

# SCAR WG-GGI NATIONAL REPORT FOR AUSTRALIA

## Report of Current Activities of Australia in Geodesy and Geographic Information for the period 2000 - 2002

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The following Australian organisations / institutes have programs to conduct research or operational work in the Antarctic in the field of Geodesy, Photogrammetry, Remote Sensing, Bathymetry, Geographic Information, Cartography and Surveying.

- Australian Antarctic Division (AAD), Department of the Environment
- National Mapping Division – Geoscience Australia (NMD-GA)
- Cooperative Research Centre for Antarctica and the Southern Ocean (ANTCRC) - University of Tasmania
- Royal Australian Navy Hydrographic Office Detached Survey Unit (RAN - HODSU)
- Australian National University (ANU)
- University of Melbourne (UMelb)

### 1. GEODESY

#### 1.1 Geodetic Surveys (NMD-GA, UMelb, & ANU)

The permanent GPS sites at Mawson, Davis, Casey & Macquarie Island have all been maintained and upgraded with the latest firmware & hardware. Glonass data also continues to be collected at Davis and is submitted to the International Glonass Service. All data is available from both IGS and Geoscience Australia's web site. The quality of the data can be seen at [www.auslig.gov.au/geodesy/argn/argnqual.htm](http://www.auslig.gov.au/geodesy/argn/argnqual.htm) and the time series of positions computed from this data is available for inspection at [www.auslig.gov.au/geodesy/sgc/gps/index.htm](http://www.auslig.gov.au/geodesy/sgc/gps/index.htm).

In the summer of 2000-2001 a number of projects were carried out and are documented in the report at [www.auslig.gov.au/geodesy/techrpts/pdf/techrept5.pdf](http://www.auslig.gov.au/geodesy/techrpts/pdf/techrept5.pdf). Additional work was undertaken at Casey in October 2001 ([www.auslig.gov.au/geodesy/techrpts/pdf/techrpt8.pdf](http://www.auslig.gov.au/geodesy/techrpts/pdf/techrpt8.pdf)).

- Precise local surveys were conducted at all sites, between the permanent GPS monuments and the surrounding reference marks, to check for possible local movement.
- The differences in height between the GPS monuments and the stations' tide gauge bench marks were measured by levelling and GPS, to connect the sea level measurements and the ellipsoidal heights determined by GPS ([www.auslig.gov.au/geodesy/antarc/antgauge.htm](http://www.auslig.gov.au/geodesy/antarc/antgauge.htm)).
- Four sites in the Australian Antarctic Geodetic Network were observed with GPS as part of the continuing program to upgrade it. The updated positions resulting from the readjustment of the network in terms of the ITRF2000, are available at [www.auslig.gov.au/geodesy/antarc/aagn.txt](http://www.auslig.gov.au/geodesy/antarc/aagn.txt).

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- In line with SCAR's aim to unify control networks, the Chinese, Russian and Australian control networks in the vicinity of the Larsemann Hills were connected by GPS and an attempt was made to produce transformation parameters between the three systems.
- A geometric geoid for the Vestfold Hills was produced by the observation of precise GPS at existing benchmarks with mean sea level heights. Geoscience Australia obtained observations at 13 benchmarks and an additional 10 obtained by students from the University of Tasmania. The resulting geoid was compared to the gravimetric EGM96 geoid over the same area.
- Students from UMelb set up a DORIS transmitter on the Sorsdal Glacier (see [www.sli.unimelb.edu.au/students/ugrad/projects/2001/sorsdal\\_2001.html](http://www.sli.unimelb.edu.au/students/ugrad/projects/2001/sorsdal_2001.html) for further information)

A November 2000 expedition to Heard Island provided GPS observations at eight stations, to upgrade the island's geodetic control network. Four of these stations used stable geodynamic quality marks. One of these, the fundamental pillar at Atlas Cove, was observed for more than two months, to provide a sound basis for future measurements of tectonic movement. All aspects of this survey are documented in the report at [www.auslig.gov.au/geodesy/techrpts/pdf/techrept6.pdf](http://www.auslig.gov.au/geodesy/techrpts/pdf/techrept6.pdf). In addition, the ITRF2000 positions resulting from this survey are available from [www.auslig.gov.au/geodesy/ngdb/heard.txt](http://www.auslig.gov.au/geodesy/ngdb/heard.txt)

### **1.2 Remote Sensing (AAD, NMD-GA & ANTCRC)**

Coastline, glaciers mapped from about 50 East longitude to 165 East longitude interpreted from Landsat 7 imagery by AAD Glaciology and NMD-GA.  
AAD has funded BAS to add the data to Version 3 of the SCAR ADDB.  
Photogrammetric plotting of Larsemann Hills nearing completion.

### **1.3 Bathymetry (AAD / RAN - HODSU)**

Chart of the Commonwealth Bay will be produced 2002. Coastline mapping completed.  
Hydrographic surveying by RAN of approaches to Commonwealth Bay

### **1.4 Aerial Photography (AAD)**

Aerial photography of penguin colonies in Cape Denison area  
Aerial photography of Casey station and Davis station

### **1.5 Surveying (AAD)**

Photo control for mapping completed in the Larsemann Hills.  
Vestfold Hills - lake levels – ongoing.  
Location of bench marks in the Vestfold Hills – ongoing.

### **1.6 Tide Gauges (AAD)**

Level connections to tide gauges and NMD-GA ARGN units at Mawson, Davis, Casey and Macquarie Island in the 2000/2001 and 2001/2002 season. All tide gauges bench marks

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and GPS base station now levelled to either second order and first order standards.  
Timed water level measurements at Mawson and Davis.

### *Mawson*

Bottom mounted tide gauge 1 downloaded. The gauge has been in operation for six years.  
The gauge will be removed in the 2002/2003 summer.

Bottom mounted tide gauge 2, deployed 2001/2002 summer.

Aquatrak tide gauge installed. Further development work required to bring it on-line by the end of 2002-2003 season.

### *Davis*

Bottom mounted gauge downloaded in 1999/2000 summer. Second bottom mounted gauge deployed May 2002.

### *Casey*

Tide gauge has not been found. Divers will search for the gauge in the 2002/2003 summer.

### *Macquarie Island*

Aquatrak and Druck pressure gauge downloaded monthly. Low voltage problems have been resolved by the installation of extra solar cells and battery.

Maintenance work on both gauges completed in March 2002. Both continue to operate satisfactorily.

### *Zhongshan*

*Tide gauge downloaded in January 2001. Data sent to CHINARE.*

### *Metadata tide gauges*

Metadata for each tide gauge installation can be found at:

<<http://www-aadc.antdiv.gov.au/Metadata/>>

### *Tide gauge data*

Records of tidal data can be viewed at the Australian Antarctic Division web site at:

<[http://www-aadc2.antdiv.gov.au/Metadata/tide\\_gauge/available\\_data.html](http://www-aadc2.antdiv.gov.au/Metadata/tide_gauge/available_data.html)>

Tidal data is available on request from the National Tidal Facility at:

<<http://www.ntf.flinders.edu.au/TEXT/WOCE/databases.html>>

## **2. MAPPING ACTIVITIES**

### **2.1 Topographic Mapping (AAD)**

The following maps were published in the period 2000 -2002:

Vestfold Hills 1:50 000 topographic map

Macquarie Island 1:50,00 topographic map

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### **Thematic Mapping (ANTCRC)**

Sea ice atlas from AVHRR imagery for the following areas:  
Mawson, Davis, Casey, Dumont D'Urville and Terra Nova Bay

### **2.3 Bathymetric Mapping (AAD)**

No bathymetric maps produced.

### **2.4 Digital Station Area Maps (AAD)**

Macquarie Island, Davis, Casey and Mawson station area maps have been updated each year.

The maps can be viewed on the web at:

<http://www-aadc2.antdiv.gov.au/gis/areamap/areamap.html>

### **2.5 Photogrammetric Plotting (AAD)**

Mawson coastline and offshore Islands – photogrammetric plotting completed

Framnes Mountains - photogrammetric plotting completed

Cape Denison, McKellar Islands and coastline mapped from high resolution Ikonos satellite imagery.

Larsemann Hills – nearing completion.

### **2.6 Orthophoto Maps (AAD)**

Casey station – various scales

## **3. GEOGRAPHIC INFORMATION ACTIVITIES**

The Australian Antarctic Data Centre has continued to improve the infrastructure to make digital spatial data and maps readily available to scientists and other users.

Map catalogue – production of an online map catalogue of all maps produced by SCAR countries. On line editing by SCAR member countries possible. Connections from the map catalogue to the SCAR composite gazetteer.

Feature type catalogue – production of a Feature Type Catalogue for SCAR to be tabled at Shanghai meeting.

### **3.1 Digital Datasets (AAD)**

A list of available digital datasets can be found by searching the metadata database at:  
<<http://www-aadc.antdiv.gov.au/Metadata/>>

### **3.2 Digital maps**

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The AADC now has some 295 maps available on line. An increase of about 165 maps since the Tokyo meeting.

The maps can be viewed at:

<<http://www-aadc2.antdiv.gov.au/gis/areamap/areamap.html>>

Larger digital map products include A0, A3 and A4 maps of Macquarie Island, Heard Island and Australian stations in Antarctica.

Helicopter operations maps – produced for all areas where Australia has helicopter operations and there are known concentrations of fauna. About 40 A4 maps in all. Maps can be downloaded from the web.

### 3.3 Metadata (AAD)

Information on Australia's metadata records can be viewed at <http://www-aadc.aad.gov.au/metadata/default.asp>

### 3.4 SCAR map catalogue (AAD)

The Australian Antarctic Data Centre has developed an online SCAR map catalogue [http://www-aadc.aad.gov.au/mapping/map\\_catalogue.asp](http://www-aadc.aad.gov.au/mapping/map_catalogue.asp). The catalogue lists details of all SCAR maps. The ability to edit the database online by WG-GGI members is now possible. All countries that responded to Henk Brolsma's emails have been sent a password for access to the catalogue for online editing and addition of new maps.

## 4. SCIENTIFIC PAPERS PUBLISHED / PRESENTED

Articles on tide gauges and mapping produced in the Australian Antarctic magazine, editions 1 and 2. SCAR Members wanting copies of future editions please send postal details to [henk.brolsma@aad.gov.au](mailto:henk.brolsma@aad.gov.au). Digital copies can be downloaded from the web at: <http://www.aad.gov.au/magazine/>

Manning, J. (2001), "The SCAR Geodetic Infrastructure of Antarctica", SCAR Report No. 20, May 2001, International Council for Science, Scott Polar Research Institute, Cambridge, UK.

Manning, J. and Wilson, T. (2001), "Antarctic Neotectonics", SCAR Report No. 20, May 2001, International Council for Science, Scott Polar Research Institute, Cambridge, UK.

Manning, J. (2001), "The SCAR GIANT Program", proceedings from ANTEC Workshop, Siena, Italy, July 2001 (in preparation)

Manning, J. (2002), "SCAR Geodesy in Antarctica", SCAR Report No. 21, (January 2002), International Council for Science, Scott Polar Research Institute, Cambridge, UK.

Manning, J., Johnston, G. and Digney, P. (2002), "GPS Connections at Antarctic Tide Gauge Bench Marks in 2000/2001 Summer", SCAR Report No. 21, (January 2002), International Council for Science, Scott Polar Research Institute, Cambridge, UK.

Dawson, J., Govind, R. and Manning, J. (2002), "Application of the NMD-GA Online GPS Processing System (AUSPOS) to Antarctica", SCAR Report No. 21, (January 2002), International Council for Science, Scott Polar Research Institute, Cambridge, UK.

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Johnston, G., Digney, P. and Manning, J. (2002), "Upgrades to the Australian Antarctic Geodetic Network, 2000/2001", SCAR Report No. 21, (January 2002), International Council for Science, Scott Polar Research Institute, Cambridge, UK.

Johnston, G., Digney, P. and Manning, J. (2002), "Extension of the Antarctic Geodetic Network in the Grove Mountains", SCAR Report No. 21, (January 2002), International Council for Science, Scott Polar Research Institute, Cambridge, UK.

Johnston, G., Digney, P. and Manning, J. (2002), "Connections between Geodetic Networks in the Larsemann Hills 2000/2001", SCAR Report No. 21, (January 2002), International Council for Science, Scott Polar Research Institute, Cambridge, UK.

### **5. PLANNED ACTIVITIES FOR THE NEXT TWO YEARS**

#### **5.1 Geodetic Surveys (NMD-GA, OSU and USGS)**

##### **(a) Field Surveys**

In the 2002-2003 Summer Geoscience Australia's National Mapping Division will provide survey support for the PCMEGA project in the South Prince Charles Mountains. This will include additional upgrading and extending the Australian Antarctic Geodetic Network at the southern end of the Southern Prince Charles Mountains.

(<http://www.antdiv.gov.au/goingsouth/Expeditioner/projects/pcmega.asp>)

In 2003-2004, a cooperative project is planned with Ohio State University (OSU) and the United States Geological Survey (USGS) to establish a deformation network along the Transantarctic Mountains in the eastern sector of the Australian Antarctic Territory. This will be an extension of the existing Transantarctic Deformation network (TAMDEF) in Southern Victoria Land.

It is anticipated that extended GPS observations will continue to be obtained on an annual basis at the Groves Mountain geodynamic mark.

##### **(b) Data base activities**

Work will continue on the geodetic control database developed at NMD-GA in 2002 ([www.scar-ggi.org.au/geodesy/giant.htm#controldb](http://www.scar-ggi.org.au/geodesy/giant.htm#controldb))

#### **5.2 Remote Sensing (AAD & ANTCRC)**

Purchase of Landsat, Ikonos, Quickbird, Aster and Landsat imagery of Prince Charles Mountains and other selected inland areas.

#### **5.3 Topographic Mapping (AAD)**

Large scale mapping of Heard Island - continuing

1:10 million map of Antarctica

Revision of 1:1 million Lambert Operations map – nearing completion

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Production of three 1:2 million maps of the Amery Ice Shelf, Lambert Glacier, Prince Charles Mountains showing the water column, bedrock and surface elevation – ongoing  
Framnes Mountains -

### **5.4 Geographic Information Activities (AAD)**

Windmill Islands GIS - inclusion of contaminated sites  
Vestfold Hills GIS - inclusion of geological data and lake bathymetry  
Heard Island GIS – ongoing.  
Larsemann Hills – inclusion of new topographic data  
Input of historical spatial data from sources such as publications, field books etc.

### **5.5 Bathymetry (AAD / RAN - HODSU)**

Macquarie Island – integration of bathymetric data from various sources  
Mawson - outer approaches to  
Larsemann Hills – inner and outer approaches

### **5.6 Bathymetric Mapping (AAD)**

Revision of bathymetric maps in the area from Prydz Bay to Mawson.

### **5.7 Tide Gauges (AAD)**

- (a) Ongoing operation of tide gauges at Macquarie Island, Casey, Davis, Zhongshan and Mawson
- (b) Shore mounted gauge (Aquatrak) at Mawson – further development
- (c) Repeat of level connections from tide gauge sensors to nearby coastal bench marks.

### **5.8 Field Surveys (AAD)**

Rauer Islands - photo control  
Prince Charles Mountains – photo control  
Bathymetric surveying of selected lakes in the Vestfold Hills  
Vestfold Hills – lake levels  
Windmill Islands – assistance with surveys of contaminated sites

### **5.9 Orthophoto maps (AAD)**

Maps are planned for following areas (in order of priority)  
Heard Island  
Beaver Lake area  
Vestfold Hills - Marine Plain  
Shirley Island

### **5.10 Photogrammetric Plotting (AAD)**

Areas to be plotted include:  
Heard Island – selected areas  
Rauer Group of islands  
Sansom Island

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### 5.11 SCAR Projects (AAD & NMD-GA)

- SCAR Map Catalogue.  
Development of SCAR web page with explanatory notes on how to use the catalogue.
- Symbology  
Symbols in digital format developed for inclusion in the SCAR symbology dictionary - ongoing
- Spatial Data Model – Feature Type Catalogue  
The Australian Antarctic for Feature Type Catalogue both large scale and small-scale data sets has been further developed. Further development of the catalogue, should be considered by the SCAR WG-GGI group in conjunction with the SCAR symbology dictionary.
- Gazetteer
- Geodetic control database  
A preliminary geodetic control database has been developed at NMD-GA and can be viewed at: [www.scar-ggi.org.au/geodesy/giant.htm#controldb](http://www.scar-ggi.org.au/geodesy/giant.htm#controldb)