

Submission to the Senate Inquiry into Australian Antarctic Division funding

Geoscience Australia

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Executive Summary

Geoscience Australia plays a fundamental role in supporting Australia's national interests in Antarctica. As the national public sector geoscience organisation, we provide geoscientific advice to the Australian Government to support national priorities and interests for Australia and external territories, including the Australian Antarctic Territory. Our Antarctic activities contribute to preserving Australia's sovereignty over the Australian Antarctic Territory, support a strong and effective Antarctic Treaty System, demonstrate world-class scientific research and support decision-making to protect the Antarctic environment.

Geoscience Australia is engaged in the Australian Antarctic Program through several scientific and strategic activities. We operate a network of geodetic and geophysical observatories across the Australian Antarctic Territory, lead activities as part of the Australian Antarctic Mapping Program and are a key partner in collaborative Antarctic research programs. We provide advice to government and participate in key government Antarctic forums, represent Australia in the international Antarctic science community, maintain a collection of Antarctic data and samples, and conduct public outreach activities.

Geoscience Australia works in close partnership with the Australian Antarctic Division (AAD) to deliver our Antarctic activities. We maintain regular engagement with AAD officials at all levels and have a mutual understanding of Australian Antarctic Program priorities and constraints. We regularly communicate our requirements to AAD to assist them in the difficult task of prioritising resourcing.

Geoscience Australia's contributions to the Australian Antarctic Program are supported through a range of funding arrangements with the AAD. This includes crucial, in-kind logistical support for field-based activities, direct funding for specific projects, and co-contributions to collaborative activities.

This submission outlines Geoscience Australia's capabilities and current activities as part of the Australian Antarctic Program, and the support provided by the Australian Antarctic Division.

Introduction

Geoscience Australia is Australia's national geoscience public sector organisation. Our mission is to be a trusted source of information on Australia's Earth science for government, industry and community decision-making. Our work covers the Australian landmass, marine jurisdiction and external territories, including the Antarctic. Geoscience Australia delivers enduring data and advice that helps government, industry and the community to address challenges and enhance opportunities facing Australia now and into the future.

Geoscience Australia plays a fundamental role in supporting Australia's national interests in Antarctica (as outlined in the *Australian Antarctic Strategy*¹). We provide geoscience leadership in the Australian Antarctic Program, including providing geoscientific information and advice to government on the Australian Antarctic Territory and adjacent marine jurisdiction, supporting Australia's Antarctic strategic interests and obligations under the Antarctic Treaty System (ATS). Geoscience Australia leads world-class geoscientific activities that underpin our advice to government and deliver data and information to support a range of scientific, strategic, and operational objectives. Geoscience Australia also operates geophysical monitoring observatories in Antarctica that form key components of Australia's scientific infrastructure and contribute to Australia's international treaty obligations.

This submission outlines Geoscience Australia's capabilities and current activities as part of the Australian Antarctic Program, and the support provided by the Australian Antarctic Division (AAD).

Terms of Reference

The Terms of Reference (ToR) for the Senate Environment and Communications References Committee inquiry into the current management of the funding of the Australian Antarctic Division, call for particular reference to:

- a. revelations that the AAD is pursuing cuts worth roughly 16% of its operating budget
- b. the direct and indirect impacts of cuts to public funding of Australia's Antarctic activities, including on full-time, part-time and contract AAD jobs
- c. the ramifications for Australia's international commitments and obligations
- d. the internal compilation of a list of at least 56 existing projects, programs and research activities that could be cut and/or terminated
- e. the extent of the Albanese Government's involvement in, and response to, these cost-cutting plans
- f. the consequences of funding cuts to Australia's Antarctic program for our country's geopolitical and strategic international interests
- g. complications that the proposed \$25 million worth of cuts will cause for the full delivery of the Australian Antarctic Science Strategic Plan, the Australian Antarctic Strategy, the 20-year Action Plan, and the extra \$804.4 million Antarctic funding package delivered by the Morrison Government in early 2022
- h. the widespread view, including among numerous Antarctic science experts, that funding cuts of this scale and nature are catastrophic for Australia
- i. any other related matters.

Geoscience Australia does not have any visibility of AAD's budget. However, we have a long history of working in partnership with AAD as part of the whole-of-government Australian Antarctic Program and understand the need for AAD to prioritise activities within the constraints of the resources it has available.

¹ https://www.antarctica.gov.au/site/assets/files/53156/2022_update_20yearstrategy.pdf

Overview

Geoscience Australia's engagement in and contribution to the Australian Antarctic Program is reflected in our strategic priorities, as outlined in Geoscience Australia's *Strategy 2028*.²

We will undertake geoscientific programs in Antarctica in our national interests.

Our work is strategically aligned to Australian Government strategic priorities in Antarctica, as outlined in the *Australian Antarctic Strategy and 20 Year Action Plan*³ and the *Australian Antarctic Science Strategic Plan*.⁴

Geoscience Australia works in close partnership with the Australian Antarctic Division to deliver our Antarctic activities. We maintain regular engagement with AAD officials at all levels and have a mutual understanding of Australian Antarctic Program priorities and constraints. We regularly communicate our requirements to AAD to assist them in the difficult task of prioritising resourcing.

Geoscience Australia is engaged in the Australian Antarctic Program through several scientific and strategic activities (see Appendix A for further details), including as:

- Chief Investigator of 2 Australian Antarctic Science Program (AASP) projects
- Co-investigator on 4 AAD-led projects
- a partner in 3 Antarctic collaborative research programs:
 - Australian Antarctic Program Partnership⁵
 - Securing Antarctica's Environmental Future⁶
 - Australian Centre for Excellence in Antarctic Science⁷
- a member of the Australian Antarctic Science Council
- provider of advice to government on Antarctic geoscience matters, including those raised in the Antarctic Treaty System forums.

In addition, Geoscience Australia:

- represents Australia on international Antarctic committees and working groups through the Scientific Committee for Antarctic Research (SCAR)
- maintains a collection of physical samples (rocks, sediments, fossils) and geoscientific data and information from Antarctica (e.g. analytical databases, aerial photographs, publications) that are publicly available via the Antarctic Geoscience Portal,⁸ a valuable asset for the Antarctic science community
- is a member of the Australian National Ground Segment Technical Team (ANGSTT),⁹ a consortium of agencies managing a coordinated network of satellite ground station facilities, including several in Antarctica. The ground stations, operated by the Bureau of Meteorology, ensure Australians have access to the satellite Earth observation data we need and support critical international partnerships
- conduct regular Antarctic outreach activities including public seminars, engagement with school students, and library displays.

Geoscience Australia's contributions to the Australian Antarctic Program are supported through a range of funding arrangements with the AAD. This includes crucial, in-kind logistical support for field-based activities, direct funding for specific projects, and co-contributions to collaborative activities.

² <https://www.ga.gov.au/strategy-2028>

³ https://www.antarctica.gov.au/site/assets/files/53156/2022_update_20yearstrategy.pdf

⁴ <https://www.antarctica.gov.au/site/assets/files/53908/australian-antarctic-science-strategic-plan.pdf>

⁵ <https://aappartnership.org.au/>

⁶ <https://arcsaef.com/>

⁷ <https://antarctic.org.au/>

⁸ <https://portal.ga.gov.au/persona/antarctic>

⁹ <https://www.angstt.gov.au/>

Geodetic and Geophysical Observatories

Geoscience Australia's long-term *geodetic and geophysical monitoring program* (AASP Project 4642) involves the operation and maintenance of geodetic, seismic, geomagnetic and infrasound observatories in Antarctica and on Macquarie Island (Appendix B). These Antarctic observatories are an essential component of Geoscience Australia's integrated geophysical observing system and support diverse applications including navigation, engineering surveys, airborne geophysical surveys, topographic mapping, as well as for detecting nuclear explosions and potentially tsunamigenic earthquakes.

The monitoring program consists of 4 key elements:

1. **Geodetic monitoring:** Geoscience Australia operates an array of long-term continuous and semi-continuous geodetic reference stations across the Australian Antarctic Territory (AAT), including 4 Global Navigation Satellite System (GNSS) reference stations as well as survey and gravity benchmarks. Data from the GNSS stations is archived, processed and disseminated 24/7 via the GNSS data portal, and contributes to the development and maintenance of the International Terrestrial Reference Frame (ITRF) that enables accurate position, navigation, and mapping of the Earth's surface and systems. The geodetic observatories support navigation of aircraft and ships in Antarctica and enable precise monitoring of environmental changes.
2. **Geomagnetic monitoring:** Geoscience Australia's 3 geomagnetic observatories in Antarctica (Casey, Mawson and Macquarie Island) monitor the Earth's continuously changing magnetic field and form part of wider Australian and international observatory networks. Data from geomagnetic monitoring is used in regional and global mathematical models of the geomagnetic field, are required by international treaties to support maritime and aviation compass navigation and contribute to space weather monitoring and research into geomagnetic phenomena (particularly in auroral zones), Earth structures and processes, and solar-terrestrial physics.
3. **Seismic monitoring:** Geoscience Australia's 3 Antarctic seismological stations (Casey, Mawson and Macquarie Island) form part of the Australian National Seismograph Network (ANSN), a network of stations and instrumentation that monitors natural and anthropogenic hazards in Australia and around the globe. Data from these ground stations are a key component of the regional tsunami warning network and support studies of continental plate motions. The Casey observatory is operated jointly with the United States Geological Survey.
4. **Nuclear monitoring:** Geoscience Australia's seismological and infrasound stations contribute to the global monitoring of nuclear tests. These stations deliver on Australia's commitment to the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Australia's obligations under the Treaty include the establishment, operation, maintenance and upgrade of these stations, and the provision of uninterrupted data.

Data from Geoscience Australia's observatory network is acquired, quality controlled and delivered 24 hours a day, 7 days a week in near real-time and distributed to support various warning services and global initiatives, including the:

- Joint Australian Tsunami Warning Centre (JATWC)
- National Earthquake Alerts Centre (NEAC)
- International Data Centre of the Comprehensive Nuclear-Test-Ban Treaty (CTBT)
- Bureau of Meteorology's Space Weather Forecasting Centre (ASWFC)
- International GNSS Service (IGS).

AAD Support

Geoscience Australia's geodetic and geophysical monitoring program in Antarctica requires support from the Australian Antarctic Division for:

- ongoing satellite-based communications and power supply for real-time data transfer

- over-wintering AAD Communications Technical Officers, trained and partly funded by Geoscience Australia, to support operations, including year-round, weekly geomagnetic observations and general assistance, including routine maintenance and technical support
- ongoing logistics and field support to install and maintain observatories and ground stations. This includes cargo and personnel transfer to and from Antarctic stations, accommodation and other facilities, logistics and communications. Geoscience Australia typically requests 2 berths at each station every 2-3 years.

For the 2023/24 season, the project will be supported by AAD expeditioners at the 4 stations. Geoscience Australia's request for 2 berths to travel to the mainland Antarctic stations for maintenance activities has not been supported. Geoscience Australia has been offered one round-trip berth to Macquarie Island to finalise relocation of the seismic observatory. However, this trip may need to be postponed pending completion of supporting infrastructure. Geoscience Australia have requested AAD prioritise support for this project next season due to the need to conduct maintenance of the observatories.

Australian Antarctic Mapping Program

Geoscience Australia is a key partner in the AAD-led *Australian Antarctic Mapping Program* (AAP Project 5202). This project delivers on the Australian Government's commitment to implement an enhanced program of mapping and charting in East Antarctica, as outlined in the *Australian Antarctic Strategy and 20 Year Action Plan*. Enhanced mapping of Antarctica and the Southern Ocean will lead to an improved understanding of the Antarctic environment, contribute to better safety and operational efficiency, and demonstrate best practice environmental stewardship, international engagement and leadership.

The Australian Government committed funding to support the implementation of the mapping program as part of the \$804.4 million allocated to the AAD in the 2022/23 budget.¹⁰ Key activities in AAP Project 5202 involving Geoscience Australia include:

- development of a new Digital Earth Antarctica capability
- installation of SouthPAN equipment at Davis station
- contribution to the AusSeabed initiative

Geoscience Australia does not have visibility of the funding available for each of these activities but understands the funding for Digital Earth Antarctica is in the order of \$13 million over 4 years.

Digital Earth Antarctica

Geoscience Australia is currently scoping a Digital Earth Antarctica capability. Development of Digital Earth Antarctica aims to provide Earth observation storage, processing and data delivery for the Antarctic continent. The new Digital Earth Antarctica platform will be created using Open Data Cube (ODC) core programming and infrastructure, extending existing Digital Earth Australia capabilities to provide Earth observation data and services in an Antarctic context. Digital Earth Antarctica will facilitate increased research and monitoring capability and bolster Australia's international scientific leadership reputation.

When fully operational, Digital Earth Antarctica will:

- organise collections of satellite imagery of Antarctica in a consistent and standardised manner as Analysis Ready Data (ARD) in a high-performance-computing domain
- facilitate time-series analysis at any scale of computation and enable systematic monitoring of the Antarctic environment
- demonstrate Australian leadership in monitoring changes in Antarctica and provide scientific information to underpin Australia's scientific and strategic interests and Treaty obligations
- be globally recognised and provide a shared, Australian-sponsored service for all Antarctic nations, becoming a focal point for international collaboration.

Geoscience Australia's Digital Earth Australia (DEA) program is an exemplar of this capability. The potential scientific applications in Antarctica are diverse and include monitoring biodiversity, glacier and ice sheet dynamics, and environmental change.

AAD Support

Geoscience Australia has signed a Project Agreement with the AAD to conduct the 6-month scoping project, to the value of \$750,000. Under this agreement, Geoscience Australia is scoping the requirements and plan for the implementation of Digital Earth Antarctica. The intent is for the scoping project to lay the foundation for a subsequent implementation project to be delivered over three years. The current project agreement expires at the end of September 2023. Funding beyond the current project agreement is not yet agreed.

¹⁰ [Parliament of Australia | Antarctica Budget Review 2022-23 Index](#)

SouthPAN

Geoscience Australia is currently preparing for the installation of a Satellite-Based Augmentation System (SBAS) ground station, consisting of a GNSS Ground Reference Site (GRS) and Signal Quality Monitor (SQM), at Davis station. This ground station will form part of the Southern Positioning Augmentation Network (SouthPAN), a joint initiative of the Australian and New Zealand Governments that provides SBAS services in Australia, New Zealand, and its maritime region.¹¹ Installation of the SBAS ground station in the Australian Antarctic Territory will improve positioning and navigation services, contributing to improved air safety.

AAD Support

Geoscience Australia is procuring the equipment, construction material, housing and antennas for the ground station. AAD are supporting installation of the ground station through:

- provision of advice to validate requirements and specifications of the site design
- logistics and field support during the 2024/25 and 2025/26 seasons. This includes transportation of cargo to Davis station. Transfer and accommodation for one Geoscience Australia official or contractor may be required for site acceptance testing (SAT) during the 2025/26 season
- support from AAD expeditioners and staff for installation and commissioning of the ground station, including construction of footings and installation of power and communications cables in the 2024/25 season, and final equipment and on-site support of the SAT in 2025/26.

Upon completion, it is anticipated Geoscience Australia will manage the ground station remotely with ongoing, on-site support from AAD for:

- satellite-based communications and power supply for real-time data transfer
- logistics and field support for maintenance, including routine maintenance and electronics and communications technical support.

Installation and SAT of the station is to be completed no later than March 2026 to meet SouthPAN project timelines specified in the SouthPAN Prime contract with Lockheed Martin Australia. Geoscience Australia will seek to formalise an agreement with AAD for the ongoing, on-site support before installation is completed.

AusSeabed

Through the Geoscience Australia-led, national collaborative AusSeabed initiative,¹² we are partnering with the AAD to improve the coverage, quality, discoverability and accessibility of Antarctic seabed mapping data.

The AAD operates Australia's only deep-water research vessel with modern multibeam sonar equipment capable of acquiring seabed mapping data across the entire Southern Ocean, including on the Antarctic continental shelf. Acquiring high-quality seabed information is a critical component of the enhanced program of mapping and charting in East Antarctica.

In 2022, Geoscience Australia quality assured, processed and publicly released seabed survey data collected during icebreaker RSV *Nuyina's* maiden voyage to East Antarctica through the AusSeabed Data Portal.¹³ This dataset was highly sought after by the Antarctic science community to improve ocean and ice-sheet models. In addition, Geoscience Australia provided advice to AAD.

In anticipation of further data being acquired for processing, Geoscience Australia and the AAD have established a secure, cloud-based data transfer pipeline that enables Geoscience Australia to provide standardised data processing services to the AAD and deliver data directly back to the AAD and publicly

¹¹ <https://www.ga.gov.au/scientific-topics/positioning-navigation/positioning-australia/about-the-program/southpan>

¹² <https://www.ausseabed.gov.au/home>

¹³ <https://www.antarctica.gov.au/news/2022/antarctic-seabed-jigsaw-piece-publicly-released/>

through the AusSeabed Data Portal in adherence with the FAIR¹⁴ data principles. There are opportunities for Geoscience Australia to further support the AAD to improve data acquisition on future voyages by extending and automating existing processes for the continued delivery of standardised, interoperable seabed mapping data acquired from the RSV *Nuyina* through the AusSeabed Data Portal.

AAD Support

AAD has supported the Geoscience Australia-led AusSeabed initiative since its inception in 2018. This includes participating in workshops and in-kind contributions to AusSeabed governance forums.

In 2022/23, the AAD provided \$450,000 to Geoscience Australia as a co-investment in the AusSeabed initiative. This supported processing and delivery of the RSV *Nuyina* dataset, helped establish cloud infrastructure for AAD to integrate with Geoscience Australia's data processing environment and data portal, and contributed to an initial market scan to assess open-source data processing tools. Geoscience Australia is still in discussion with the AAD regarding co-investment in the AusSeabed initiative for 2023/24.

¹⁴ Findable, Accessible, Interoperable, Reusable

Marine and Terrestrial Geoscience

Geoscience Australia leads activities to map and characterise the Antarctic onshore and offshore environments. This work underpins our advice to government and informs environmental management and protection decisions. Geoscience Australia also contributes marine geoscience expertise to the Australian Antarctic Program Partnership (AAPP) and the Australian Centre for Excellence in Antarctic Science (ACEAS), and marine and terrestrial geoscience expertise to the Securing Antarctica's Environmental Future (SAEF) program.

Geological and geomorphological mapping is essential for landscape vulnerability and geoheritage assessments which identify and characterise fragile landforms and sites of intrinsic geological significance in ice-free areas of Antarctica. These activities inform the development of appropriate environmental management and protection strategies for the AAT under the Committee for Environmental Protection (CEP).

Seabed mapping to produce and interpret high-resolution bathymetry and related datasets supports a diverse range of applications, including:

- operational requirements, e.g. nautical charts, infrastructure development and facilitating search, rescue and recovery operations
- scientific research, e.g. oceanography, benthic ecology, paleoclimate studies, ice sheet dynamics and tsunami modelling
- strategic national interests, e.g. fisheries management, definition of maritime boundaries, evidence-based marine environmental management.

Geoscience Australia leads the *Towards a lighter touch: human impact assessments to support environmental stewardship* project (AASP Project 4620), which aims to improve understanding of the vulnerability of ice-free landscapes to human impacts (e.g. physical disturbance) and natural landscape change (e.g. permafrost movement, climate change). This project will involve field activities in ice-free areas of the AAT and produce geoscience datasets to support decision-making and best-practice in environmental stewardship.

Geoscience Australia is a co-investigator in the AAD-led *Hydrographic Surveying and Seafloor Characterisation Program* (AAP Project 5198), which aims to map and characterise priority areas of the Southern Ocean adjacent to the AAT. The project, a collaboration with the AAD, Australian Hydrographic Office and Geoscience Australia, will acquire and analyse hydrographic and seabed data from the RSV *Nuyina* and its science tender. Data management will be undertaken as part of the Geoscience Australia-led AusSeabed initiative.

AAD Support

For AASP Project 4620, Geoscience Australia has requested logistics support from the AAD for three field seasons. Request for logistics support in 2023/24, as part of the Denman Terrestrial Campaign, is not supported. However, the AAD have indicated Geoscience Australia is likely to be allocated berths the following season. This delay is welcomed by Geoscience Australia as it allows additional time to complete desktop mapping, prepare field equipment, and undertake training.

Geoscience Australia is not involved in any field activities for AAP Project 5198, AAPP, ACEAS and SAEF in the 2023/24 season.

Conclusion

Geoscience Australia's unique capabilities support a range of scientific, strategic, and operational objectives across the Australian Antarctic Program and our activities contribute to the whole-of-government investment in Antarctica. We rely on AAD support for our activities and have a strong working relationship, developed over our decades-long engagement in the Australian Antarctic Program. We understand the Antarctic operating environment and the constraints on logistics that require the AAD to prioritise activities each season. We will continue working with AAD to ensure our requirements are understood and supported wherever possible so Geoscience Australia can continue to provide positive input to the Australian Antarctic Program, and support broader government obligations, into the future.

Appendix A : Current GA Antarctic projects and research programs

Project or Research Program	Type	GA role	Duration	AAD Support to GA
<i>Geoscience Australia's Geodetic and Geophysical Monitoring Program</i> Operation and maintenance of geophysical observatories at Australia's Antarctic stations (geodetic, geomagnetic, seismic, infrasound)	AASP ¹ Project 4642	Chief Investigator	2022-2032	Logistics/field support Year-round technical assistance and weekly observations
<i>Towards a lighter touch: human impact assessments to support environmental stewardship</i> Assessment of landscape vulnerability to human impacts in ice-free areas using geomorphic mapping	AASP Project 4620	Chief Investigator	2022-2027	Logistics/field support
<i>Australian Antarctic Mapping Program</i> Development of Digital Earth Antarctica Installation of Satellite-based Augmentation System (SBAS) ground station at Davis AusSeabed	AAP Project 5202	Co-investigator	2022-2025	Direct funding Logistics/field support and advice Co-contribution
<i>Hydrographic Surveying and Seafloor Characterisation Program</i> AAD, Australian Hydrographic Office (Defence), GA collaboration to collect and interpret bathymetric data on RSV <i>Nuyina</i> voyages and shallow coastal surveys. All data will be processed and released through AusSeabed.	AAP ² Project 5198	Co-investigator	2022 - 2025	Summer logistics/field support Co-contribution
<i>AAPP Denman Marine</i> Collaborative voyage on RSV <i>Nuyina</i> across the AAPP, ACEAS and SAEF to understand past and present ice sheet change in the Denman Glacier region. GA will participate in the voyage and contribute to the acquisition and interpretation of bathymetric data.	AASP Project 4631	Co-investigator	2024/25	Voyage support
<i>Southern Ocean Sea Level Monitoring Network</i> Establish a network to measure and attribute relative sea-level changes at coastal locations	AASP Project 4626	Co-investigator		N/A
<i>BEAUT – Biodiversity of East Antarctica: Underwater and Terrestrial</i> Expand and enhance knowledge of East Antarctic biodiversity.	AASP Project 4633	Co-investigator	2022-2028	N/A

Australian Antarctic Project Partnership	Antarctic Science Collaboration Initiative	Associate Partner	2019 – 2029	Voyage support via AASP 4631
Securing Antarctica’s Environmental Future – An Evidence-Based, Informatics Approach (led by Monash University)	ARC Special Research Initiative AASP 4628	Partner Investigators	2020-2027	Logistics/field support Voyage support (including via AASP 4631)
The Australian Centre for Excellence in Antarctic Science (led by University of Tasmania)	ARC Special Research Initiative	Partner Investigator	2020-2024	Voyage support via AASP 4631

¹ *Australian Antarctic Science Program*

² *Australian Antarctic Program (non-science)*

Appendix B : Geoscience Australia’s Antarctic observatories

Infrastructure Type	Number and locations	Purpose
Geodetic network (GNSS stations and survey marks)	4 x Continuous Operating Reference Stations (CORS) (Casey, Davis, Mawson, Macquarie Island) Numerous survey and gravity benchmarks at multiple outcrop locations across the AAT	<ul style="list-style-type: none"> • Form part of the Australian Antarctic GNSS Network and Australian Regional GNSS Network • Improving and extending the International Terrestrial Reference Frame (ITRF) • Monitoring deformations of the solid Earth • Variations in sea level and in earth rotation • Determining orbits of scientific satellites • Monitoring the troposphere and ionosphere • Short-term episodic geodetic observations (survey marks) • Benchmark for gravity surveys
Geomagnetic observatories	3 - Casey, Mawson, Macquarie Island	<ul style="list-style-type: none"> • Form part of the Geoscience Australia geomagnetic observatory network • Geomagnetic reference field modelling • Compass navigation • Space weather monitoring • Airborne geophysical surveys and research
Seismic observatories	3 – Casey, Mawson, Macquarie Island	<ul style="list-style-type: none"> • Form part of the Australian National Seismograph Network (ANSN) • Earthquake monitoring • Tsunami warning • Nuclear test monitoring • Part of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) global verification system (Mawson only)
Infrasound array	1 – Davis	<ul style="list-style-type: none"> • Nuclear test monitoring • Forms part of the International Monitoring System (IMS) Infrasound network • Part of the CTBTO global verification system • Supports Comprehensive Nuclear-Test-Ban Treaty