WORKING GROUP ON GEODESY AND GEOGRAPHIC INFORMATION

REPORT TO XXVI SCAR, TOKYO, JAPAN

10 - 14 JULY 2000

www.scar-ggi.org.au

1. TOKYO MEETING

Representatives and observers from thirteen SCAR countries and observers from four non/inter-government organisations attended the Working Group on Geodesy and Geographic Information (WG-GGI) meeting at XXVI SCAR, 10-14 July 2000, in Tokyo, Japan:

- Members and observers (or their representatives): Australia, Belgium, Chile, China, Germany, Italy, Japan, Korea, New Zealand, Poland, Russia, UK, USA.

- Observers: International Hydrographic Organisation (IHO), International Association of Geodesy (IAG), International Steering Committee for Global Mapping (ISCGM), International Federation of Surveyors (FIG).

Apologies were received from Argentina, Finland, France, India, Norway, Sweden and Uruguay. The current Working Group membership is listed at Attachment 1.

The WG-GGI continues to focus on providing the fundamental geodetic and geographic information needed to support Antarctic science, environmental monitoring and field operations.

The agenda for the Tokyo meeting is at Attachment 2. Key activities were:

- reports by project leaders on outcomes from the thirteen WG-GGI projects defined at Concepcion in 1998;
- definition of nine continuing and eight new WG-GGI projects for 2000-2002, and development of a new outreach program;
- discussion of the 'SCAR Review' report .

National reports were tabled from countries active in Antarctic geodesy, mapping and GIS. Presentations and briefings were given on a range of SCAR and other projects and programs. Recommendations were developed addressing information exchange and gravity data. Standing resolutions were revised to incorporate web site maintenance, adoption of an Antarctic geodetic datum, and participation in global projects.

A joint meeting was held with the Geology, Solid-Earth Geophysics, Glaciology and JCADM Working Groups, to discuss issues of common interest including ANTEC and data management.

2. REPORT ON 1998-2000 ACTIVITIES

Reports on the thirteen projects developed at the Concepcion meeting were presented. All projects either fully or substantially met their goals. In summary:

Geodetic Infrastructure for Antarctica (GIANT) Program

1. Permanent Geodetic Observatories: the permanent network now comprises 13 GPS sites, 3 DORIS sites, 2 PRARE sites, 2 VLBI sites, 2 GLONASS sites, 12 tide gauges and 8 absolute gravity stations. Nine GPS sites are contributing data daily to the International GPS Service (IGS), an increase of 5 from 1998.
2. GPS Epoch Campaigns: field campaigns were completed in 1998-99 and 1999-00. Results from all past campaigns were integrated and submitted to the International Earth Rotation Service (IERS) for inclusion in the definition of the International Terrestrial Reference Frame (ITRF) 2000.
3. Physical Geodesy: primary data sources have been identified and collaborative arrangements have been developed with the International Association of Geodesy (IAG) and the International Geoid Service (IGeS).
4. GLONASS Evaluation: one Antarctic site was contributed to the International GLONASS Experiment (IGEX) pilot project.
5. Differential GPS Base Stations: requirements were identified in the Peninsula area and information provided to COMNAP on technical aspects.
6. Remote Geodetic Observatories: four members are experimenting with autonomous remote GPS sites, but the technology is not yet proven.
7. Information Access: the WG-GGI web site was developed as the primary mechanism for information exchange and data access.

Geographic Information Program

1. Standards: a draft map and data dictionary was produced and circulated for review by members.
2. Place Names: a supplement to the first edition of the SCAR Composite Gazetteer of Antarctica (CGA) was published and presented, containing 1258 new entries including 439 previously unnamed features. The CGA web site <www.pnra.it/SCAR_GAZE> is now being updated quarterly.
3. Topographic Database: SCAR Antarctic Digital Database (ADD) Version 3.0 was released online at www.nerc-bas.ac.uk/public/magic/add_home.html, incorporating new elevation data for the Antarctic ice sheet derived from radar data. Over 1000 users from 41 countries have downloaded ADD data, and derived data has been submitted to the Global Map project.
4. King George Island GIS: a list of datasets was prepared, and a workshop to scope future developments in this project was held in China.
5. Geographic Data Integration: a conceptual data model was developed, and standardised descriptions presented on the GGI web site for the fundamental datasets (elevation, bedrock, bathymetry, coastline, imagery, features, names).
6. Maps and Charts Catalogue: a web-based catalogue was developed at www-aadc2.antdiv.gov.au/maps/ and a draft revision of the SCAR Map and Chart Catalogue was presented.

Meetings and Communication

The following WG-GGI meetings were held during the period:

- Place Names Workshop, Rome, March 1999. The project team reviewed the inclusion of feature description data and web site maintenance.
- Program Coordinators meeting, Heppenheim, July 1999. Fourteen members attended, enabling mid-term review of progress in all WG-GGI projects.
- Antarctic Geodesy Symposium (AGS99), Warsaw, July 1999. Eighteen people from eight countries attended, with ten papers presented. The proceedings have been submitted to SCAR for publication.
- Special Antarctic Session, European Geophysical Society Scientific Assembly, Nice, May 2000. Papers on the status of Antarctic geodesy were presented in the ANTEC symposium.
- King George Island GIS Workshop, Wuhan, July 2000. Thirty people attended the workshop and thirteen presentations were given, enabling further development of this WG-GGI project.

The WG-GGI web site <www.scar-ggi.org.au> now contains details of all GGI projects, reports of meetings, notices of future events, geodetic data, member contact details and links to related sites. The site is now attracting 10,000 visits per year. Two e-mail list servers are used for circulation of information to members.

Liaison

The Working Group's programs and products have significant global and interdisciplinary applications. Liaison with external bodies is therefore essential to ensure that activities are appropriately integrated and focussed on scientific and operational needs.

Reports were presented to the Tokyo meeting on the following projects and agencies: SCAR, IHO, ISCGM, GLOCHANT, JCADM, ANTEC, radar mapping, bedrock mapping, coastline mapping and ICESAT. A joint meeting was held with the Geology, Solid-Earth Geophysics, Glaciology and JCADM Working Groups. Geodesists from WG-GGI are active in a number of IAG Commissions and Special Study Groups relating to Antarctic research, and three are members of the ANTEC Group of Specialists.

3. SCAR REVIEW

The Working Group discussed the report of the ad hoc Group on SCAR Organisation and Strategy, and heard presentations from the SCAR President and the ad hoc Group Chair. WG-GGI supported the recommendations in general, but identified a number of issues that should be addressed in any subsequent implementation plan. These included:

- consultation with Chief Officers in determining the future arrangements for establishment and review of operating groups;
- preservation of long-term monitoring and database development programs;
- development of an integrated web-based SCAR communication program;
- development of an Antarctic science conference in conjunction with the two-yearly meetings of all operating groups;
- the unwieldy nature of the proposed Vice President and Delegate Committees structure.

These conclusions were discussed with other Chief Officers and incorporated into the Chief Officer report to SCAR on the review.

4. PLANS FOR 2000-2002

The Working Group continued the structure of two major programs, geodesy and geographic information, each with a number of specific projects. A third overarching program, outreach, was developed in Tokyo. Nine geodesy and geographic information projects from the 1998-2000 period are continuing, and eight new projects have been identified.

The programs, their objectives and the projects to be undertaken in 2000-2002, are listed in the following table:

Outreach Program

Objective:
- provide information on Antarctic geodesy and geographic information to the scientific and general community;
- promote use of WG-GGI data products, and encourage collaborative research.

Projects:
1. Website Maintenance
2. Publications
3. Liaison
4. Meetings

Geodesy Program

Objective:
- provide a common geographic reference system for all Antarctic science and operations;
- contribute to global geodesy for the study of the physical processes of the earth and the maintenance of the precise terrestrial reference frame.

Projects:
1. Permanent Geodetic Observatories
2. Crustal Deformation Network
3. Physical Geodesy
4. Geodetic Control Database
5. Tide Gauge Data
6. Atmospheric Impact on GPS
7. Remote Geodetic Observatories
8. New Geodetic Satellite Missions

Geographic Information Program

Objective:
- integrate and coordinate Antarctic mapping and GIS programs;
- make fundamental reference data available to the Antarctic and global user communities.

Projects:
1. Topographic Database
2. Place Names
3. Spatial Data Standards
4. Map Catalogue
5. Imagery Catalogue
6. King George Island GIS Database
7. GIS Collaboration in East Antarctica
8. Bathymetric Database
9. Online Atlases

The goals and major activities planned for the 2000-2002 period are summarised below. Program leaders are also identified. A more detailed description of each project, and the collaborating members, are listed on the WG-GGI web site.

Outreach Program

1. Website Maintenance (Executive Officer, Glenn Johnstone)
   Goal: maintain and expand web site content in support of all projects.
   Key Activities: maintain web site, list servers, map distribution list and descriptions of fundamental datasets.

2. Publications (Chief Officer, John Manning)
   Goal: promote awareness of WG-GGI activities and standards.
   Key Activities: develop a bibliography and publication program, produce guidelines for the Antarctic geodetic datum and for ice site surveys.

3. Liaison (Chief Officer, John Manning)
   Goal: enhance communication between WG-GGI, SCAR and related bodies.
   Key Activities: liaise with SCAR, COMNAP and international associations.

4. Meetings (Executive Officer, Glenn Johnstone)
   Goal: organise and coordinate meetings and symposia.
   Key Activities: arrange inter-sessional geodesy, geographic information and program coordinators meetings, and the WG-GGI 2002 meeting.

Geodesy Program (Geodetic Infrastructure for Antarctica - GIANT)

1. Permanent Geodetic Observatories (Australia, John Manning)
   Goal: develop and maintain a network of permanent geodetic observatories.
   Key Activities: expand the network into priority ANTEC areas, facilitate on-line data retrieval, publish GPS base station specifications.

2. Crustal Deformation Network (Germany, Reinhard Dietrich)
   Goal: densify the geodetic infrastructure formed from the permanent observatories and develop a surface crustal deformation model.
   Key Activities: coordinate annual epoch campaigns, integrate solutions, and contribute the results into global geodetic programs.

3. Physical Geodesy (Italy, Alessandro Capra)
   Goal: develop a new high-resolution geoid for Antarctica.
   Key Activities: collaborate in the collection and analysis of key datasets, particularly gravity, and develop a simulation model in a test area.

4. Geodetic Control Database (New Zealand, Tony Bevin)
   Goal: develop a master index of Antarctic survey control points.
   Key Activities: develop a control point index website and a template for the documentation of geodetic control and tide gauge records.

5. Tide Gauge Data (Japan, Kazou Shibuya)
   Goal: improve access to historic and current Antarctic tide gauge data.
   Key Activities: research historical tide gauges, list all permanent and significant sites, develop database of sea level determinations with dates and accuracies.

6. Atmospheric Impact on GPS Observations in Antarctica (Poland, Jan Cisak)
   Goal: to understand ionospheric and tropospheric impacts on GPS data quality.
   Key Activities: analyse data from permanent and epoch sites, participate in international studies.

7. Remote Geodetic Observatories (USA, Larry Hothem)
   Goal: identify appropriate technologies for remote autonomous GPS sites.
   Key Activities: monitor and report on developments in power and data access.

8. New Geodetic Satellite Missions (Germany, Reinhard Dietrich)
   Goal: ensure new missions are integrated with the Antarctic geodetic system.
   Key Activities: identify and report on missions contributing or requiring geodetic data, provide calibration and validation data.

Geographic Information Program

1. Topographic Database (UK, Janet Thomson)
   Goal: provide a SCAR standard small-scale topographic GIS database.
   Key Activities: develop and release Version 4.0 of the Antarctic Digital Database (ADD), and contribute Antarctic data to the Global Mapping program.

2. Place Names (Italy, Roberto Cervallati and Chiara Ramorino)
   Goal: provide an authoritative database of all Antarctic place names approved by recognised bodies (SCAR Composite Gazetteer of Antarctica – CGA).
   Key Activities: expand the CGA to include dates of approval and feature descriptions, maintain

the CGA web site with quarterly updates.

3. Spatial Data Standards (Australia, Henk Brolsma)
   Goal: develop a SCAR standard spatial data model.
   Key Activities: draft and finalise the data model based on ISO standards, incorporate map symbols in the data dictionary.

4. Map Catalogue (Australia, Henk Brolsma)
   Goal: maintain a public-access Antarctic map catalogue.
   Key Activities: finalise and publish Edition 6 of the SCAR Map Catalogue (on-line and hardcopy), develop an on-line catalogue update facility.

5. Imagery Catalogue (USA, Jerry Mullins)
   Goal: maintain a public-access Antarctic satellite imagery and aerial photography catalogue.
   Key Activities: identify location and characteristics of existing imagery, develop an on-line index.

6. King George Island GIS Databse (Germany, Reinhard Dietrich and Steffen Vogt)
   Goal: produce a SCAR standard large-scale GIS database of King George Is.
   Key Activities: develop data specification, collect and integrate existing data, develop on-line data access facility.

7. GIS Collaboration in East Antarctica (Russia, Alexander Yuskevitch)
   Goal: develop a proposal for multinational GIS collaboration.
   Key Activities: define user needs, identify site, produce a data index, develop a GIS project plan.

8. Bathymetric Data (New Zealand, Tony Bevin and John Spittal)
   Goal: develop a SCAR standard small-scale bathymetric database.
   Key Activities: identify data sources and coverage, produce and publish a data index, develop a database project plan.

9. On-Line Atlases (USA, Jerry Mullins)
   Goal: define future SCAR involvement in on-line atlas technology.
   Key Activities: identify potential SCAR and related user requirements, evaluate the Canada-Argentina proposal, develop a project plan.

5. ELECTIONS, MEETINGS, RESOLUTIONS, FINANCE

John Manning (Australia) was elected Chief Officer. Glenn Johnstone (Australia) will continue to provide Executive Officer support to the Working Group. Coordinators were appointed for the two major WG-GGI programs:

- Geodesy (GIANT): John Manning (Australia)
- Geographic Information: Janet Thomson (UK)

The Working Group proposes the following meetings in 2000-2002 (the Siena meetings being held in conjunction with an ANTEC meeting):

- Geographic information workshop, Siena, July 2001;
- Program coordinators meeting, Siena, July 2001;
- GIANT Symposium (AGS01), St Petersberg, July 2001;
- Working Group meeting at XXVII SCAR, China 2002.

The WG-GGI Standing Resolutions were reviewed. Two were revised to incorporate tide gauges and the Antarctic geodetic datum, and two new resolutions were added addressing the WG-GGI web site and participation in global programs. The current resolutions are listed in Attachment 3.

Two new recommendations to SCAR were developed, addressing information access and gravity data. These recommendations are listed in Attachment 4.

Applications for SCAR funding support have been made for the physical geodesy, topographic database, spatial data standards and place names projects, and for the inter-sessional geodesy and geographic information symposia.

Acronyms applicable to WG-GGI and used in this report are listed in Attachment 5.

Drew Clarke
Outgoing Chief Officer
14 July 2000

Attachments:
1. Working Group membership and contact details
2. Tokyo meeting agenda
3. Standing resolutions
4. Recommendations to SCAR XXVI
5. Acronyms

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WORKING GROUP ON GEODESY & GEOGRAPHIC INFORMATION

Tokyo, Japan
10-14 July 2000

AGENDA

Meeting Opened

1. Administration
2. SCAR Review Process & Outcomes
3. WG Response to State of the Antarctic Environment Report (SAER)
4. Project Reports
5. Reports from SCAR Coordination Bodies, International Liaison Bodies & Other Programs
6. Joint Meeting between Glaciology, Geology, SEG, ANTEC, JCADM and GGI Working Groups
7. National Reports
8. Review of Program Structure
9. Program Development for 2000-2002
10. State of the Antarctic Environment Report - SAER
11. Finalisation and Presentation of Proposed Programs for 2000 - 2002
12. Actions and Resolutions
13. Administrative arrangements for 2000 - 2002
14. Development of funding applications - SCAR and non-SCAR sources
15. WG Response to SCAR Review
16. Report to SCAR
17. Drafting of Final Report to SCAR

Meeting Closed

STANDING RESOLUTIONS

of the XXVI SCAR

WORKING GROUP ON GEODESY AND GEOGRAPHIC INFORMATION

Tokyo, Japan, 10 - 14 July 2000

Standards

1. That members will apply approved SCAR geodetic and geographic standards, specifications and guidelines in their national Antarctic programs (noting that the standards, specifications and guidelines in the 1994 Standing Resolutions will continue to apply until superseded).

Directories

2. That members will contribute all relevant information to SCAR directories of Antarctic geodetic and geographic information.

Information Exchange

3. That members will exchange and make freely available geodetic and geographic data, in accordance with the Antarctic Treaty. Two copies of maps, charts and other geographic publications shall be automatically distributed to the Antarctic Mapping Centres of the SCAR countries.

Control Points

4. That members will make ground control points, including photographic identifications, and tide gauge information available on the World Wide Web for use in other Antarctic mapping and research applications.

Geodetic Datum

5. That members adopt the International Terrestrial Reference Frame 2000 (ITRF2000) at an epoch of 2000.0 together with the GRS80 ellipsoid, as the geodetic datum for all Antarctic activities. This Antarctic ITRF2000 datum be known as the Antarctic Geodetic Datum 2000 (AntGD2000).

Representation

6. That whenever possible, national representation at Working Group meetings should include both geodetic and geographic information specialists.

Web site

7. That the Working Group maintain, through member contributions, a comprehensive web site outlining project activities, reports and contact details.

Global Programs

8. That the Working Group shall support all relevant global science programs through the contribution of Antarctic geodesy and geographic information, including the Global Mapping project and the International Earth Rotation Service.

RECOMMENDATIONS TO XXVI SCAR

WORKING GROUP ON GEODESY AND GEOGRAPHIC INFORMATION

The Working Group recommends that SCAR XXVI adopt the following recommendations.

1. Geodetic and Geographic Information

Noting the Antarctic Treaty Article III (1c) requirements regarding data exchange,

Recognising that the information products produced by the SCAR Working Group on Geodesy and Geographic Information are all derived from the work of National Committees and Operators:

SCAR *recommends* that National Committees and Operators provide continuing access for all SCAR members to fundamental geodetic and geographic information, including:

- geodetic observations and databases;
- geodetic control point and tide gauge records;
- topographic and bathymetric data; and
- place names data.

2. Airborne Gravity Data for Geoid Computation

Noting that determination of a high resolution geoid in Antartica benefits research of the ice density of the Antarctic ice sheet, determination of surface elevation relative to mean sea level, and the calibration and validation of satellite missions;

Recognising that there is a major gap in gravity data required for the computation of a high resolution geoid in Antarctica;

Considering the current lack of gravity data, the need to acquire gravity data at close intervals (optimally spaced between 10 and 50 km), that new satellite gravity missions will leave a gap from 82 to 90 degrees south, and that airborne gravity observation is considered the most cost effective and reliable method for collecting data;

SCAR *recommends* that National Committees and Operators:

- support a scientific programme of airborne gravity to cover gaps in Antarctica gravity data; and
- encourage all researchers to coordinate their efforts in Antarctic gravity data acquisition, in particularly airborne gravity data, and to provide such data to the SCAR Working Group on Geodesy and Geographic Information.

ACRONYMS USED BY THE SCAR WORKING GROUP ON GEODESY AND GEOGRAPHIC INFORMATION

ADD	Antarctic Digital Database
ADGRAV	Antarctic Digital Gravity project
ADMAP	Antarctic Digital Magnetic Anomalies Project
AGDI	Antarctic Geographic Data Integration project
AGS	Antarctic Geodesy Symposium
ANTEC	SCAR Group of Specialists on Antarctic Neotectonics
BAS	British Antarctic Survey
BEDMAP	Ice Bed Elevation Mapping project – British Antarctic Survey
CGA	Composite Gazetteer of Antarctica
CHAMP	Challenging Mini-satellite Payload
COMNAP	Council of Managers of National Antarctic Program
DCDB	Data Center for Digital Bathymetry
DGPS	Differential Global Positioning System
DEM	Digital Elevation Model
DIF	Data Interchange Format
DORIS	Doppler Orbitography Information System
EGM96	Earth Geopotential Model 1996
FIG	International Federation of Surveyors
GEBCO	General Bathymetric Chart of the Ocean
GIANT	Geodetic Infrastructure in Antarctica
GIS	Geographic Information System
GLOCHANT	SCAR Group of Specialists on Global Change and the Environment
GLONASS	Global Navigation Satellite System
GOSEAC	SCAR Group of Specialists on Environmental and Conservation Affairs
GPS	Global Positioning System
GRACE	Gravity Recovery And Climate Experiment mission
GRS	Geodetic Reference System
GSDI	Global Spatial Data Infrastructure
IAG	International Association of Geodesy
ICESat	Ice, Cloud and Land Elevation Satellite
IERS	International Earth Rotation Service
IGeS	International Geoid Service
IGEX	International GLONASS Experiment
IGS	International GPS Service
IHO	International Hydrographic Organisation
IOC	International Oceanographic Commission
ISCGM	International Steering Committee for Global Mapping
ISO TC211	International Standards Organisation - Technical Committee 211
ITRF	International Terrestrial Reference Frame
IUGG	International Union of Geodesy and Geophysics
JCADM	Joint Committee on Antarctic Data Management
KGIS	King George Island GIS
NADC	National Antarctic Data Centre
PRARE	Precise Range and Rate Experiment
RAMP	RADARSAT Antarctic Mapping Program
SEG	SCAR Working Group on Solid Earth Geophysics
SPA	Specially Protected Area
SCAR	Scientific Committee on Antarctic Research
SSSI	Site of Special Scientific Interest
VLBI	Very Long Baseline Interferometry
WG-GGI	SCAR Working Group on Geodesy and Geographic Information