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EXECUTIVE SUMMARY

SCAR is committed to helping scientists in all of its Member countries to participate in understanding scientifically the physical, biological, chemical and geological processes at work in the Antarctic region, to use that understanding to predict change both there and elsewhere in the world, and to provide objective and independent advice to policy makers. To achieve that goal requires that efforts be made to raise national scientific capacities, especially in developing countries. SCAR is also committed to promoting the incorporation of Antarctic science in education at all levels. The SCAR Strategic Plan 2004-2010 called for SCAR to develop a strategy setting out how it proposes to meet those objectives. This document is that Strategy. It explores ways in which SCAR can work with its Members, with COMNAP and with others to meet the stated needs.

The document describes the current situation, then spells out the scope, aims and objectives of the strategy. The strategy is designed to help Members' scientists achieve the following objectives:

- i. to engage in high quality international scientific research in the Antarctic region, and on the role of the Antarctic region in the Earth system;
- ii. to participate in, contribute to, and benefit from SCAR's main programmes and other activities;
- iii. to provide free and unrestricted access to their Antarctic scientific data and information, and make best use of others' data and information;
- iv. to provide objective and independent scientific advice to their own governments and to Antarctic Treaty Consultative Meetings and other organizations on issues of science and conservation affecting the management of Antarctica and the Southern Ocean.
- v. to make best use of Antarctic examples to illustrate key scientific principles in schools and universities.

The strategy recommends the application of ten principles, and emphasises the importance of developing partnerships to take the programme forward. It lists a number of possible mechanisms for achieving the aims and objectives, and notes that the International Polar Year provides an excellent opportunity to start a wide range of capacity building and education initiatives. It sets out a mechanism for implementation, which will be coordinated by a Capacity Building and Education Group working to clearly defined targets within a specified timeframe. Finally it provides a set of performance indicators that can be used to assess progress over time.

The SCAR Executive Committee, meeting in Sofia, Bulgaria (July 11-13, 2005) approved the distribution of this draft for consultation by e-mail with national committees and delegates, with the aim of providing a final version for the XXIX Delegates' meeting in Hobart (July 2006). The Executive Committee noted that depending on consultation with and feedback from COMNAP, the draft may be modified in future to take COMNAP requirements into account.

1. INTRODUCTION

Antarctica is a unique component of the Earth System. We may perceive Antarctica as isolated, but in fact it is connected in significant ways to the atmosphere, ocean and biota of the rest of the world. Hence it is SCAR's vision "*To establish through scientific research and international cooperation a broad understanding of the nature of Antarctica, the role of Antarctica in the Earth System, and the effects of global change on Antarctica.*" Among the purposes of that vision is to identify issues emerging from greater scientific understanding of the region that should be brought to the attention of policy makers. In a world where scientific information is fundamental to understanding many of the critical issues facing society - ranging from climate change to the crucial challenge of achieving sustainability - making wise policy decisions has become increasingly dependent on good scientific advice.

Nobody owns Antarctica or its surrounding Southern Ocean. So achieving SCAR's vision and this stated purpose demands that as many countries as possible participate in understanding scientifically the physical, biological, chemical and geological processes at work there, and in using that understanding to predict change both locally and elsewhere in the world. To enable all countries to participate in this grand scientific challenge requires that efforts be made to raise their capacity to levels at which they can fully participate in, contribute to, and benefit from the scientific research required to achieve SCAR's vision. The term commonly used to describe such efforts is 'Capacity Building'.

The Antarctic scientific research programmes of SCAR's Member nations vary greatly in their size and capacity. Some Members have scientific communities that are large, scientifically advanced and long-standing. Others have relatively small and new Antarctic science communities that are still developing. To enable all in the SCAR family to contribute to SCAR's activities, it is incumbent on SCAR to work with appropriate agencies to help to enhance the Antarctic scientific research capacity of all of its Members and Associate Members. This requirement has become more pressing with the significant increase in SCAR Membership in recent years.

SCAR also recognizes the need to help to create the cadre of Antarctic scientists for the future, which demands engaging the attention of the young, and interesting young scientists, everywhere, in Antarctic research. In this context there is a need for scientific education about Antarctica, which is regarded as complementary to scientific capacity building.

In response to these growing needs, the Delegates at the XXVIII SCAR meeting (Bremerhaven, October 2004) adopted a new aim: "*to develop scientific capacity in all SCAR Members, especially with respect to younger scientists, and to promote the incorporation of Antarctic science in education at all levels*".

The SCAR Strategic Plan 2004-2010 called for SCAR to develop a strategy setting out how it proposes to meet that objective. This document is that Strategy. It explores ways in which SCAR can work with its Members, with COMNAP and with others to meet the stated needs. Success will require the development of capacities within countries by their own efforts, and the assistance of developed countries to those still in a state of development. The Strategy for Capacity Building and Education is complementary to the SCAR Communications Plan, which deals with raising awareness about Antarctica and Antarctic science and policy issues through communications.

The approach that SCAR has adopted is consistent with the Strategic Plan of its parent body, ICSU (the International Council for Science), which requires that capacity building is given the necessary attention in all the activities of the ICSU family, and that young scientists be included in ICSU programmes. Advice on the implementation of capacity building within

the ICSU family is provided in ICSU's 2005 "Priority Area Assessment on Capacity Building in Science". That document in turn draws on the 2003 report "**Inventing a Better Future: a Strategy for Building Worldwide Capacities in Science and Technology**", published by the InterAcademy Council (IAC), which brings together all of the world's science academies

(see <http://www.interacademycouncil.net/report.asp?id=6258>).

2. CURRENT SITUATION

In the past, SCAR has not taken a systematic approach to capacity building or to education. Things are changing, however. A SCAR Fellowship Programme was launched in 2002 with the Prince of Asturias Award of US\$50,000, which paid for 5 Fellowships for 2003-2004. The programme will be sustained by contributions from SCAR Members and from other sources of revenue as they become available. It is designed to encourage the active involvement of young scientists and engineers in Antarctic scientific research, and to strengthen international capacity and cooperation in Antarctic research. The award is for postgraduate and/or post-doctoral researchers from SCAR Member countries and who are younger than 35. The Fellowships allow researchers from one SCAR Member country to undertake short term visits to major international laboratories, field facilities, and/or home institutions in or operated by other SCAR Member countries, so as to become acquainted with recent advances in research and/or to develop long-term scientific links and partnerships.

As a contribution to the International Polar Year (IPY) 2007-2008, SCAR is exploring with partners the possibility of SCAR Fellowships being connected to the Belgian offer to provide places at its new Antarctic base in Dronning Maud Land, to facilitate capacity building.

The Joint SCAR/COMNAP Committee on Antarctic Data Management (JCADM) is helping SCAR Members to create National Antarctic Data Centres, for which capacity building is commonly required. JCADM ran regional capacity building workshops in 1998, 1999 and 2003, and plans one in 2005. The JCADM web site provides guidelines on all aspects of Antarctic data management, and on e-learning programmes.

SCAR is pursuing the possibility of obtaining ICSU funds for a training workshop on "*The Exploitation of Earth System Models and Re-analysis Fields to Aid Interpretation of Environmental Data Collected in Antarctica*" to be held in Malaysia in 2006.

Quite a number of capacity building opportunities, particularly for training, are provided already at the national level. To give a just a few examples of existing programmes, New Zealand has provided opportunities for Malaysian scientists to work at Scott Base, and runs a postgraduate Certificate in Antarctic Studies and a Masters degree programme at Gateway Antarctica (see <http://www.scar.org/about/capacitybuilding/index.html>). The UK and Germany provided initial Antarctic opportunities for Dutch scientists. The USA has run and financially supported several post-graduate training courses at McMurdo Station that are internationally advertised and strongly competed for. This list is not exhaustive.

On the education front, some SCAR Members have developed educational material, for example in Antarctica Schools Pack published by the UK and prepared for UK schools by the British Antarctic Survey.

3. SCOPE, AIMS AND OBJECTIVES

A more systematic approach is now needed to meet SCAR's new aim: *"to develop scientific capacity in all SCAR Members, especially with respect to younger scientists, and to promote the incorporation of Antarctic science in education at all levels"*.

In terms of scope, the term 'capacity building' can cover a wide range of subjects, from human capacity (more and better trained scientists), through institutional capacity (the right balance of institutions to enable Antarctic science to move forward effectively at the national level), to infrastructure capacity (access to appropriate equipment, field stations, research ships and so on). JCADM is addressing both human and institutional capacity in promoting the development of National Antarctic Data Centres and providing training for their personnel. Recognising SCAR's limited resources, this document proposes that SCAR focus its efforts at the international level on working with Members to facilitate the building of human capacity, leaving to Members the bulk of the effort on building institutional capacity and infrastructure.

SCAR's capacity building efforts should be designed to help Members' scientists achieve the following objectives:

- i. to engage in high quality international scientific research in the Antarctic region, and on the role of the Antarctic region in the Earth system;
- ii. to participate in, contribute to, and benefit from SCAR's main programmes and other activities;
- iii. to provide free and unrestricted access to their Antarctic scientific data and information, and make best use of others' data and information;
- iv. to provide objective and independent scientific advice to their own governments and to Antarctic Treaty Consultative Meetings and other organizations on issues of science and conservation affecting the management of Antarctica and the Southern Ocean.

In addition, SCAR's education efforts should be designed

- v. to help Members to make best use of Antarctic examples to illustrate key scientific principles in schools and universities.

4. PRINCIPLES AND PARTNERSHIPS

The following ten principles are designed to guide the development of SCAR's strategy for capacity building and education.

SCAR's Capacity Building and Education Programme should:

1. help scientists and students, especially from developing countries and non-traditional polar researching nations, to develop interests in Antarctic scientific research, and understanding of the role of the Antarctic region in the Earth system.
2. be implemented at the international level, by SCAR, and at the national level by National SCAR Committees, whichever is most appropriate for the issue at hand;
3. lead to sustained improvements in human capacity, enabling Member countries to move to a position where they can take all necessary actions to continuously improve their own capacity;

4. be undertaken in partnership with national stakeholders and national or international donors from the outset, and satisfy the priorities of both;
5. work to clearly stated requirements, with well defined and achievable targets, and short-term, medium-term and long-term goals, established through consultation with national committees and agencies;
6. capitalize on existing systems, maintaining and strengthening them as necessary, and developing new systems where appropriate;
7. be embedded in all SCAR scientific research programmes and activities;
8. recognize the related interests of other global and regional science and observation programmes of other organizations and of Members, avoid duplication of effort, and work in concert with them where appropriate;
9. optimize limited resources;
10. have well-designed accounting or follow-up of activities, enabling performance to be measured, adaptations to be made, and focus to be retained.

The second principle, above, is based on the fact that SCAR has very little money to invest in capacity building activities, most of which will be funded from national or other international sources. SCAR's role is to promote these activities and facilitate them by seeking appropriate funds and helping to develop the kinds of partnerships that seem to be essential for the success of capacity building and education in any context. Inevitably, then, **national Antarctic science committees have a key role to play** in stimulating the development of Antarctic science at national levels.

The fourth principle recognizes that no one organization can build all the capacity that any one nation may require. Bilateral or multi-lateral partnership projects or programmes offer one possible way forward. Such partnerships would bring together developed and developing world countries with similar scientific questions and priorities. Activities should be designed by all partners working together towards mutually beneficial and mutually agreed objectives. There should be long-term commitment, with financial or in-kind contributions by all partners. Partner organisations might include, for instance the Third World Academy of Sciences (TWAS; <http://www.twas.org/>), the Islamic Academy of Sciences, and world bodies such as ICSU or WMO.

5. MECHANISMS FOR ACHIEVING AIMS AND OBJECTIVES

To meet the five objectives [(i) through (v)] of Section 3 (above) SCAR encourages all Members to consider how they can contribute to capacity building and education individually or collectively by applying the above principles and by supporting any or all of the following activities, through bilateral or multilateral arrangements.

Objective (i) to help Members, especially developing country scientists, to engage in high quality international scientific research in the Antarctic region, and on the role of the Antarctic region in the Earth system;

Provide Fellowships enabling students from developing countries to spend time in leading polar science institutions elsewhere.

SCAR itself offers 3-5 fellowships per year

(see <http://www.scar.org/awards/fellowships/index.html>).

Fellowships (overseas or in the developing country region) can also be provided through international programmes such as ICSU, or the Third World Academy of Sciences (TWAS);

(see <http://www.twas.org/>),

or the European Commission (EC)

(see http://europa.eu.int/comm/research/index_en.cfm)

for instance, or supported by individual agencies at their own discretion.

Provide training through research.

Institutions in developed countries can provide opportunities for developing country scientists to participate in joint projects, joint field activities, and joint cruises, or to undertake PhD studies.

Encourage development of Distinguished Visiting Researchers programme to bring top scientists to developing countries for short periods to teach or spend sabbaticals.

Facilitate advance lecture series and hands-on workshops with national Antarctic programs of non-US/EU countries.

This will enable a larger audience from these countries to get access to the latest developments in Antarctic Sciences.

Build and sustain a number of network nodes on specific scientific issues.

Interested scientists can visit these nodes to seek opportunities for collaboration.

Provide developing country libraries with appropriate key journals

Help developing country scientists to publish in top quality international journals

Objective (ii) to help Members, especially developing country scientists, to participate in, contribute to, and benefit from SCAR's main programmes and other activities;

Get developed country scientists working on Antarctic topics in partnership with developing country scientists.

Enable developing world scientists to participate in the activities and meetings of SCAR's Action Groups, Expert Groups and Scientific Research Programmes.

Provide funds for developing country scientists to attend SCAR meetings and workshops (sources being national agencies in developed and developing countries, and international organisations like TWAS or the EC).

Objective (iii) to help Members, especially developing country scientists, provide free and unrestricted access to Antarctic scientific data and information, and make best use of others' data and information;

Encourage all countries to make their data readily available. This will include encouraging all countries to get their analog data records digitised, and onto the web in forms suitable for analysis by and exchange with developing world scientists

Continue training national data managers in the development of National Antarctic Data Centres.

These activities have already begun under the aegis of JCADM.

Create networks of specialists trained in the use of Antarctic region data acquired by remote sensing from space satellites

Objective (iv) to help Members, especially developing country scientists, provide objective and independent scientific advice to their own governments and to Antarctic Treaty Consultative Meetings and other organizations on issues of science and conservation affecting the management of Antarctica and the Southern Ocean.

Educate/train managers/lawyers/administrators in aspects of the benefits and applications of Antarctic science

Provide advice on preparing briefing papers, and, where appropriate, short professional courses on topical issues

Ensure that scientists are aware of the need for and importance of providing scientific advice, and encourage their participation in SCAR's Standing Committee on the Antarctic Treaty System.

(adapted from Objective (i), above) Build and sustain a number of network nodes on specific scientific issues.

Interested policy makers can visit these nodes to obtain information that will influence policy decisions.

Objective (v) to help Members to make best use of Antarctic examples to illustrate key scientific principles in schools and universities.

Education can take two main routes: (i) direct contact with young people in school and universities to interest them in Antarctica and its science; and (ii) contributing information about Antarctica and its science to educators, to enable them to spread the message by incorporating information in their coursework. SCAR can provide some of what is required by posting information about Antarctica and Antarctic science on the SCAR web site. However, recognizing the broad spread of languages within the SCAR family, **much of the responsibility for these activities must rest with National Antarctic Committees and Programmes.**

To facilitate education (addressed here) and the raising of awareness about Antarctica (addressed in SCAR's Communications Plan), SCAR should develop a web Portal through

which a wide range of educational and other materials on Antarctica could be made available. This Portal currently exists under the heading “Antarctic Information” on the SCAR web page (<http://www.scar.org/information/>).

At **schools level**, two examples of providing scientific material for schoolchildren are:

- i. the educational pack of the British Antarctic Survey (<http://www.scar.org/information/>);
- ii. the work by Woods Hole Oceanographic Institution with an educational publishing company to bring real-world ocean science into the classroom in the Turnstone Ocean pilot and ocean Explorer kits (see <http://www.steck-vaughn.com>).

Other possible educational examples (**for schools or universities**), from the IPY Plan (see section 6, below) include:

- Generating polar emphasis in existing science/environmental programs;
- Including polar themes in science and history contests/programs;
- Having an international polar day at schools around the globe;
- Getting teachers to organize curriculum projects based on IPY projects, activities and results;
- Organising summer schools with a polar focus.

At **university level** capacity building efforts can be designed to:

Provide places for Members’ young scientists, especially from developing countries, in MSc or other specialist courses in major polar education and training centres;

Several Members have academic or government organisations offering advanced specialised training courses on some aspect of polar science. Usually there is the potential for these courses to be joined by participants from developing countries, provided that a source of funds can be found.

Provide access to training in the use of new technologies;

Training in the interpretation of remotely sensed data from satellites can be arranged with the assistance of the Working Group on Education and Training (WGEdU) of the Committee on Earth Observation Satellites (CEOS) (see <http://wgedu.ceos.org/>). Access to and training in the use of freeware packages for numerical modelling can be arranged via the Internet.

Provide tailor-made distance learning programmes.

Consideration should be given to the setting up of an International Antarctic Institute, combining the teaching capabilities of a range of institutions from different countries

(see <http://www.scar.org/about/capacitybuilding/antarcticinstitute/index.html>).

6. THE INTERNATIONAL POLAR YEAR (IPY) 2007-2008

The development of the IPY offers a splendid opportunity to enhance capacity building. SCAR is well placed, through membership of several SCAR scientists on the Steering

Committee for the IPY, to promote the building of human capacity for Antarctic research, and the aim of raising the profile of the Antarctic region in education.

As mentioned above, SCAR is working with the International Polar Foundation, based in Belgium, to link SCAR Fellowships during the IPY to the Belgian offer to provide places at its new Antarctic base in Dronning Maud Land to facilitate capacity building.

The IPY will be promoting many of the approaches set out in section 5 above

(see <http://www.ipy.org/concept/framework/outreach.html>).

The SCAR web Portal could be organized in conjunction with the IPY.

7. IMPLEMENTATION, TARGETS AND TIME FRAME

7.1 A SCAR Capacity Building and Education Group

As a first step towards developing a capacity building and education strategy, Delegates meeting at SCAR XXVIII (Bremerhaven, October 2004) agreed:

- i. to create a SCAR Capacity Building and Education Group (CBEG) (Terms of Reference below), to help SCAR Members:
 - work towards building human capacity for Antarctic science by a variety of means;
 - promote education of students so as to increase awareness of the value of Antarctic science;
 - manage the SCAR capacity building and education programme.
- ii. that one of the SCAR Vice Presidents would take responsibility for reporting on capacity building and education.
- iii. that capacity building efforts should focus on Asia for 2 years (2005-2007), then on South America.

The CBE Group shall comprise representatives nominated by Members, representatives of SCAR's major scientific research programmes and other SCAR experts as appropriate, representatives of donor organizations, and the Executive Director. The Group will report to the Delegates Committee on Outreach and Administration.

The Group's Terms of Reference should be to:

- initiate, plan, and oversee the implementation of SCAR capacity building;
- develop policies and plans for funding,
- promote educational activities highlighting the importance and value of Antarctic science;
- evaluate the performance of the programme and suggest changes as appropriate.

7.2 Strategic Guidance

The strategy should be flexible, recognising that different countries have different needs. It should be creative, to leverage expertise, equipment, facilities, capital and funding sources to increase the scope and impact of the programme. It should capitalise on growing Internet access for disseminating information that can be used for training.

The strategy should exploit the various capacity building initiatives of other institutions, such as the IOC (Intergovernmental Oceanographic Commission), WMO (World Meteorological Organisation), ICSU, IGBP (International Geosphere-Biosphere Programme), CEOS (Committee on Earth Observation Satellites) and others, and the contacts that these organisations have within developing country regions.

The strategy should also exploit the existing capacity building initiatives of Members. As a first step it will be instructive to compile an inventory of ongoing capacity building initiatives, not least as a means of identifying possible gaps.

The strategy should consider the needs of different regions, with a focus initially on Asia, followed by South America.

Implementation of the strategy will require the development of well-targeted proposals for funding, at both the national and international level.

7.3 Targets and Time Frame

This document sets out some provisional targets. One of the tasks of the Capacity Building and Education Group will be to refine these targets and timeframes.

2 Year Targets

- Maintain the SCAR Fellowship programme;
- Review gaps in education and training;
- Develop plans to maintain and strengthen education and training;
- Develop a network of experts involved in existing national and global capacity building initiatives to participate in future capacity building;
- Inform Members of existing efforts in capacity building and education;
- Encourage the development of a capacity building component in all SCAR activities;
- Facilitate access to data and numerical models particularly for developing countries;
- Develop priorities for new or augmented efforts in capacity building;
- Devise a SCAR web Portal.

6 Year Targets

- Obtain funding of multinational capacity building programmes;
- Refine monitoring and evaluation mechanisms for determining the efficacy of capacity building and education efforts;
- Continue to facilitate appropriate education and training;
- Refine priorities

10 Year Target

Have in place a viable sustained capacity building programme that will have significantly enhanced the capability of all Members, and particularly developing country Members, to participate in and contribute to Antarctic scientific research and advice to policy makers, and that will continue to make such enhancements as needed.

8. PERFORMANCE MEASURES

Each capacity building project should specify the objectives, anticipated results and expected schedule against which the success of the activity can be judged.

Performance measures might include, for example:

Input Measures, such as:

- Expenditure on education, training and technical cooperation;
- Sources and amounts of new funding;
- Number of staff managing education, training and technical cooperation;
- Number of experts aiding in these activities.

and

Output Measures, such as:

- Number and type of education activities;
- Number and type of training activities;
- Number and type of capacity building workshops;
- Type and amount of technology transfer;
- Number of reports resulting from the activities;
- Number of publications resulting from the activities;
- Number of men/women participants;
- Countries of people participating;
- Examples of key achievements
- Outcomes (e.g. improvements in the scope, quality and quantity of data from observing systems)
- Impacts (e.g. impacts of weather forecasts that would not have been possible without the activities)

List of Acronyms and Abbreviations

| | |
|--------|--|
| CBEG | Capacity Building and Education Group (|
| CEOS | Committee on Earth Observation Satellites |
| COMNAP | Council of Managers of National Antarctic Programmes |
| EC | European Commission (|
| IAC | InterAcademy Council (|
| ICSU | International Council for Science |
| IGBP | International Geosphere-Biosphere Programme |
| IOC | Intergovernmental Oceanographic Commission |
| IPY | International Polar Year (|
| JCADM | Joint Committee on Antarctic Data Management (|
| PhD | Doctor of Philosophy |
| SCAR | Scientific Committee on Antarctic Research |
| TWAS | Third World Academy of Sciences (|
| WGEdu | Working Group on Education and Training (|
| WMO | World Meteorological Organisation |