GeoReach

Newsletter from the
SCAR Geoscience Standing Scientific Group

Volume 2, Number 2 **April 2003**

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From the CO's Desk

Dear Geoscience Antarctican,

SCAR activities are in full swing with meetings in Freiburg and Nice just completed and preparations for ISAES in Potsdam and AGS'03 in Lviv in full swing. On the Antarctic Treaty front, SCAR is receiving requests for comments and information from the Treaty meetings and from the Committee for Environmental Protection. These requests tend to come to me first and I will attempt to pass them on via the list server so everyone knows what is going on.

We have received requests for comment on a number of Antarctic Special Protected Area management plans and Comprehensive Environmental Evaluations (CEEs). These requests are important because, in the longer term, such management regimes will govern our access to Antarctica. Our input as geoscientists will help establish regimes that protect the Antarctic while still maintaining sufficient access to allow for important science.

I am asking for two things:

1. That you take the time to examine reports and plans in areas you know something about.

2. That you provide the best scientific advice with as little bias as possible. I find it easy and very tempting when dealing with environmental issues, particularly those dealing with access for scientist, to push for the outcome that I prefer. Long term credibility depends on managers and the public seeing us as providers of scientific advice, not advocates for one position or another. A speaker at AGU last year, (talking about river management not the Antarctic), commented that some scientists, when asked for advice, push an agenda rather than stick to the facts. These people have become known as "combat biologists" in the USA and their advice tends to be discounted. We must avoid this trap.

On a similar note, the marine acoustics issue is still with us. SCAR is moving to form an Action Group to deal with comments on the report and to evaluate recent events and research. I have been asked for nominations to be part of this group.

These things are important for the Antarctic community so, please look at the Antarctic Special Protected Area and CEE requests when they come around and see if you can contribute to their development. And, if you know any whale biologists who might be able to help, let me know,

Phil O'Brien
Chief Officer, SCAR GSSG

SALE News

[From the Subglacial Antarctic Lake Exploration (SALE) Scientific Research Program]

The exploration of subglacial lakes has caught the imagination of the scientific and lay public. The high level of interest has been generated by the possibility of life in lakes having been isolated for many millennia, and in potentially providing a paleoclimatic record from deep within the Antarctic continent.

Plans by the scientific community to explore subglacial lakes have been advanced by a series of workshops that started in 1996. The first wide publicity about the possible presence of a large lake under the East Antarctic ice sheet was engendered by the article of Kapitsa et al. (1996 - Nature, 381: 684-686).

Subsequent to this article, the presence of the lake was reported during the Rome meeting of SCAR. Following the first several workshops, activities culminated with an international workshop in Cambridge in 1999. From this meeting a scientific plan was produced and suggestions were made for a phased-in approach to implementation of a comprehensive subglacial lake exploration program.

SCAR then established a Group of Specialists for Subglacial Lake Exploration (SALE). Workshops have included:

i) Lake Vostok Workshop: "A Curiosity or a Focus for Interdisciplinary Study", Washington D.C., USA, November, 1998;
ii) Workshop on Subglacial Lakes, Cambridge, UK, September, 1999;
iii) Subglacial Lake and Deep Ice Exploration: Canadian Expertise and International Opportunities, Ottawa, Canada, March, 2001;
iv) Life in Ancient Ice Workshop, Gleneden Beach, Oregon, USA, June, 2001;
v) Subglacial Lakes: Biology and Decontamination Issues, Amsterdam, Netherlands' August, 2001;
vi) SCAR Group of Specialists: Subglacial Antarctic Lake Exploration, Bologna, Italy, November, 2001;
vii) SCAR Group of Specialists: Subglacial Antarctic Lake Exploration, LDEO, New York, USA, May, 2002;
viii) International Conference of Intelligent Robots and Systems IROS 2002, IEEE/RSJ, Lausanne, Switzerland, September, 2002;
ix) Fastdrill 2002 Workshop: Interdisciplinary Polar Research Based on Fast Ice-Sheet Drilling, Santa Cruz, California, October, 2002; and
x) SCAR Group of Specialists: Subglacial Antarctic Lake Exploration, Santa Cruz, California, October, 2002.

Background reports from these workshops and further information is available at the SALE website: salegos_scar.montana.edu/

Following the general concepts outlined in the 1999 Cambridge Workshop report, the SALE group has made significant progress toward "putting the flesh on the bones" of the plan for lake exploration. It was recognized that the endeavour needed to be broken down into broad components based on time to meet objectives. Further, it was recognized that subglacial lake exploration has a series of supporting and interconnected scientific objectives that require different levels of technological advances and developments, financial resources, and logistical support.

The grouping into time-related objectives with their associated technological milestones are:

i) short term (0 to 3 years) - pre-lake entry and regional surveys (includes 7 technological milestones);
ii) medium term (3 to 6 years) - lake entry and observatory deployment with no sample retrieval (includes 3 technological milestones);
iii) long term (6 to 9 years) - lake entry and sample return of water and shallow sediments (includes 3 technological milestones); and
iv) very long term (9+ years) - lake entry and sample return of long sediment cores (includes 1 technological milestone).

To meet these time-related objectives of the overall exploration program, the SALE group has developed a portfolio of components with their own self-contained objectives and requirements.

A series of Scientific Portfolios are currently envisioned to include: i) remote studies - accreted ice, study of analog settings, modelling, and remote sensing; ii) deployment of remotely operated *in situ* lake observatories and "down-ice-hole" studies; iii) subglacial lakes as systems through survey and inventory; and iv) subglacial lake processes and histories.

At its third meeting the SALE group evaluated different management strategies of large international scientific programs, and concluded there are several past and on-going programs in Antarctica on which a lake exploration program could be modelled. There was also a compilation of important documents dealing with contamination issues based on NASA's experience in space exploration. These provide an excellent

background and are very strongly analogous to the problems of contamination that will be faced with subglacial lake exploration. SALE also provided SCAR with a list of recommendations that it believes need to be considered in order to place SCAR in a leadership position for developing an international subglacial lake exploration program. SALE believes SCAR is well-positioned to establish the framework and guiding principles for such a program and to build international consensus by following the recommendations below:

Recommendation 1 - SCAR adopt the guiding principles for subglacial lake exploration as enunciated in the SCAR/COMNAP workshop in Cambridge, UK, 1999: i) the program be internationally coordinated; ii) the program be interdisciplinary in scope; ii) minimum disturbance and contamination must be fundamental considerations in program design and execution; iii) the ultimate goal should be lake entry and sample return; and iv) the ultimate target for study must be large lakes such as Lake Vostok.

Recommendation 2 - SCAR adopt the goals for subglacial lake exploration as enunciated in the SCAR/COMNAP workshop in Cambridge, UK 1999: i) determine the form, distribution, and activity of life in the lake water, the sediments below, and the ice above; ii) recover climatic information contained in ice overlying the lake and in sediments underlying the lakes; and iii) understand the origins of subglacial lakes and their impact on the evolution of life under the ice.

Recommendation 3 – SCAR coordinate and consult with COMNAP in providing guidance on the technological needs and requirements for safe and clean lake entry and sample retrieval.

Recommendation 4 - SCAR coordinate and consult with COMNAP in considering ways to promote the use of shared logistics to implement a subglacial lake exploration program, and to establish an effective management structure and cost-sharing mechanism.

Recommendation 5 – SCAR encourage National Antarctic Committees in countries with an interest in subglacial lake exploration to form an International Science Steering Committee (ISSC) to promote and organize an international subglacial exploration program.

Recommendation 6 – SCAR encourage National Antarctic Committees in countries with an interest in subglacial lake exploration to form National Science Steering Committees (NSSC) to promote and organize subglacial lake exploration interests within their countries.

Recommendation 7 – SCAR explore a partnership with COSPAR (ICSU) to share expertise and experiences in addressing environmental issues related to “forward’ and “backward” contamination during subglacial lake exploration.

Recommendation 8 – SCAR encourage parties interested in subglacial lake exploration to consult with and engage independent and objective scientific bodies to provide guidance on contamination issues in a way analogous to the Space Studies Board and COSPAR.

Recommendation 9 – SCAR explore ways to promote subglacial lake exploration including funding of targeted workshops, news releases, articles, symposia, and planning activities to address key issues.

Thus far these recommendations have not been evaluated nor acted on by the SCAR Executive. The next meeting of the SALE group is immediately before the EGU-AGU scientific meeting in Nice during April, 2003. The main objectives of the up-coming SALE meeting are primarily to discuss a way forward following the presentation of these recommendations to the SCAR Executive.

Members of SALE are: Dr. John Priscu (Convener), Montana State University, United States; Dr. Robin Bell, Lamont-Doherty Earth Observatory, United States; Dr. Sergey Bulat, St. Petersburg Nuclear Physics Institute, Russia; Dr. Cynan Ellis_Evans, British Antarctic Survey, United Kingdom; Dr. M. Chuck Kennicutt II (Secretary), Texas A&M University, United States; Dr. Valerii Lukin, Arctic & Antarctic Research Institute, Russia; Dr. Heinz Miller, Alfred Wegener Institut für Polar und Meeresforschung, Germany; Dr. Jean-Robert Petit, LGGE, France; Dr. Ross Powell, Northern Illinois University, United States; Dr. Martin Siegert, University of Bristol, United Kingdom; and Dr. Ignazio Tabacco, DST. Geofisca, Italy.

GIG News

There are a number of articles of interest in relation to what has been happening with geospatial information activities over the last few months.

Map exchange

Have you ever wanted to know where to send your recently published maps, charts or geographic publications of Antarctica?

Standing Resolution Number 3 of the Group of Experts on Geospatial Information (from XXVII SCAR) states

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

GSSG members are asked to provide Glenn Johnstone with updated map exchange contact details. The contact for your country can be found at:

www.geoscience.scar.org/mapexchange.htm

The list is to aid GSSG members with the latest contact information where maps, charts or geographic publications need to be sent.

Finnish GPS in Dronning Maud Land

In January-February 2003 the Finnish Geodetic Institute (FGI) installed a permanent GPS station at the Finnish Antarctic base Aboa at Basen (latitude 73 03'S, longitude 13 24'W) in Western Dronning Maud Land. The work is a part of the Finnarp 2002 expedition. The GPS station is co-located with an absolute gravity site occupied by FGI in 1994 and 2001.

It will be tied to the Swedish station Wasa at 200 metres distance and has been occupied in SCAR epoch GPS campaigns since 1997.

[Thanks to Jaakko Makinen, FGI, for providing this information]

Freiburg GIS workshop

The 2nd International Antarctic GIS Workshop (AntGIS 2003) was held at the Institut für Physische Geographie (IPG), Albert-Ludwigs-Universitaet in Freiburg, Germany, from 7-10 April 2003.

There were 25 participants representing 9 countries and 21 papers presented. It was a very successful workshop, with a number of new projects being show-cased for the first time. Participants remarked that the organisers had done a very good job in organising and hosting the workshop.

Prof Gossman, Head of IPG, commented he was pleased to see there was a mixture of experienced researchers and younger enthusiastic researchers in attendance. He said there was a wide variety of Antarctic GIS research presented and was impressed with what he saw during the 3 days. He also said that the work this group undertakes plays an important role within SCAR and hoped it will continue.

The 5 sessions of the workshop focussed on such topics as: GIS applications in Antarctica; Internet GIS; Web Portals and; Antarctic GIS Standards.

Among the highlights were the following:

- The Australian Antarctic Data Centre has completed the first version of the SCAR Feature Catalogue in cooperation with a number of other SCAR member nations, including Germany, Chile, the UK and the USA. More information can be found at Australian Antarctic Division's web site. Work continues on the Feature Catalogue, including new type definitions and Feature Associations.

- Within the next 4 months a new version of the SCAR Antarctic Digital Database (ADD) will be released. The ADD will be converted to use the SCAR Feature Catalogue (FC) as defined above at this release if possible, or at the next release otherwise. It is expected that the process of migrating the ADD to the SCAR FC will result in development and strengthening of the FC, in particular through the provision of Feature Associations. The adoption of ISO standards by this important Antarctic resource will enable their use by a much larger community than previously.

- The online Cybercartographic Atlas of Antarctica will be working towards creating web feature servers and other web services to bring together Antarctic spatial resources. In particular, the Cybercartographic Atlas will work with the Antarctic Digital Database to provide a web server to disseminate these data.

There will be a copy of all presentations and papers provided on the GSSG web site and the IPG web site in the coming weeks. Selected papers from the workshop will be published in a special edition of the German publication "Polarförschung".

Held concurrently with the workshop was a meeting on the Composite Gazetteer of Antarctica - a report on progress of the project and summary of this meeting are available for viewing.

On the final afternoon of the workshop there was a business meeting of the SCAR Group of Experts on Geospatial Information (GIG). This examined the progress of the Geographic Information Work Program for 2002-2004 and found that most projects are progressing well. Some fine tuning of activities was discussed and noted.

Cybercartographic Atlas of Antarctica

Development of The Cybercartographic Atlas of Antarctica (CAAP) has been led by Prof. Fraser Taylor, at the Geomatics and Cartographic Research Centre (GCRC) at Carleton University, Canada, in collaboration with Dr. Vergani from Centro Nacional Patagónico, Argentina.

After a multi-stage application process, GCRC was recently awarded a major collaborative initiatives research grant. The four year project, titled *Cybercartography and the New Economy* is being funded by the Social Sciences and Humanities Research Council of Canada under The Initiative on the New Economy (INE) program. There are 2 separate research projects taking place under this banner. One is focussing on Antarctica, the other on Canadian trade.

The research will be addressing Human interaction with geospatial information, a topic which has been recognized but not well addressed by major standards initiatives. The project includes collaborators from a number of disciplines including Psychology, Cognitive Science, English, Economics, International Studies, Music and Film Studies.

The four-year research grant (finishing in January 2007) means that the project has received a significant boost in resources. Peter Pulsifer, Technical Manager of the project, said that all together there would be some 16 students (spread out over the 2 projects on Antarctica and Canadian trade) dedicated to specific research aspects.

ESRI and Oracle products will be used (but also other platforms will be tested). Mapserver will be used as the web mapping server.

Geographic Markup Language or GML is the main requirement in order for the data files to be transportable and have the ability to be queried over the internet.

A paper recently presented at the Freiburg meeting introduced a preliminary abstract model for the CAAP. At present, no firm decisions have been made. This paper is an attempt to elicit feedback from SCAR stakeholders as to the feasibility of the proposed Web Services Architecture approach. In particular, it is an invitation to interested individuals to participate in the user needs analysis. Doing so will help to insure that The Atlas provides resources that are useful to the scientific community.

In the near future (July/August 2003), the user needs analysis process will begin. Concurrently, infrastructure will be developed with the expansion of laboratory space and installation of new equipment having already begun. An Atlas prototype is scheduled for demonstration at the 2004 SCAR general meeting to be held in Bremen, Germany.

What is JCADM?

[In the spotlight for this edition is the Joint Committee on Antarctic Data Management or JCADM. Lee Belbin, Deputy Chief Officer has provided the following information...]

The issue of data management was formally raised within the Antarctic Treaty System with ATCM Recommendation X111-5 (1985). This called on SCAR for advice on steps that could be taken to improve the comparability and accessibility of Antarctic scientific data, in the context of additional protective arrangements for the Antarctic environment. In response to this, SCAR carried out an initial review of databases in the biological sciences and then in 1989 established the SCAR ad hoc Committee on the Coordination of Antarctic Data (CCAD).

Subsequent to this, ATCM Recommendation XV-1 6 (1989) made a number of recommendations to governments to assist the work of the CCAD, including assisting in the development of an Antarctic scientific data directory.

The SCAR-COMNAP ad hoc Planning Group on Antarctic Data Management was established at XXII SCAR in June 1992 to replace the CCAD. The terms of reference for the Planning Group included the development of a plan for the coordination and management of Antarctic data, taking into account SCAR's programs and requirements under the Antarctic Treaty System especially with respect to the Protocol on Environmental Protection. The Group's first report

(October 1992) proposed a committee for Antarctic data management managing the development of an Antarctic Data Directory System (ADDS), comprising National Antarctic Data Centers (NADCs) linked to an Antarctic Master Directory (AMD). The proposed technology for the AMD was the International Directory Network (IDN) using its Directory Interchange (metadata) Format (DIF). The recommendations of this report were accepted by the Antarctic Treaty Meeting in November 1992 and by the SCAR and COMNAP Executives in April 1993.

The SCAR-COMNAP Joint Committee on Antarctic Data Management (JCADM) was established in 1997. JCADM is responsible for the coordinated development of the ADDS. Members of JCADM are usually the managers of NADCs, or a relevant national contact if an NADC has not yet been nominated. JCADM meets annually to update its workplan.

The role of JCADM is to:

- Promote the establishment, coordination and support of the ADDS
- Promote data management within the Antarctic scientific community
- Assist in establishing Antarctic data management policies and priorities
- Report to SCAR and COMNAP (and indirectly to the Antarctic Treaty) on Antarctic data management issues
- Provide guidance to the AMD host, the Global Change Master Directory through the GCMD, to participate in the development of the CEOS International Directory Network (IDN)

The Roles of the constituents of the ADDS are clearly defined. JCADM coordinates the development of the ADDS. The NADCs are set up to provide the national focal point for the ADDS and currently twelve NADCs have been designated.

The AMD is currently hosted by the Global Change Master Directory (GCMD) of NASA. The NADCs act as an interface between the Antarctic scientists and the AMD. Antarctic research scientists are both the originators of the metadata and the major beneficiaries.

The AMD is a directory containing metadata. It is not intended to develop a central database containing the actual data, and conditions of access to the actual data will be the responsibility of data custodians through the NADCs. All Antarctic scientific data will be described - including historical data, environmental monitoring data, and data for which access restrictions may apply. There will be no restrictions on access to the directory.

Repositories and Directories

The ICSU World Data Center system and groups such as the World Meteorological Organisation are data repositories. Collectively, they contain a subset of the data collected as a result of Antarctic research, but the status of data management varies considerably depending on discipline and local factors. The ADDS is a data index providing a unique, consistent and uniform source of information about all Antarctic data (multi-disciplinary and multi-national), no matter where they are located.

The IDN, implemented by the national space agencies of the United States, Europe, and Japan under the auspices of the Committee on Earth Observation by Satellites (CEOS), provide universal access to metadata located in different countries and relating to different disciplines. The AMD enhances the geographic and scientific coverage of the IDN. Within the IDN, the Global Change Master Directory (GCMD) is the agency responsible for the development of DIF, supporting software and technical support.

A questionnaire was developed by SCAR and COMNAP to seek the Antarctic communities feeling about the utility of the ADDS. The response was positive. Details can be found at www.jcadm.scar.org/Reports/SCAR_DM_questionnaire_results.htm.

SCAR Fellowship Programme

The ad hoc Group on SCAR Organization and Strategy recommended that National Antarctic Committees should give more attention to participation of younger scientists in SCAR's activities. There have been several suggestions at different times that SCAR should establish an award or grant programme to encourage young scientists undertaking Antarctic research. In 2001 the Executive Committee proposed establishing a small fund within SCAR from which a SCAR prize for young scientists might be funded.

These ideas were given a very welcome boost by the award to SCAR of the Prince of Asturias Prize for international cooperation 2002 in recognition of SCAR's contribution to international cooperation in Antarctica.

At the XXVII SCAR meeting in Shanghai, 22-26 July 2002, the SCAR Delegates established an ad hoc group to recommend how best to make use

of the 50,000 Euros generously awarded to SCAR as part of the Prince of Asturias Award. Delegates approved the following regulations for nominations and awards of a SCAR Fellowship.

SCAR has established a Fellowship Programme for postgraduate and postdoctoral researchers within SCAR nations to encourage the active involvement of young scientists in Antarctic science and to strengthen international scientific capacity and cooperation in Antarctic research. The initial funding for the programme will come from the award to SCAR of the Prince of Asturias Prize for international cooperation 2002.

1. The primary selection criterion shall be the scientific excellence of the proposed research.

2. An additional criterion shall be the desire to strengthen the scientific capacity of nations with smaller or less well-developed Antarctic research programmes.

3. The award shall be limited to scientists younger than 35 on the day of the deadline for applications.

4. The work shall be carried out in a research group of a SCAR nation different from that of the applicant's origin.

5. Each award shall be related to a field of science of the three SCAR Scientific Standing Groups and should be linked to one or more of the Science Programmes endorsed by SCAR.

6. There shall be five awards of 10,000 Euros each to be made during 2003.

7. Proposals shall be made on the attached form that should be submitted to the SCAR Secretariat.

8. The closing date for receipt of proposals is 31 May 2003.

9. Proposals will be overseen and judged by a review panel comprising:
   a. One member of the SCAR Executive (Chairman).
   b. Three SSG Chief Officers or their Alternates
   c. One member nominated by the SCAR Delegates

This initiative should represent the initial phase of an ongoing SCAR Fellowship Programme, recognizing that further sources of funding will be necessary for the continuation of the programme.

The proposal form to be completed by the applicant may be downloaded as a pdf file from the SCAR website.

Delegates are asked to bring this to the attention of their Antarctic science communities.

This message has also been sent separately to SCAR National Committees and SCAR Executive Committee.

Peter Clarkson
SCAR Executive Secretary

International Polar Year 2007-08

International Polar Year (IPY) 2007-08 to celebrate the 50th anniversary of the International Geophysical Year (IGY) 1957-58 and the 125th anniversary of the first IPY.

The Polar Research Board of The National Academies has created a website with a list of events related to the next IPY (IPY-4), links to other IPY web sites, a brief history of previous IPYs, and an on-line forum to foster discussion on IPY-4.

More information can be found at www.nationalacademies.org/prb/ipy

You are encouraged to visit the site and to send your ideas to the SCAR Secretariat for consideration by the SCAR Executive.

AnSWeR website

Dr Anya Reading would like GSSG members to know about AnSWer - the Antarctic Seismic Web Resource. This is a centralised source of information relating to Antarctic seismic data and seismological results.

At present, the site concentrates on broadband seismic data and tectonic (ie non-volcanic) earthquakes, although its scope may be extended in future. It is divided into two parts:

AnSWeR1 home page
The resource for seismologists working on Antarctica: includes information on permanent observatories and temporary deployments, data sources and technical material.

AnSWeR2 home page
The resource for the wider scientific community:

includes information on Antarctic earthquakes, structure derived by earthquake seismic methods and stress indicators.

For further details or to add any information of a seismic nature please contact Dr Anya Reading at ANU.

Call for papers - AGS'03

AGS03 continues the annual series of Antarctic Geodesy Symposia as part of the Geodetic Infrastructure of Antarctica (GIANT) program of the Geospatial Information Group.

The overall theme of the symposium is "Status of the Antarctic Geodetic infrastructure and future prospects for research".[Please note that the working language of AGS'03 will be English.]

The event will be hosted by the Ukraine National University "Lvivska Polytechnica" at their campus in Lviv and will be held in close cooperation with the Ukrainian Antarctic Center.

Specific Symposium Themes to be addressed include:

- 2002/03 Austral Summer Geodesy Activities
- Atmospheric Impacts on GPS Observations in Antarctica
- Local and Regional geodetic networks; past and future
- Improvements to Antarctic geodetic reference frame
- Antarctic gravity
- The SCAR Antarctic Neotectonics program
- GIANT Program activities and business Meeting
- Sea level monitoring

Papers examining the use of Geographic Information Systems (GIS) will also be considered.

Potential attendees are invited to send abstracts of papers for inclusion in the program by 14th July 2003. Please send abstracts to:

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More information can be found at the following web sites:

Ukrainian page:
www.uac.gov.ua/index2.php?news/160403_e.htm

Other Information:
www.geoscience.scar.org/geodesy/ags03/

Upcoming meetings

- 8th International Permafrost Conference (IPA), Bern Switzerland July 2003
- ISAG 7 - 7th International Symposium on Antarctic Glaciology - Milano, Italy, 25-27 August 2003
- International Symposium on Antarctic Earth Sciences (ISAES) – Potsdam, Germany – September 2003
- International Hydrographic Bureau - Antarctic Hydrographic Committee meeting, Monaco, 08-10 September 2003. Contact Captain Hugo Gorziglia, for further information.
- 5th International Antarctic Geodesy Symposium (AGS'03), Lviv, Ukraine, 15-17 September 2003

Next Edition

We would ask for your contributions on:

- News items
- Field work/workshop reports
- Reports from leaders of Action Groups, the Expert Group, Scientific Research Programmes and Scientific Programme Planning Groups
- Diary events

Details should be sent to Glenn Johnstone <glenn@glennjohnstone.freeserve.co.uk>.

The deadline for contributions to the upcoming editions are as follows:

- Vol. 2 No. 3 - Monday 21 July 2003
- Vol. 2 No. 4 - Monday 20 October 2003