that is laying the foundations for smart transport infrastructure to improve safety and mobility on Queensland's roads. Position data for this research was provided by a commercial service provider, SmartNet. This service uses positioning infrastructure based on the network of CORS operating in Queensland. The program consists of Cooperative Intelligent Transport Systems (C-ITS) pilot, Cooperative and Highly Automated Driving (CHAD) pilot, Vulnerable Road user pilot.	<ul style="list-style-type: none"> – The Cooperative Intelligent Transport Systems (C-ITS) trial of 500 vehicles demonstrated effective operation. – Driving data from the trial indicated a potential 20% reduction in crashes with a fully operational C-ITS network. – A cost-benefit analysis revealed that every dollar invested in developing a C-ITS ecosystem in south-east Queensland would yield \$3.40 in benefits, including crash reduction, fuel savings, and emissions savings. – A 2019 study estimated that congested urban roads cost Australia \$19 billion annually in 2016, projected to reach \$39 billion by 2031. – The CAVI program aims to realise benefits such as reduced accidents and deaths on roads and reduced road congestion.
National heavy vehicle register	Spatial vision	Road Transport	NVHR and Spatial Vision created a strategy to best implement geospatial data to increase efficiency and safety of heavy vehicle transport	<ul style="list-style-type: none"> – Improved access for heavy vehicles alone can deliver \$7 billion (According to the National Transport Commission in 2018) in benefits through the reduction of time and cost for the heavy vehicle industry, with flow on benefits to other parties in the supply chain.
Improving accuracy for Tom Tom	Geoscape	Public administration and safety	Geoscape Australia tailored a custom data solution using Geoscape G-NAF Live and the Geoscape Deltas API, which reduced TomTom's cycle time for address updates and minimised transformation needs.	<ul style="list-style-type: none"> – Automated processes with weekly updates enabled TomTom to quickly access new and updated addresses, improving the efficiency and effectiveness of its location technology. The partnership between TomTom and Geoscape Australia has successfully enhanced the accuracy and timeliness of TomTom's services.
Navigation technologies	Here	Transport	Isuzu Trucks, the leading heavy commercial vehicle brand in Australia, has deployed HERE Navigation in its new 2022 model year F Series, FX Series, and FY Series trucks sold in the country. HERE Navigation is an off-the-shelf navigation solution for embedded in-vehicle infotainment (IV) platforms.	<ul style="list-style-type: none"> – The deployment of HERE Navigation optimises Isuzu's fleet operations with a connected in-vehicle navigation system from HERE Technologies, the leading location data, and technology platform.

Case study	Organisation	Principal Sector	Description	Impact
Route optimisation	Here	Professional services	<p>Here provides map data that draws on AI technologies from Satalia to quickly find the optimal route for transport operations from warehouse to store. There is a reason artificial intelligence (AI) proves itself to be an effective tool for route optimization.</p> <p>"There are 620,448,401,733,239,000,000,000 possible routes between 24 locations," said Paul Hart, Head of Logistics at AI technology company Satalia. "Searching through all of those possibilities, it would take a computer 2 trillion years to find the optimal route. And that doesn't include the complexity of shift patterns, vehicle capacities or any other real-world constraints." Algorithms detect the best available route in seconds as customers pick their delivery slot from a website. The difference between grocery deliveries and many other goods is that the customer gets a one-hour time window from the moment of ordering. Customers ordering online for non-food products usually only get an estimated time of arrival (ETA) on the day itself.</p>	<ul style="list-style-type: none"> - Faster deliveries - usually next day
Heavy Vehicle Access Management System	Tasmanian Department of State Growth	Heavy vehicle operators	<p>The Tasmanian Department of State Growth introduced the geospatially enabled Heavy Vehicle Access Management System (HVAMS) to provide heavy vehicle operators with a self-service system to check which roads and bridges can be accessed without a permit and under what conditions given specific vehicle and load type. HVAMS helps prevent operators from driving outside allowed vehicle dimensions and axle masses, understand the constraints on bridges or structures and plan activities and routes without needing to apply for a permit.</p> <p>The HVMS was built on a map layer compiled from Foundation Spatial Data contained in the Land Information System of Tasmania (LIST). The map aligns network and route information with the properties of structures and road segments and analysis each road segment to determine the allowable network for a given heavy vehicle activity</p>	<p>The HVAMS has improved road access for the heavy vehicle industry and reduced red tape for the industry. As a result, 80% of Over Size Over Mass vehicle movements and 90% of special purpose vehicle movements are now undertaken permit free. This has led to reductions in waiting times and a reduction in road manager resources required to administer permits.</p>
Integrity and efficiency monitoring for intelligent transport	ACIL Allen	Public administration and safety	<p>Previous research into precise positioning integrity has explored methods such as relative positioning, precise point positioning (PPP), and Real-Time Kinematic (RTK). Recent studies, like that by El-Mowafy et al., have investigated how different sources of positioning information, including low-cost RTK GNSS data, Doppler measurements, information from low-cost inertial measurement units (IMU), and vehicle odometer data, impact the integrity of continuous positioning systems for Intelligent Transportation Systems (ITS). To maintain lower vehicle costs, car manufacturers aim to keep sensor costs below a few hundred dollars. However, low-cost sensors may have limitations, raising the importance of combining them to achieve the required positioning quality for ITS.</p> <p>Researchers have also explored integrating three-dimensional city models into positioning systems to predict routes with the best integrity, availability, and precision, aiding in selecting the most optimal route. This integration can identify potential non-line-of-sight GNSS signals, which contribute to positioning errors. Furthermore, research into using sensors for monitoring positioning integrity has been conducted, enabling the detection and exclusion of faulty observations, and alerting the driver if the probability of positioning errors exceeds a specified threshold.</p>	<ul style="list-style-type: none"> - Reduced environmental impacts: ITS can lower emissions through decreased fuel consumption. For instance, automated trucks could achieve fuel savings of 5 to 15%. - Increased safety: Well-designed Autonomous Vehicles (AVs) can mitigate human errors, enhancing road safety. Public acceptance of AVs hinges on ensuring their safe operation, as recognised by Australia's National Transport Commission. - Reduced congestion: AVs equipped to monitor traffic information can avoid congested roads, leading to smoother travel between origin and destination points. - Realising these benefits necessitates further Research and Development (R&D) to integrate information from various sensors, ensuring accurate, reliable, and affordable positioning information for ITS. - Tim Rawling, CEO of AUSCOPE, highlighted the importance of R&D focusing on integrating positioning information from different sources, affirming it as the future direction.

Case study	Organisation	Principal Sector	Description	Impact
Supply chain logistics	Here	Professional services	To achieve this, location data and services play a crucial role in the transportation and logistics industry. HERE Technologies provides cutting-edge solutions that cater to the needs of companies, enabling them to optimise their operations, improve overall asset tracking and shipment visibility, and enhance overall customer experience. HERE owns a rich portfolio of map data and location services that can be easily integrated into existing IT landscapes and offer a scalable way to increase the ROI and throughput of assets. These products and services go beyond traffic data and navigation to include tour planning, optimisation, and routing services.	<ul style="list-style-type: none"> Increasing fleet utilisation through advanced tour planning to lower operational costs. Calculating accurate ETAs and improving on-time performance Data analytics of assets, reports, and tracking of inventory Dynamic route optimisation with on-road freights Gaining end-to-end multimodal visibility Improving driver safety, enhancing the driver experience, and retention Keeping track of shipments Tracking and management of warehouse assets Tracking of returnable, reusable packages
Port Hedland Under Keel Clearance	ICSM, Pilbara Port Authority and MMA Offshore	Public administration and safety	<p>Under Keel Clearance (UKC) requirements can be a limiting factor in a port's shipping volume, constraining the movement of goods in and out of Australian ports.</p> <p>Port Hedland is one of three major iron ore ports in the Pilbara, Western Australia, and the largest bulk export port in the world. The Pilbara Ports Authority developed a Hydroid, or Lowest Astronomical Tide Model, which is a model to better understand sea levels and depths of a particular area.</p> <p>The use of the Hydroid has delivered considerable improvements to the port's productivity.</p> <p>The use of the Hydroid extends the tidal sailing window by an hour (the times in which ships can travel through the port), with the port seeing potential to increase the number of vessels from 6 to 8 per tide, which equates to a 33% increase. The port also reports a reduced unit cost, by allowing ships to increase the volume of goods onboard, while maintaining safety. The success of the Port Hedland Hydroid has resulted in action for the creation of a national hydroid model, referred to as AUSHYDROID.</p>	<ul style="list-style-type: none"> The use of the Hydroid extends the tidal sailing window by an hour (the times in which ships can travel through the port), with the port seeing potential to increase the number of vessels from 6 to 8 per tide, which equates to a 33% increase. The port also reports a reduced unit cost, by allowing ships to increase the volume of goods onboard, while maintaining safety. The success of the Port Hedland Hydroid has resulted in action for the creation of a national hydroid model, referred to as AUSHYDROID. The Port estimates that the technology delivers around \$240 million per annum in savings from increased ship movements into the port.
Development of a point density map for automated ship identification system.	AMSA	Marine transport	The Shipborne Automatic Identification System (AIS) as specified by IMO, is a ship and shore-based broadcast system, operating in the VHF maritime band. It is capable of sending and receiving ship information such as identity, position, course, speed, ship particulars and cargo information to and from other ships, suitably equipped aircraft and shore. It can handle over 2,000 reports per minute and updates information as often as every two seconds.	While AIS is conventionally a line-of-sight radio broadcast system for communication between ships and between ships and shore stations, recent technology developments have seen satellites adapted for reception of AIS messages from Low Earth Orbit (LEO).
Specific Geospatial services				
Seabed Survey Coordination Tool	Geoscience Australia	Public administration and safety	Mapping the depth and terrain of even a small area of the seabed is labour-intensive and often costs millions of dollars and requires extensive time at sea. Bathymetric survey data is essential across a wide range of applications including defence, navigation, maritime industries, ocean and hazard modelling, and environmental management. Seabed mapping data is collected by State and Commonwealth government agencies, academic institutions, and the private sector. With numerous operators in this space, there has historically been little shared knowledge of the activities and research interests of different groups, limiting meaningful collaboration and resulting in considerable duplication of effort.	<ul style="list-style-type: none"> The AusSeabed Survey Coordination Tool ensures that expensive seabed mapping data collected around Australia adheres to the 'collect once, use many' principle, benefiting a wide variety of end users. Impact examples: The HIPP Survey Request function represents community needs in the largest-ever investment in Australian hydrographic survey program - HIPP, which will collect \$1.03 billion worth of survey data over the next decade. Submissions to the Areas of Interest function prioritise opportunistic survey activities by domestic and international research vessels.

Case study	Organisation	Principal Sector	Description	Impact
				During 2020 and 2021, the RV Falkor was restricted to Australian waters due to the COVID-19 pandemic. The Areas of Interest function helped plan and conduct sustained mapping operations in poorly understood, potentially vulnerable, remote, and ecologically significant Australian waters in the Coral Sea. Thanks to the AusSeabed Survey Coordination Tool, over 200,000 km ² of seafloor data were collected in a region of particular need. It is estimated that it would cost an Australian agency approximately \$83M to collect an equivalent bathymetric survey.
MondoPin	ACIL Allen	Public administration and safety	Connects to GA's CORS network and calculates the user's positioning errors, thus providing users with precise positioning information. MondoPin is open-source and accessible from a standard GPS receiver and provided through a monthly subscription.	Low cost, flexible positioning information would reduce costs for end users.
Public-private collaboration delivering a unified positioning network	ACIL Allen	Public administration and safety	GA's NPIC provides a unified approach to the management of national positioning infrastructure. NPIC's network contains over 700 GNSS reference stations and is enabling centimetre accurate and reliable positioning services in areas of mobile phone coverage	NPIC reduces the overall costs of maintaining the network and reduces duplication of stations in the same area between providers. It also creates opportunities for new businesses.
Navigation technologies	Here	Positioning	What3Words	Accurate and precise navigation even in remote areas-
Navigation technologies	Here	Positioning	Safe remote adventurers with better maps and navigation	Isuzu Trucks, the market leading heavy commercial vehicle brand in Australia, today announced that it has deployed HERE Navigation, an off-the-shelf navigation solution for embedded in-vehicle infotainment (IVI) platforms, in its new 2022 model year F Series, FX Series and FY Series trucks sold in the country. HERE Navigation optimizes Isuzu's fleet operations with a connected in-vehicle navigation system from HERE Technologies, the leading location data and technology platform.
Faster deliveries	Here	Positioning	Using maps to deliver products more efficiently	– Quicker and higher volume deliveries
Deformation monitoring	Monitum Kurloo	Geospatial services	<p>Geospatial data is a critical component of every construction project, reducing risk and improving efficiencies. But gathering this data is often costly and labour intensive. Monitum's Managing Director, Lee Hellen, recognised that more affordable, simpler products are needed to enable broader uptake of precise positioning technology.</p> <p>Monitum partnered with the Queensland University of Technology (QUT) to develop a cost-effective Internet of Things (IoT) solution using low-medium-end Global Navigation Satellite System sensors and low-power wide-area networks. Monitum's Australia-made product makes precise positioning accessible and affordable, with applications across industries such as infrastructure, transport, and mining.</p> <p>Working with QUT, Monitum has created a fully integrated smart device that is supported by a cloud processing and data analytics service. Together, they enable millimetre-precise deformation data to be obtained automatically, remotely and in near real-time. The collective research competence provided by QUT's project team, led by Professor Yanming Feng, has been critical to delivering this innovative outcome.</p>	<ul style="list-style-type: none"> – Near-term local-based manufacturing estimated at 500 units by end of 2022-23 and 4,000-5,000 units within 3 years. – Cost-Benefit Analysis (CBA) results provided in Table G.2 at 3, 7, and 10 per cent discount rates. – Inputs adjusted to 2021-22 dollars included as costs. – Benefits include cost savings, cost avoidance, and additional revenue for Kurloo. – 7 per cent discount rate recommended by Commonwealth Government for best-practice CBA, with 3 and 10 per cent rates as sensitivity tests. – Net impact positive at all three discount rates – At 7 per cent discount rate, Net Present Value (NPV) expected to be \$34,152,858 over analysis period (2016-17 to 2029-30) – Benefit-Cost Ratio (BCR) is 7.76, indicating benefits outweigh costs

Source: ACIL Allen



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