



Antarctic Science and Policy Advice in a Changing World



Strategic Plan 2011-2016





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*"If Antarctica were music it would be Mozart.
Art, and it would be Michelangelo.
Literature, and it would be Shakespeare.
And yet it is something even greater;
the only place on Earth that is still as it should be.
May we never tame it."*

Andrew Denton (1960 –present)



Preface



The realities of conducting research in the southern polar regions bring with it great challenges but also great opportunities. The questions being asked by those with interests in Antarctica, the Southern Ocean and the Earth system are more complex and demanding than ever before. The critical role of scientific knowledge developed from the study of Antarctica and the Southern Ocean has never been more important in discerning the future of our planet. Antarctica and the Southern Ocean are a natural laboratory where global forces play out in ways not experienced or observable elsewhere on the planet. Antarctica also serves as a unique vantage point to look outwards from our planet to observe near-Earth space, our solar system and beyond. In a time of economic stress, it is important that resources be utilized to optimum affect, that investments in science in Antarctica be justified, and that the community develops and shares a collective vision of future scientific directions. A well-conceived strategy is not only essential but critical.

The strength of an organization can best be judged by the dedication and participation of its members. To ensure the highest level of contributions, those involved must feel genuine ownership of an

organization's vision, mission and goals. This can best be accomplished by involvement in developing plans for the future. This is especially important for an organization whose success is dependent on membership fees and volunteers, such as the Scientific Committee on Antarctic Research (SCAR). The process of developing this strategic plan has been inclusive, consultative and iterative, aiming for a consensus view of how best to accomplish SCAR's vision and mission over the next six years.

SCAR has a special place amongst international scientific organizations, in that its focus – Antarctica – invokes the best of human emotions – wonder, awe, inspiration and even joy! Since its inception, more than 50 years ago, SCAR has greatly benefited from the support of a dedicated community of "true believers" in the uniqueness and grandeur of the southern Polar Regions. It is a privilege to conduct science, to work and to learn in one of Earth's remaining wildernesses. With this privilege, there is a responsibility to act as environmental stewards of the last great under-explored continent on our planet.

As I said during planning for the Oslo International Polar Year Conference, [Antarctica] evokes a sense of discovery as [a location] of unexplored places and the origin of surprising findings that inspire unconventional thinking. Now is the time for the Antarctic science community to

build on its past accomplishments and elevate their presence and importance in the global conversation. SCAR is uniquely positioned to foster and lead these efforts. It is not just for the future of SCAR that we must think and act strategically, but for the greater good of the place we cherish, the societies we live in and the planet we inhabit.

**Mahlon "Chuck" Kennicutt II,
President of SCAR 2008–2012**

◀ The beauty of Antarctica is depicted in this perfect wave. This photo was taken near Palmer Station. © Sean Bonnette, NSF

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◀ Top: Emperor penguin. © Peter Clarkson

Middle: Korean icebreaker Araon during its maiden voyage © KOPRI

Bottom: Ecuadorian Scientists, Greenwich Island, South Shetland.

© Hernan Moreano

Summary of SCAR'S Strategic Plan 2011-2016



The study of Antarctica and the Southern Ocean, and their role in the Earth system, has never been more important as the region experiences change that has global implications. The Antarctic region is a "natural laboratory" for scientific research of importance in its own right and impossible to achieve elsewhere on the planet. SCAR's strategic vision is for a world where the science of the Antarctic region benefits all, excellence in science is valued and scientific knowledge informs policy. SCAR's mission is to be the leading non-governmental, international facilitator and advocate of research in and from the Antarctic region, to provide objective and authoritative scientific advice to the Antarctic Treaty and others, and to bring emerging issues to the attention of policy makers.

SCAR will accomplish its vision and mission by:

- encouraging excellence in Antarctic and Southern Ocean research by developing transformational scientific programmes that address issues of regional and global importance;
- scanning the horizon to identify evolving issues and emerging frontiers in Antarctic science;

◀ The Long Duration Balloon (LDB) carrying the scientific payload known as CREAM (Cosmic Ray Energetics and Mass). © Robyn Waserman, NSF

- expanding its activities to include the human element (e.g., history, social sciences and the value of Antarctica);
- providing objective and independent scientific advice on the conservation and management of Antarctica and the Southern Ocean;
- partnering with other Antarctic Treaty advisory bodies to provide objective and authoritative scientific advice (e.g., the Convention for the Conservation of Antarctic Marine Living Resources and the Council of Managers of National Antarctic Programmes);
- expanding its advisory sphere of influence on global issues to other audiences (e.g., the Intergovernmental Panel on Climate Change);
- affiliating with organizations with complementary interests to address regional and global issues;
- providing venues for presentation of the latest research results, exchange of up-to-the-minute scientific findings, and promotion of cross- and interdisciplinary communication (e.g., Science Conferences, Symposia, workshops, reviews, assessments, and syntheses);
- promoting an interdisciplinary philosophy and eliminating barriers to cross-fertilization of ideas;
- motivating cooperation with Arctic counterparts (e.g., International Arctic Science Committee);
- preserving and building on the legacies of the IPY 2007-2008;
- facilitating unrestricted access to Antarctic scientific data as a portal to repositories;
- developing the capacity of students and early career scientists (e.g., Association of Early Career Scientists);
- encouraging emerging national Antarctic programmes;
- recruiting countries that have not traditionally participated in Antarctic research;
- promoting and facilitating the incorporation of Antarctic science into education at all levels; and
- informing the public and the media of the importance of the knowledge gained by the study of Antarctica and the Southern Ocean.

SCAR re-dedicates itself to its founding values, which are as valid today as they were more than 50 years ago.

What is SCAR?



Name:
Scientific Committee on Antarctic Research (SCAR)

Founded:
1958 (founded during the International Geophysical Year 1957-1958)

Secretariat Location:
Scott Polar Research Institute, Cambridge, England

Secretariat Staff :
Executive Director - Michael Sparrow,
Executive Officer - Renuka Badhe, and
Administrative Assistant (part-time) -
Rosemary Nash.

President and Executive Committee* (term):
Mahlon Kennicutt II, President (2008-2012),
Vice Presidents - Sergio Marensi (2010-2014),
Rasik Ravindra (2008-2012); Yeadong Kim
(2010-2014), and Ad Huiskes (2008-2012).

◀ Top: Helicopter support to a science field camp on Seymour Island. © Instituto Antártico Argentino
Middle: SCAR President at Antarctic Treaty Meeting in Uruguay, 2010 © Mike Sparrow
Bottom: Examining embryos through a microscope in the Scott Base wet lab. © Simon Morley, Antarctica NZ Pictorial Collection

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Classification:
Non-governmental, Interdisciplinary
Scientific Body of the International Council
of Science, a registered Charity in the UK,
and Observer to the Antarctic Treaty and the
UNFCCC.

Mission:
SCAR's mission is to be the leading,
independent, non-governmental facilitator,
coordinator, and advocate of excellence in
Antarctic science and research. Secondly,
SCAR's mission is to provide independent,
sound, scientifically-based advice to the
Antarctic Treaty System and other policy
makers including the use of science to
identify emerging trends and bringing these
issues to the attention of policy makers.

Members (2010)*:
Full Members - Argentina, Australia,
Belgium, Brazil, Bulgaria, Canada, Chile,
China, Ecuador, Finland, France, Germany,
India, Italy, Japan, Korea, Malaysia,
Netherlands, New Zealand, Norway, Peru,

Poland, Russia, South Africa, Spain, Sweden,
Switzerland, Ukraine, United Kingdom,
United States, and Uruguay; ICSU Union
Members - International Astronomical
Union, International Geographical Union,
International Union for Quaternary
Research, International Union of Biological
Sciences, International Union of Geodesy
and Geophysics, International Union of
Geological Sciences, International Union of
Pure and Applied Chemistry, International
Union of Physiological Sciences, and Union
Radio Scientifique International; and
Associate Members - Denmark, Monaco,
Pakistan, Portugal, and Romania.

Area of Interest:
Scientific - life sciences, geosciences,
physical sciences, and the human element;
data management and geographic
information; scientific advice; and
Geographic - Antarctica and the Southern
Ocean.

Note that this plan and all supporting
documentation are available online at
www.scar.org/strategicplan2011

* For the latest details on SCAR members and officers
go to <http://www.scar.org/about/officers/>

The Foundations

*"The loftiest edifices
need the deepest
foundations."*

George Santayana (1863-1952)

SCAR values the legacies of those that have gone before, applies lessons learnt from past experiences and capitalizes on the foundations built over the organization's history.

In 1998, on the occasion of its 40th anniversary, SCAR members pledged to examine SCAR's mission, its science initiatives, structure, administrative and communication practices, and advisory role. Based on the recommendations of the 2000 review group, SCAR restated its mission and reorganized at the constitutional, Delegate, Executive Committee, Secretariat, and subsidiary group levels. In the ensuing 10 years, these changes were implemented. A recent external review summarized SCAR's re-emergence: "... the SCAR 2009 Review

Group has been favourably impressed by the reform process that SCAR initiated in 2000 ... It is a record of change that few national or international voluntary science associations can equal ... SCAR has prepared itself well to address emerging challenges through the reforms undertaken during 2000–2009. By building on these developments ... SCAR can continue to play a central role in facilitating and coordinating science and advising governments working together in the Antarctic Treaty System ...". This strategic plan is the next step in consolidating the gains made over the last decade and sets a course for even greater accomplishments in the next six years.

◀ An iceberg near Palmer Station.
© Robin Solfisburg. NSF



SCAR's Strategic Vision

SCAR's strategic vision is for a world where the science of Antarctica and associated systems is used for the benefit of all, excellence in science is valued, and scientific knowledge is effectively linked to policy making. SCAR has a key role to play in leading the international Antarctic science community, implementing new scientific initiatives, discerning emerging scientific themes, promoting international cooperation and partnerships, and engaging with policy-makers and other sectors of society to advance this vision. As an Interdisciplinary Scientific Body of ICSU, SCAR embraces and contributes to the strategic vision and mission of ICSU.

The Foundations for Strategic Planning: SCAR Accomplishments 2000-2010

Vision, Mission and Goals	Finances, Organization, Partnerships and Communication	International Polar Year 2007-2008 (IPY)
Reassertion of international leadership in Antarctic science.	Exercise of prudent financial management of SCAR's resources and improved transparency in reporting.	A key lead participant in the International Polar Year 2007-2008.
Reestablishment of pre-eminence as a scientific advisor to the Antarctic Treaty System.	Streamlined and restructured administrative procedures and scientific portfolio.	Commitment to the preservation and perpetuation of the legacies of the IPY.
Establishment of plans for Capacity Building, Education, and Training; Communications; Data and Information.	Improved participation of and communication with members, partner organizations and other constituencies.	Enhanced capacity building through partnerships with the Arctic community and early career Scientists.
	Creation of the SCAR Open Science Conference	

The Strategic Plan

"In strategy it is important to see distant things as if they were close and to take a distanced view of close things."

Unknown



This Strategic Plan aims to foster a sense of dedication and commitment in SCAR members and the community it serves to ensure realization of the organization's vision, mission and goals. The Strategic Plan guides collective decision-making about priorities and resource allocation.

This Plan is a roadmap for the six-year period from 2011–2016. SCAR is an international, interdisciplinary body of the International Council for Science (ICSU) and a charity registered in the United Kingdom². SCAR's interests include science of the Antarctic region, the linkages between Antarctica and the Earth system, and observations of and from Antarctica³. Regular, consultative strategic planning is undertaken to guide the organization⁴. This present Strategic Plan takes into account: i) the Strategic Plan 2004–2010; ii) reports from reviews, workshops, meetings, and planning activities; iii) changes in the environment that SCAR operates within; iv) changes in SCAR and Antarctic Treaty System memberships; v) developments in ICSU; and vii) in-depth consultations with the SCAR community⁵.

◀ View from Amundsen-Scott South Pole Station.
© Daniel Luong-Van

SCAR's Mission (from the Memorandum of Association)

"SCAR's mission is to advance and promote scientific knowledge, understanding and education on any aspect of the Antarctic region*, on the role of the Antarctic region in the Earth system and on the effect of global change on the Antarctic region. SCAR initiates, facilitates, co-ordinates and encourages international research activity in the Antarctic region, on the role of the Antarctic region in the Earth System, and on the effect of global change on the Antarctic region. SCAR provides objective and independent scientific advice to the Parties to the Antarctic Treaty and other organizations on issues of conservation affecting the management of the Antarctic region and the Southern Ocean."

* "Antarctic region" includes Antarctica, the offshore islands of Antarctica and the surrounding ocean including the Antarctic Circumpolar Current, the northern boundary of which is the Subantarctic Front, and the Subantarctic islands lying south of the Subantarctic Front as well as those which lie north of the Subantarctic Front but fall within the area of interest, namely Ile Amsterdam, Ile St Paul, Macquarie Island and Gough Island.

Why Form a Strategic Plan?

INTERNAL	EXTERNAL
Ensures organizational discussion, consideration and acceptance of the vision, mission and goals of SCAR.	Provides an unambiguous statement of the strategic vision, mission and goals of SCAR.
Provides direction for formulating SCAR biennial work programmes and budgets.	Offers a framework for decision-making on Antarctic investments by member nations.
Guides the alignment of resources, human and financial, with strategic goals while optimizing leverage, return and impact.	Informs Members about managing national level activities that contribute to SCAR activities.
Presents an overview of activities, products and future directions in Antarctic science for planning purposes.	Ensures transparency in the organization's activities, management, finances, procedures, and processes for all stakeholders.
Assesses the impacts of scientific, technological, social and economic developments on the future of SCAR.	Ensures that SCAR is poised to maintain its leadership into the future (beyond the time limits of this strategic plan).
Provides the Secretariat and Executive Committee with metrics for monitoring SCAR's progress toward goals and overall performance.	
Guides the organizing and prioritization of the activities of SCAR's subsidiary bodies.	

Leadership in Antarctic Science

“Excellence encourages one about life generally; it shows the spiritual wealth of the world.”

T.S. Eliot (1888 – 1965)

The study of Antarctica and the Southern Ocean and their role in the global Earth system has never been more important as the region is experiencing dramatic changes that have global implications. The Antarctic region is a matchless “natural laboratory” for vital scientific research that is important in its own right and impossible to achieve elsewhere on the planet.

SCAR encourages excellence in all aspects of Antarctic research by developing transformational scientific programmes that address compelling topics and emerging frontiers in Antarctic science of regional and global importance.

SCAR initiates, facilitates and coordinates international cooperation in scientific research conducted in and from the Antarctic region and on the role of Antarctica in the Earth system.

SCAR provides venues for the presentation of the latest research results, exchange of up-to-the-minute scientific findings and promotes cross-disciplinary communication amongst the Antarctic scientific community (i.e., Open Science Conferences, Symposia, topical workshops, reviews, assessments and syntheses).

SCAR will initiate regular assessments to identify evolving issues and emerging frontiers in Antarctic science and will consider expanding its activities to include the human element (e.g., history, social sciences and the value of Antarctica).

SCAR encourages multi-disciplinary cooperation and aims to increase the involvement of the wider scientific community in SCAR’s initiatives.

The directions taken by SCAR science in the coming years will be driven by ideas that emanate from the international Antarctic scientific community. A major goal in the next six years is to move to a new portfolio of major Scientific Research Programmes.

The following is an overview of research directions that are likely to be important themes for SCAR’s scientific activities during the six years covered by this plan.

EARTH SYSTEM SCIENCE

Understanding the Earth system, its components, connections and feedbacks is a major endeavour of contemporary Antarctic science and a focus of SCAR research. As a key component of the global system, there remain major gaps in understanding the Antarctic region’s role in the Earth system. SCAR organizes its core scientific activities as Life sciences, Geosciences and Physical sciences. Scientific frontiers often lie at the interfaces between disciplines, requiring interdisciplinary approaches to advance knowledge. SCAR promotes an interdisciplinary philosophy and aims to eliminate barriers to cross-fertilization of ideas.

Life Sciences – Although thought of as a cold and isolated environment, Antarctica is undergoing significant change due to regional climate warming, ozone depletion, non-native species introductions, global transport of contaminants, increased scientific and tourist visits, and natural resource exploitation and extraction. Biologically, Antarctica and the Southern Ocean are centres of evolutionary divergence and adaptation to environmental extremes. Antarctic life sciences research

◀ Brittle stars. © Huw-Griffith, BAS



focuses on understanding the effect of past, current and predicted environmental change on biodiversity, adaptation, organism functioning, ecosystem structure/function and the effects of cold, darkness and isolation on organisms and ecosystems, both on the continent and in the Southern Ocean.

Geosciences – The Antarctic continent and surrounding oceans have been key elements of the Earth system throughout the history of the planet. The basement of Antarctica is built of a suite of crustal blocks that were parts of various supercontinents and the continent contains outcrops that provide insight into Earth processes in the distant past. Sedimentary records on and around Antarctica provide glimpses of palaeohistory and variations in the Earth's environment over the aeons, harbouring clues to the evolution of Antarctica. Geodetic and geophysical observatories document the geodynamics of the continent. Antarctic geosciences research focuses on continental crustal structure and composition, geodynamical processes, the record of life in a warmer Antarctica, the effects of

geological processes on Antarctic biota and understanding the controls on ice sheet evolution and stability.

Physical Sciences – Processes at the interfaces between ice, ocean, land and atmosphere are key to understanding climate dynamics and predicting future climate. The nearly pole centred continent of Antarctica, harbouring 70% of the Earth's fresh water as ice and surrounded by a relatively warm ocean, gives it a unique place in the global climate system. A focus of Antarctic physical sciences research are the ways in which the polar regions are affected by – at the same time as they affect – climate processes. This research aims to understand ice sheet dynamics, climate records from ice cores, changes in sea ice distribution and ocean circulation, atmospheric dynamics and chemistry, oceanic upwelling and melting ice shelves and the impact of the ozone hole on Antarctic climate. The Antarctic continent is also a unique place for astronomical and solar-terrestrial observations of phenomena such as interactions between the Sun and the Earth.

► Scientists drilling through sea-ice.
© Instituto Antártico Argentino



EMERGING FRONTIERS

A review of ongoing and emerging research activities provides a glimpse of possible directions in Antarctic science over the next few years. Several major themes are apparent that will, in all likelihood, be a continuing focus of Antarctic research: past, current and future climate change; the systematic response of Antarctica to change; understanding Antarctic biodiversity, evolution and ecology; exploration and modelling of ice dynamics and sub-ice environments; ocean, ice, atmospheric and cryospheric observing and modelling; linkages and teleconnections between polar regions and the Earth system; and the poles as a vantage point to observe Earth, near-Earth space, the Solar System and beyond.

Antarctica and Global Climate – Antarctica and the Southern Ocean are critically important parts of the Earth system. The climate and physical and biological properties of the continent and the surrounding ocean are closely coupled to other parts of the global environment by the ocean and the atmosphere. For example, the Antarctic ozone hole was one of the most significant scientific discoveries of the last century. For the last 30 years the ozone hole has shielded the bulk of Antarctica from some of the effects of global warming⁶. Nevertheless, the Southern Ocean is warming and the ecosystems are

responding⁶. There has been a rapid expansion of plant communities across the Antarctic Peninsula⁶. Parts of Antarctica are losing ice at a rapid rate and palaeoclimate studies in Antarctica show the current changes in global climate are unusual⁶. If greenhouse gas concentrations were to double over the next century, Antarctica is expected to warm by as much as 3°C⁶. Although new data are being collected and analyzed on an almost daily basis, major

gaps in knowledge remain and additional instrumental data gathering is needed to improve models. Antarctic and global climate will remain areas of interest for the foreseeable future and continue to be a major component of SCAR science. Understanding of the dynamics of polar climate systems is rudimentary at best and a lack of fundamental knowledge limits predictions of future change with confidence. Much remains to be done to

▲ [Downloading data at the Mt. Fleming soil climate station.](#) © Rod Strachan, Antarctica NZ Pictorial Collection

produce a truly integrated view of the planet's climate system and the role of Antarctica in it. SCAR programmes will continue to address these issues for the foreseeable future⁷.



Deciphering Palaeoclimate – A detailed understanding of past climate is essential for a more complete understanding of climate variability and the forces that control future change and responses to change. As the continent most remote from direct human influence, Antarctica is an ideal location to study local-to-global scale climate change. There is no other approach or experiment that can provide perspectives across a range of time scales other than deciphering past climate change through proxies archived in ice and sedimentary records. Records on timescales of thousands, hundreds of thousands, or millions of years stored in Antarctica have yet to be retrieved and analyzed. To fill gaps in records of past climate, retrieval of ice and sedimentary records continues to be a high priority. Major objectives for the geosciences community are to obtain geological records of past Antarctic ice sheet dynamics and integration of this knowledge into coupled ice sheet-climate models. Improved models are critical to constrain and improve the accuracy and precision of predictions of future changes in global and regional temperatures, ocean acidification and sea level⁸. Much remains to be accomplished in deciphering palaeoclimate records and improving integrated Earth system models. These topics are a high priority for Antarctic geoscientists.

Organisms, Ecosystems and Biodiversity – While significant advances have been made in recent years, Antarctica's biological and ecological domains remain, to a large extent, unexplored. Antarctic life scientists strive to understand the evolution and diversity of life in Antarctica and the Southern Ocean to determine how these processes have produced unique Antarctic ecosystems. One of the most important developments in life sciences in Antarctica in recent years is the increased knowledge of Antarctic marine and terrestrial biodiversity. There is a growing body of evidence that Antarctic organisms, ecosystems and biodiversity are responding to climate change. The Census of Antarctic Marine Life (CAML) was invaluable in providing a baseline for the marine environment that can be used to recognize future change. Comparable surveys are not available in the terrestrial environment and remain a high priority for Antarctic life scientists. Life sciences research in the Antarctic has a long history of studying adaptations, ecosystem functioning and structure, and the physiology of the unique organisms that inhabit the region. Research on these topics is expected to continue to address basic questions about life in the cold and dark, in and under the ice, and at environmental extremes. Extension of observations beyond the traditional summer season and application of contemporary methods (such as molecular genomics and



proteomics) to better understand biological structure and function in Antarctica are needed. While the inventory and description of extant species in Antarctica remains a high priority, there is an emerging interest in the palaeoecology of Antarctica that requires close integration with geological and glaciological studies. Antarctica today is more than 99% covered by permanent ice and snow and evidence suggests that, as recently as the last glacial maximum, ice sheets were both thicker and more extensive than they are now. It was thought that most of the currently ice-free ground would have been over-ridden by ice during previous glaciations, suggesting that Antarctic pre-glacial terrestrial life (other than microbiota) was wiped out by successive glacial events. That, in turn, suggested that most, possibly all, contemporary terrestrial life colonized

▲ Prof. Steven Chown searching for invertebrates in tussock grass on sub-Antarctic Heard Island.
© Dana Bergstrom

the continent during subsequent periods of glacial retreat. Recent biological results challenge this paradigm and suggest greater regionalization and evolutionary isolation than previously thought. Cosmogenic isotopes now suggest that many high rock surfaces were not over-ridden, so may have been available as refugia. The life sciences community will continue to focus its efforts on describing and understanding the unique organisms that live and function in marine and terrestrial Antarctic habitats and to use the perspective of geological time to provide a glimpse of the response of biology and ecology to environmental change over the millennia⁹.



Ice Sheet Dynamics and Sub-ice

Environments – Several international, field intensive programmes are aimed at understanding the dynamics of Antarctica's ice sheets, ice shelves, glaciers and sea ice, as well as the Antarctic continent hidden beneath kilometres of ice. These studies use a range of exploration technologies and are providing views above and below the Antarctic ice sheet that have never before been seen. These studies aim to answer fundamental questions such as: i) what role does topography play in the nucleation of continental ice sheets?; ii) how are major elevated continental massifs formed within intra-plate settings but without an obvious plate tectonic mechanism?; iii) where is the oldest climate record in the Antarctic ice sheet?; iv) how do tectonic processes control the formation, distribution, and stability of subglacial lakes?; (v) what role does subglacial water play in ice flow to the sea?; and (vi) to what extent are subglacial lakes interconnected to form networks of waterways and what does this imply about microbial residents?

◀ Top: Chinese Icebreaker Xue Long. © CHINARE
Middle: View of the stars from Amundsen-Scott South Pole station. © Daniel Luong-Van
Bottom: Brunt Ice Shelf. © John Withers, BAS

Subglacial aquatic environment research is changing our view of Antarctica. New frontiers in the study and exploration of these environments will address fundamental processes including providing clues to the tectonic evolution and history of the continent, the importance of subglacial hydrology in ice sheet and ice stream dynamics, and the adaptation of microbial life to extreme environments¹⁰. Major subglacial aquatic environment exploration programmes are continuing and will accomplish first entry and sampling of these environments in the next few years. It can be expected that once these sites are entered and observatories are established, a network of study sites across Antarctica will transform our understanding of subglacial aquatic environments and their importance to fundamental Earth processes. SCAR's science portfolio will continue to include research that studies one of Earth's last frontiers – sub-ice environments.

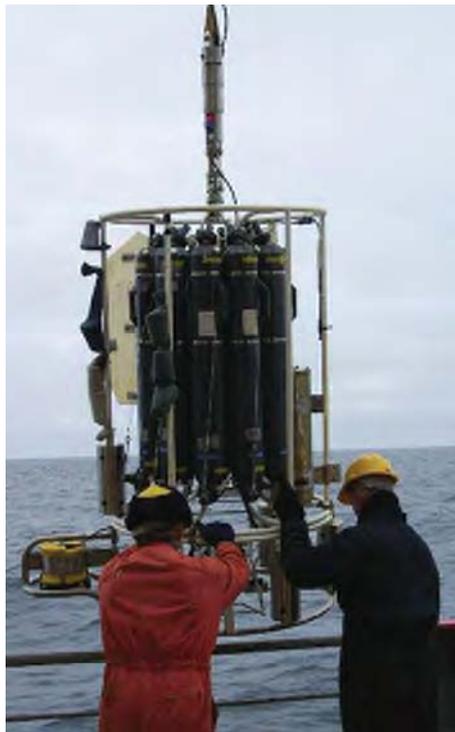
The Poles as a Vantage Point – Near-Earth space is an integral part of the Earth system, providing the link between the Sun and Earth primarily through the Polar Regions¹¹ and posing a potential hazard to space-borne and ground based technology on which society is increasingly dependent. Near-Earth space observations also offer the potential for linking space weather (and such phenomena as solar flares) to

terrestrial weather as experienced in the lower atmosphere; such linkage calls for close collaboration between the ground and space weather communities. An integrated, quantitative description of the upper atmosphere over Antarctica and its coupling to the geo-space environment is needed¹². Antarctica also has unique characteristics that make it a highly desirable vantage point for upper atmospheric, solar, astrophysical and astronomical observations. Antarctic astronomy and astrophysics researchers address fundamental questions including: locating first stars, first galaxies, and re-ionization tomography; defining the nature of the dark universe; detecting gravity waves; and identifying exo-planets and the formation of exo-solar systems. The interests of this community will continue to evolve as major new infrastructure and instruments come on-line enhancing an already impressive array of instruments in the Polar Regions. The SCAR Astronomy and Astrophysics in Antarctica (AAA) programme began in 2010 providing a focus for this community¹³.

TRANSITION OF SCIENTIFIC RESEARCH PROGRAMMES

A major element of SCAR's reorganization was the creation of Scientific Research Programmes (SRPs). The decision was to focus efforts on a limited number of high priority topical areas. The first portfolio of SRPs included Antarctic Climate Evolution (ACE), Antarctica and the Global Climate

▼ Conductivity-Temperature-Depth cast in Drake Passage. © Mike Sparrow



System (AGCS), Evolution and Biodiversity in Antarctica (EBA), Inter-hemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research (ICESTAR), and Subglacial Antarctic Lake Environments (SALE). While recognizing that activities in the Antarctic region are nationally funded, the SCAR SRPs were designed to achieve scientific goals that would be impossible for any one nation, project or scientist alone. The full effect of these programmes is realized when national programmes come together, with the assistance of SCAR, to add value and create synergy. These programmes have a finite duration, usually 6 to 8 years, to allow for regular renewal and updating of SCAR's science activities and encouragement of broad participation in SCAR science. All five of SCAR's first generation SRPs were approved within a 2-year period and they will be coming to an end in 2012-2014. As mentioned above, ICESTAR has made the transition to an Expert Group and AAA was approved as a new SRP. SALE has concluded its work and is also transitioning to an Expert Group. The process that generates proposals for new SRPs is managed by the Standing Scientific Groups and four Programme Planning Groups were approved in 2010. A critical objective over the next few years will be development and approval of the next generation of SCAR Scientific Research Programmes.

OBSERVING SYSTEMS

Antarctica contains 90% of the world's ice and 70% of its fresh water, enough to raise sea level by more than fifty metres¹⁴. Some regions of Antarctica, particularly the Peninsula, have warmed rapidly in recent years, contributing to disintegration of ice shelves and accelerating the retreat of glaciers¹⁵. There is growing consensus that the Antarctic ice sheet is experiencing a net mass loss¹⁶. Loss of ice from the West Antarctic ice sheet may possibly contribute to a rise in sea level by 2100 of up to 1.9 metres¹⁷. Observations of the cryosphere are therefore of the utmost importance. SCAR is a partner in the Integrated Global Observing Strategy Cryosphere Theme Report (CryOS)¹⁸ and various SCAR programmes such as the Antarctic Sea Ice Processes and Climate Expert Group (ASPeCt)¹⁹ make a direct contribution to this effort and will continue to do so.

The Southern Ocean plays unique and critical roles in the Earth system by driving global weather and climate. For example, Antarctic Bottom Water, formed along the Antarctic coast, sinks to ventilate the global ocean. Meanwhile, Antarctic Intermediate Waters supply the world ocean with 75% of the nutrients that sustain ocean productivity. The ocean absorbs around 40% of anthropogenic atmospheric emissions of CO₂ of which 40% is absorbed by the Southern Ocean²⁰. This uptake is increasing

the acidity of the oceans, which may be deleterious to marine organisms and ecosystems²¹. It has been documented that the Southern Ocean is changing, but observations to confirm and monitor this change are sparse. Integrated, multi-disciplinary observations are needed to understand and predict the response of biota to changes in Southern Ocean chemistry, temperatures and circulation. A plan for a Southern Ocean Observing System (SOOS) has been developed with the support of international partners, in particular the Scientific Committee on Oceanic Research (SCOR)²². The plan outlines the scientific rationale and strategy for the SOOS; identifies the variables to be observed; presents a draft plan for an integrated multi-disciplinary observing system for the Southern Ocean; and identifies the next steps required for implementation. At the time of writing, a Secretariat was being set up in Hobart, Australia to take forward implementation of the SOOS. The SOOS will provide a focus for appropriate data collection and modelling and encourage integration across a wide range of marine scientific investigations over the next decade or more.

SCANNING THE HORIZON

To sustain a position of leadership, SCAR must maintain a continually evolving vision of frontiers and emerging directions in Antarctic and Southern Ocean science. To this end, SCAR will sponsor a regular assessment of scientific frontiers. The objective will be to assemble the world's leading experts to scan the horizons for emerging frontiers in Antarctic and Southern Ocean science and identify gaps in knowledge. This gathering will draw on data and information from SCAR conferences, symposia, workshops, meetings and other scientific gatherings; the outcomes of SCAR's Action, Expert and Programme Planning Groups; National Antarctic Programme planning and strategic documents; outcomes of SCAR's Scientific Research Programmes; and reports of SCAR's Cross-linkages Meetings. The assessment will produce a 5- and 10-year vision of future directions and grand challenges in Antarctic science. These assessments will inform SCAR leadership and members as it evaluates its scientific portfolio, concludes programmes and approves new ones.

THE HUMAN ELEMENT

In recent years a community has developed with interests in the social sciences and the history of Antarctica. To date, these activities have been approved on a case-by-case basis. SCAR will assess its undertakings in the human element as a new dimension in the portfolio of SCAR activities. A group of experts in the fields of interest will be assembled from the Antarctic community and beyond and tasked with assessing the productivity of these activities to date, the relevance of this dimension to SCAR's vision and mission, and proposing recommendations on if and how SCAR might pursue these new directions. The group will consider that these activities fall outside the scope of the current Standing Scientific Groups and bring additional demands on limited resources.

► [Bad weather conditions during Antarctic Field Training.](#) © Wendy Clavano, Antarctica NZ Pictorial Collection



Scientific Advice

*“Wise people
listen to advice.”*

Proverbs 12:15

SCAR provides objective and independent scientific advice to the Antarctic Treaty Consultative Meetings and other organizations on issues affecting the conservation and management of Antarctica. SCAR identifies issues emerging from greater scientific understanding of the region and brings them to the attention of policy makers. SCAR aims to provide objective, independent and authoritative scientific advice and does so by partnering with other Antarctic Treaty advisory bodies (e.g., the Convention for the Conservation of Antarctic Marine Living Resources and the Council of Managers of National Antarctic Programmes). SCAR aims to expand its advisory sphere of influence on global issues to other audiences (e.g., the Intergovernmental Panel on Climate Change). SCAR affiliates with organizations with complementary interests to address global issues (see the Partnerships section).

THE ANTARCTIC TREATY SYSTEM

SCAR provides scientific advice to governments, promotes productive linkages between scientists and policy/decision-makers, and ensures that science contributes to the formulation of scientifically sound international agreements. SCAR initiates advice as well as responding to requests for information. In recent times, advice has been primarily in regard to the conservation, protection and management of Antarctica. Scientific advice related to climate change and its impacts has received increasing attention in recent years. Over the last decade, SCAR has made significant improvements in delivering scientific advice to the Antarctic Treaty Consultative Meetings (ATCM)²³. SCAR has established guiding principles to govern its advisory activities. Those activities are carried out in the spirit of partnership between SCAR and the ATCM, with the aim of achieving mutually beneficial interactions²⁴. SCAR has most connections at the Antarctic Treaty Meetings with the Committee on Environmental Protection (CEP)²⁵. Recent efforts to better manage interactions with



► Top: Science work at Paradise Bay, Antarctic Peninsula. © Jeniffer Muñoz Palma, INACH

Middle: Antarctic Treaty Meeting 2010.
© Pablo Wainschenker, ATS

Bottom: Nacreous clouds and the wind farm.
© Sandy Lillecrappe, Antarctica NZ Pictorial Collection

the CEP have met with success and these efforts will continue including regular intersessional contact and communication. The initiative by the CEP to develop a long-range work plan is a welcome development that will assist SCAR in planning its advisory work. SCAR provides advice to the Treaty Parties through its Standing Committee on the Antarctic Treaty System (SCATS)²⁶. SCAR often prepares papers for the ATCM in partnership with other entities (e.g., COMNAP and IUCN) and individual Antarctic

▼ Left: Amphipod crustacean found living on the sea floor near the Antarctic Peninsula. © BAS

Right: Watching the C17 taxi after landing.
© Dave Collett, Antarctica NZ Pictorial Collection

Treaty Parties. SCAR's status as an independent and objective advisor is maintained at all times. As an educational initiative, SCAR provides a SCAR Science Lecture as an ATCM agenda item, addressing the latest developments in Antarctic sciences and emerging issues. SCAR is committed to working with all advisory bodies within the ATS in a cooperative and collaborative manner to increase efficiency, share workloads and ensure the widest possible consultation during the advisory process. The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) is an important Observer at the ATCM²⁷. Many SCAR scientists are directly

involved in providing data to the CCAMLR Scientific Committee through their national delegations. SCAR is initiating actions to improve consultation and interactions with CCAMLR. SCAR will engage CCAMLR in a dialogue aimed at strengthening the relationships between the two organizations. The Council of Managers of National Antarctic Programmes (COMNAP) is another key Observer at the ATCM²⁸. SCAR and COMNAP have been engaged in dialogue to improve interactions between the two organizations and this will continue. SCAR consults with the Advisory Committee to the Agreement on the Conservation of Albatrosses and Petrels (ACAP) as needed²⁹.

EXPANDING THE ADVISORY ROLE

SCAR also provides scientific advice on the role of the Antarctic and associated systems in global climate change to the Intergovernmental Panel on Climate Change (IPCC) and the UN Framework Convention on Climate Change³⁰. SCAR aims to expand its advisory role beyond its traditional relationships while reaffirming its commitment to be the pre-eminent scientific advisor to the Antarctic Treaty Parties.



Partnerships

"Friendship is essentially a partnership."

Aristotle (384–322 BC)

Partnerships with organizations with complementary skills, technologies and interests bring added value to SCAR's activities. SCAR partners with ICSU bodies, advisory bodies to the Antarctic Treaty System, organizations with a polar mission, and global programmes with polar interests. Partnerships support SCAR's goals to provide authoritative scientific advice to policy makers, expand its advisory sphere of influence on global issues, develop the capacity of students and early career scientists, and encourage cooperation with Arctic counterparts.



SCAR partnerships vary considerably in scope and level of activity. In some instances, formal co-sponsorship of an activity is warranted, entailing shared responsibility for programme management and resourcing. SCAR is always looking for ways to strengthen existing partnerships and establish new ones. SCAR actively pursues strong links with other ICSU bodies³¹. Exemplars include a partnership with the World Climate Research Programme (WCRP)³² and joint sponsorship of programmes with the Scientific Committee on Oceanic Research (SCOR). SCAR will incorporate and contribute to the Grand Challenges in Global Sustainability identified by ICSU³³. SCAR maintains a close relationship with the Council of Managers of National Antarctic Programmes (COMNAP). SCAR will continue to coordinate its activities with COMNAP through: (i) joint meetings of the SCAR and COMNAP Executives; (ii) joint meetings of the full memberships of both organizations; and (iii) liaison in the margins of the ATCMs. SCAR is committed to working bi-laterally and multi-laterally with National Antarctic Programmes and collectively through COMNAP.

BIPOLAR SCIENCE

SCAR recognizes the many interests that the Antarctic and Arctic scientific communities have in common. Areas of current and future collaboration include studies related to the cryosphere and to the roles of Polar Regions in the climate system. SCAR's principal partner on bipolar issues is the International Arctic Science Committee (IASC)³⁴. SCAR will continue to increase bipolar cooperation with IASC through the Joint Bipolar Action Group on Science Cooperation (BipAG II) that is charged with identifying areas for scientific cooperation. SCAR and IASC are considering their stewardship responsibilities for the legacies of the International Polar Year in observing systems, data and information management, and mentoring of students and early career scientists. SCAR and IASC will address issues regarding the IPY legacies as a joint activity of their Executive Committees.

◀ Early career scientists at the 2010 SCAR Open Science Conference in Buenos Aires.

© Shridhar Jawak

THE NEXT GENERATION

Supporting the development of the next generation of polar researchers is being pursued in collaboration with the Association of Polar Early Career Scientists (APECS)³⁵. SCAR and IASC have signed Memoranda of Understanding with APECS. SCAR's partnership with APECS has been especially productive and new ways to strengthen this relationship in the future will be explored (see the "Capacity Building, Education and Training" section).

Examples of SCAR Partners in 2010*

ICSU Bodies	Antarctic Treaty System	Organizations with a Polar Focus	Programmes with a Polar Interest
International Association of Cryospheric Sciences (IACS)	Agreement on the Conservation of Albatrosses and Petrels (ACAP)	Southern Ocean component Global Ocean Ecosystem Dynamics Programme (SO-GLOBEC)	Global Biodiversity Information Facility (GBIF)
International Astronomical Union (IAU)	Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)	Integrating Climate and Ecosystem Dynamics in the Southern Ocean Programme (ICED)	Integrated Global Observing Strategy Partnership (IGOS-P)
International Arctic Science Committee (IASC)	Council of Managers of National Antarctic Programmes (COMNAP)	International Permafrost Association (IPA)	Past Climate Changes (PAGES)
Scientific Committee on Oceanic Research (SCOR)	Committee on Environmental Protection (CEP)	International Partnerships in Ice Core Sciences (IPICS)	Global Ocean Observing System (GOOS)
Scientific Committee on Solar Terrestrial Physics (SCOSTEP)		Association of Early Career Scientists (APECS)	Partnership for Observation of the Global Oceans (POGO)
World Climate Research Programme (WCRP)			
The Committee on Data for Science and Technology (CODATA)			

* For details go to: <http://www.scar.org/about/partnerships/>. Note that this list is not exhaustive as SCAR works in partnership with many organizations to reach shared objectives.

Data and Information Management

"It is a capital mistake to theorize before one has data."

Arthur Conan Doyle (1859-1930)

SCAR promotes free and unrestricted access to Antarctic data and information by promoting open and accessible archiving practices. SCAR aims to be a portal to data repositories of Antarctic scientific data and information.

Data and information are valuable and irreplaceable resources. In the pursuit of various scientific objectives, it is often necessary to use data and information collected by scientists from many countries. SCAR recognizes the critical and essential importance of the stewardship of data and information within national and international programmes and its accessibility to all. Proper management of data and information is not an "add-on" or an additional task; it is a fundamental aspect of modern science. SCAR encourages the community to make maximum use of all data; to develop and operate mechanisms to facilitate the collection, storage, retrieval and dissemination of data and information for the common good; and to ensure that these mechanisms are effective. SCAR has adopted a Data and Information Management Strategy (DIMS), developed by the SCAR Standing Committee on Antarctic Data Management (SCADM), to ensure that the scientific user community has adequate access to data and information³⁶. Science in Antarctica relies on a consistent geographic framework. SCAR's Standing Committee on Antarctic Geographic Information (SCAGI) manages and enhances the geographic framework for Antarctic scientific research, operations, environmental management, and tourism. SCAGI works closely with SCADM, often meeting in parallel, with joint sessions of relevance to both Committees³⁷.

IMPLEMENTATION

The next steps in the DIMS involves production of an Implementation Plan outlining resource implications and the adoption of a SCAR Data Policy. For the DIMS to be effective, it will need to be implemented in consultation with the scientific community that it is meant to benefit. To meet the requirements of the DIMS, SCAR will build an Antarctic Data Management System (ADMS) capable of supporting interdisciplinary Antarctic science. The ADMS is viewed as a science enabler. SCAR is making progress towards achieving the vision of DIMS but much more can be achieved. Strategic foundations must be put in place to enable better coordination of individual, and often disconnected, efforts. Better articulated governance arrangements and strong leadership will be necessary to develop a distributed, loosely federated shared infrastructure. The Data Policy will stipulate the norms that should be adopted with respect to data sharing and access, data management planning and the establishment of National Antarctic Data Centres (NADCs).

◀ Log-periodic antenna system of the Southern Hemisphere Antarctic Radar Experiment (SHARE)
© Chris Gilbert, BAS





INFRASTRUCTURE DEVELOPMENT AND TRAINING

SCAR uses its systems, capabilities and resources to assist those with less developed data and information infrastructures. The objective is to create a network of permanent data archives capable of the long-term management and publication of

all Antarctic data. The number of NADCs is low relative to the number of national SCAR Members. SCAR promotes implementation of standards that support the interoperation of technology platforms and data transport protocols. Education, outreach and guidance on all facets of system operations, protocols, and functions are essential as well.

Increasing the number of NADCs and improving the capabilities of those that exist can only be achieved through training and mentoring. These activities are supportive of SCAR's larger mission in capacity building (see the "Capacity Building, Education, and Training" section).



SCAR Products*

Antarctic Data Directory System (ADD)	Antarctic Digital Magnetic Anomaly Project	Antarctic Biodiversity Database	Antarctic Map Catalogue	Antarctic Bedrock Mapping (BEDMAP)	Composite Gazetteer of Antarctica (CGA)
Continuous Plankton Recorder Database (CPR)	Geodetic Data	International Bathymetric Chart of the Southern Ocean	Reference Antarctic Data for Environmental Research	Seismic Data Library System	Tide Gauge Data

* For details go to: <http://www.scar.org/researchgroups/productsandservices/>.



◀ Top: WAVE (West Antarctic Volcano Exploration)

Campsite on south side of Mt. Murphy.

© John Smellie, BAS

Middle: Access shafts to the old German George von Neumayer base, Princess Martha Coast.

© Andy M Smith, BAS

Bottom: Joint Argentine-US project "Investigating Iceberg Evolution during Drift and Break-up"

© Pedro Skvarca, Instituto Antártico Argentino

Capacity Building, Education and Training

*"The turning point...
was when I really
realized that you can
do it yourself."*

Timothy Blixseth (1950- present)



SCAR is committed to developing scientific capacity in its Members, emerging National Antarctic programmes, students and early career scientists. SCAR also aims to recruit countries that have not traditionally participated in Antarctic research. SCAR promotes and facilitates the incorporation of Antarctic science in education at all levels and aims to communicate scientific information about the Antarctic region to the public.

To enable all in the SCAR family to participate in, contribute to and benefit from SCAR's activities, SCAR works to enhance the capacity of all of its members and the Antarctic community in general. The National Antarctic Programmes of SCAR Members vary greatly in size and capacity. Some have large scientific communities that are scientifically advanced and long standing. Others have relatively small and/or new Antarctic science communities that are developing.

◀ Crevasse rescue field training near Rothera Research Station. © Chris Gilbert, BAS

▶ Top: SCAR/APECS workshop during 2010 SCAR Open Science Conference. © Francisco Fernandoy

Bottom: The Clean Air Sector Laboratory (CASLAB). © Chris Gilbert, BAS

REVISION OF THE CAPACITY BUILDING, EDUCATION AND TRAINING (CBET) PLAN
The CBET Plan was developed and a CBET Committee created as a goal of the previous strategic plan³⁸. The CBET Committee is led by a SCAR Vice President and supported by the SCAR Secretariat³⁹. The Committee initiates, plans and oversees all of SCAR's capacity building, education and training activities. Current SCAR programmes in CBET include a Fellowship Programme⁴⁰, a Visiting Professor Programme⁴¹, SCAR Secondments⁴², the Martha T. Muse Prize for Science and Policy in Antarctica⁴³, social networking groups⁴⁴, and a partnership with the Association of Polar Early Career Scientists⁴⁵. The CBET Committee manages SCAR's awards and recognition activities including selection of speakers for named lectures, fellowship recipients, reward of certificates of appreciation and selection of SCAR Medals awardees. A group of experts will be assembled to review, assess the productivity, and examine the mix of CBET activities. As a shared responsibility, the review group will be tasked with making recommendations on how better to engage National Antarctic Programmes. The review group will also be tasked with considering the increasing importance of regional Antarctic science associations (for example in South America and the Far East) and recommending how SCAR might best interact with and capitalize on these developments. Based on the recommendations of the review group,

the CBET Plan will be updated. The resources required to implement recommendations will be estimated, a resourcing strategy developed and a timeline established for implementation. The SCAR Development Council will be specifically tasked with identifying and soliciting external funding for CBET activities as an activity that resonates with funding agencies and Foundations.



Communications

"Communication works for those who work at it."

John Powell (1960 – present)

Effective communication with those that have an interest in SCAR is essential. SCAR utilizes a range of tools to ensure timely and frequent contact with various communities and entities. SCAR aims to inform the public and the media of the importance of Antarctica and the Southern Ocean; communicate effectively its

mission, relevance and accomplishments; improve understanding of the benefits and importance of Antarctic science; and communicate the importance of Antarctic research to those that fund science. The communication strategy is intended to increase the visibility of SCAR and its activities; improve cooperation with partners; facilitate interactions between the Secretariat, the Executive Committee, and scientific activities; and ensure that all Members are aware of opportunities to participate in SCAR.

Over the last decade SCAR has transformed itself from a paper-driven institution into one that conducts virtually all of its work electronically. This increases transparency and makes information easily accessible by National Committees, scientists working in Antarctica and the interested public. SCAR is effectively using its communication tools during the intersessional period between biennial Delegates meetings.

WEB PRESENCE

The SCAR web site is the major outlet for the organization to communicate with its members, the general public and scientists interested in SCAR's work. The next generation SCAR website will be designed to appeal to a wider audience, including the general public, educators, policy makers and journalists. The content will include highlights that address key issues of the day. SCAR will explore techniques used for marking-up content and cross-link the SCAR site and others to improve search engine rankings. Dynamic features will be included on the web site pages (e.g., RSS feeds and multimedia material). SCAR will make its web site a collaborative workspace that can be used to manage and administer SCAR meetings and conferences.



◀ Tracking and Data Relay Satellite (TDRS). © NASA

SCIENTIFIC MEETINGS

SCAR communicates its message through its business meetings, conferences, symposia, workshops and other meetings⁴⁶. In addition, SCAR subsidiary groups commonly arrange workshops or seminars. The SCAR Open Science Conferences have been well attended and, most importantly, draw together an interdisciplinary community including early career researchers. For some early career researchers this may be their first large polar science conference. SCAR will closely monitor the Open Science Conferences and assess whether the present schedule should be maintained. Improvements in planning efficiency to reduce costs and creation of a revenue stream to assist in sustaining Conference activity will be considered. The SCAR Secretariat will investigate the feasibility of managing an in-house system in order to reduce costs, increase efficiency, improve standardization and brand the events. A group will be assembled to assess the efficiency of the current structure of the biennial meetings. The group will be tasked with considering all aspects of these meetings including finances, timing and structure within the biennial meetings, the frequency of meetings and their impact.

NATIONAL COMMITTEES

National Committees are an important partner in improving communication with the Antarctic scientific community. SCAR will continue to urge National Committees to raise awareness of the importance of Antarctic science by organizing Conferences or Symposia on Antarctic and Southern Ocean science and drawing attention to the relevance of that science to major issues of public concern. SCAR also recognizes that English is the official language of communication and encourages the presentation of papers in plain English, using simple and direct language. At Delegates' meetings key working documents are converted to summary power points for projection. Documents are also made available at the SCAR web site well in advance of meetings.

IMPROVING THE VISIBILITY OF ANTARCTIC SCIENCE

Communication within and amongst the scientific community is in large part driven by the publication, wide dissemination and presentation of research findings in the peer-reviewed literature. The value of Antarctic science is highly dependent on the communities' ability to communicate and share data, knowledge and information with peers, the wider scientific audience beyond Antarctica, and the public and lay communities. SCAR is committed to ensuring that research results, scientific findings and data syntheses are published in the highest quality and most widely cited scientific periodicals. To optimize the process of "getting the message out", SCAR will encourage Antarctic journals that are not ISI-listed to meet the criteria for listing to increase the visibility and recognition of published work. Publication in non-Antarctic journals is also crucial for widening the influence and impact of Antarctic science. SCAR aims to ensure that Antarctic science and research results have maximum visibility in the wider scientific community and especially in citation indices, an accepted measure of impact. SCAR is committed to improving the visibility of the science that its programmes and members produce.

REVISION OF THE COMMUNICATIONS PLAN

A Communications Plan was developed under the previous strategic plan⁴⁷. The Communications Plan identifies SCAR's target audiences, desired outcomes for each audience and mechanisms to communicate with each audience. A group of experts will be assembled to review, assess the effectiveness and examine the mix of communication activities. The review group will be tasked with making recommendations on how best to use limited resources to greatest effect. Based on the recommendations of the review group, the Communications Plan will be updated. The resources required to implement the recommendations will be estimated, a resourcing strategy developed and a timeline established for implementation.

Organization and Management

"The achievements of an organization are the results of the combined effort of each individual."

Vince Lombardi (1913 – 1970)

SCAR is committed to continuous improvement in the effectiveness, efficiency and flexibility of the structure, procedures and practices of the organization. SCAR encourages the widest participation in decision-making.

SCAR is, first and foremost, an organization of members⁴⁸. As a Charity, SCAR operations are directed by a Memorandum of Association, Articles of Association and

Rules of Procedure that are in compliance with the law of the host country. The SCAR President and Vice Presidents serve as the Directors of the Charity with the SCAR Executive Director serving as the Company Secretary⁴⁹. SCAR accomplishes its work through a number of subsidiary bodies including Action, Expert, and Programme Planning Groups; Standing Scientific Groups and Committees; Scientific Research Programmes; Delegates' Committees^{50,51}, and an Executive Committee⁴⁹. Final decision-making authority rests with the Delegates by unanimous consent and the Executive Committee is empowered to act on behalf of the Delegates. The business of SCAR is conducted at biennial meetings that include subsidiary body meetings, scientific group business meetings, an Open Science Conference and the Delegates' meeting. SCAR science is proposed and planned by Programme Planning groups, managed by the Standing Scientific Groups, and organized as Scientific Research Programmes⁵². Scientific quality is maintained through regular, rigorous internal and external review. Scientific decision-making is informed by workshops, symposia, Standing Scientific Groups and programmes, and the scientific community.

SCAR subsidiary body leadership is selected by a combination of elections and appointments. The administrative functions of SCAR are carried out by the Secretariat staff and Standing Committees organized around each facet of SCAR's mission (i.e., advice, finances, CBET and administration)⁵³. The organizational structure adopted in response to the review of SCAR has proven beneficial and no major structural or procedural changes are expected, while minor adjustments will be made to improve efficiency, inclusiveness and responsiveness as necessary.

Experience has shown that assembly of expert groups to provide assessments and review is an effective mechanism to improve structure, policies and procedures. At the highest level the Strategic Plan will be reviewed annually at the Delegates' and EXCOM meetings, with a mid-course (~2013/14) external review recommended. This plan calls for a series of these reviews over the next few years including reviews of the structure and frequency of biennial meetings, the Communications Plan, the CBET Plan, partnerships, expansion into the human element and others. A wide range of reforms has been implemented with regards to how meetings are conducted to improve participation and inclusiveness and these adjustments will continue.



◀ Sea ice sampling off Port Lockroy. © Mike Sparrow

Resources

“Literature was formerly an art and finance a trade; today it is the reverse”

Joseph Roux (1725-1793)

The challenge for SCAR is to match available funds with the demands for resources while maintaining a healthy and vibrant organization. SCAR adheres to the highest accounting and ethical standards in all of its dealings. SCAR's resources are leveraged by the willingness of the Antarctic scientific community to volunteer time and by the in-kind support provided by its Members.

SCAR's ability to carry out its mission effectively depends on its financial capacity. SCAR's financial principles include balancing annual budgets, cost-effective management of resources to accomplish organizational goals, active solicitation of external funds, allocation of resources in concert with organizational goals, maintenance of a reserve, and fair and equitable compensation of its employees. SCAR's financial statements and budget are presented so they are easy to understand⁵⁴. An annual audit is carried out by an independent auditor to ensure that SCAR conforms to accounting practices for UK charities. SCAR budgets are approved for a biennium⁵⁵. SCAR's core funding comes from membership fees and is supplemented by grants and contracts from external sources⁵⁶. A reserve is maintained to cover one year of administrative costs. Member countries occasionally make additional voluntary contributions to the Secretariat to support

specific activities. SCAR members also host or financially support conferences, workshops, summer schools and other meetings. To keep pace with escalation of salaries and wages and increased operating costs, membership fees are increased by unanimous consent. External funds are actively sought to support SCAR activities⁵⁷. SCAR charges a modest fee to manage projects, which involve additional tasks assumed by the Secretariat.

DEVELOPMENT COUNCIL

A Development Council will be formed to identify potential sources of external funds and to develop strategies to cultivate and expand SCAR's donor base of support.

▼ Iceberg off Antarctic Peninsula © Mike Sparrow



Momentum and Continuity

“(SCAR) acquires momentum as (SCAR) advances.”

modified from Virgil (70BC-19BC)

This strategic plan sets SCAR on an ambitious path for the next six years. The next decade will be a critical time for SCAR as voluntary enterprises and organizations face significant cost pressures. SCAR must carefully choose its priorities in a context of budgetary constraints.

SCAR's vision, mission and goals will only be accomplished if its members and the community of international scientists it serves see value in the activities of the organization and are willing to commit the time and energy necessary to attain success. SCAR has generated significant positive momentum over the past decade. Continuing and building on this momentum

will be dependent on organizational leadership, a continued spirit of volunteerism by SCAR supporters and participants, wise management of limited resources and careful consideration of priorities. To sustain progress and to continue to fulfil the vision and mission of SCAR, the next generation must be encouraged to assume leadership roles.



► Sunset over a frozen Sea, taken from RRS James Clark Ross. © Mike Sparrow

Notes and References

- 1 Scientific Committee On Antarctic Research: A Decade Of Progress; New Challenges Ahead: Report of the 2009 SCAR Review Group www.scar.org/strategicplan2011/2009Review.pdf
- 2 For details on SCAR's charity status, see <http://www.scar.org/about/constitution/>.
- 3 Defined as including the continent, the adjacent islands and the Southern Ocean
- 4 SCAR Strategic Plan 2004–2010, see www.scar.org/strategicplan2011/strategicplandec04.pdf
- 5 See www.scar.org/strategicplan2011
- 6 *Antarctic Climate Change and the Environment (ACCE) report*. Editors J.Turner, R. Bindshadler, P. Convey, G. di Prisco, E. Fahrbach, J. Gutt, D. Hodgson, P. Mayewski, C. Summerhayes. ISBN 978-0-948277-22-1. 2009
- 7 Examples of ongoing SCAR programmes that focus on climate issues include the Antarctica and the Global Climate System (AGCS) programme, the Prediction of Changes in the Physical and Biological Environment of the Antarctic (PCBEA) group and the ACCE Expert Group.
- 8 An example of a SCAR programme that focuses on palaeoclimate is the Antarctic Climate Evolution (ACE) programme (see <http://www.ACE.scar.org>)
- 9 Examples of SCAR programmes that focus on organisms, ecosystems and biodiversity include Evolution and Biodiversity in Antarctica (EBA, <http://www.eba.aq/>) and the Programme Planning Groups Antarctic Ecosystems: Adaptations, Thresholds and Resilience (AntETR); and State of the Antarctic Ecosystem (AntEco). The Census of Antarctic Marine Life (CAML) was invaluable in providing a baseline for the marine environment that can be used to recognize future change www.caml.aq.
- 10 SCAR programmes such as the Subglacial Antarctic Lake Environments (SALE) have fostered significant advances in understanding <http://www.sale.scar.org/>
- 11 Understanding of the complex geospace environment has matured to the level of being able to describe many of its component parts and a major goal now is to seek a unified framework that can specify and predict its global state and, therefore so called "space weather". Antarctica offers a privileged position to remotely sense the vast region of geospace (extending over millions kilometers from the planet) because the Earth's magnetic field focuses the effects of geospace into the polar regions and Antarctica has a land mass on which to base instruments at high latitudes.
- 12 SCAR's Inter-hemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research (ICESTAR) programme has been a leading contributor to this effort. <http://scar-icestar.org/>
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- 22 SOOS partners include SCAR, the Scientific Committee on Oceanic Research (SCOR), the Partnership for Observations of the Global Ocean (POGO), the Census for Antarctic Marine Life (CAML), the World Climate Research Programme (WCRP) and the Global Ocean Observing System (GOOS). The SCAR/SCOR Expert Group on Oceanography and the CLIVAR/CLIC/SCAR Southern Ocean Region Implementation Panel have taken the lead in producing the SOOS strategy, though views have been solicited from as wide a range of interested parties as possible. These efforts will be a continuing focus for an interdisciplinary group of Southern Ocean scientists for years to come.
- 23 The numbers of papers submitted to the ATCM have dramatically risen in recent years. It is expected that the demand for scientific advice will increase in the coming years and that central issues will continue to be environmental stewardship, conservation and protection; the impact of climate change; and the response of Antarctic systems to climate change. Emerging issues before the Antarctic Treaty parties that will most likely require scientific advice include the impacts of tourism; bioprospecting activities; introduction of non-native species; global contaminant transport; environmental monitoring; and 21st century conservation practices regarding species and area protection, bioregionalization models, ecosystem based management practices, and delineation of human-induced change against a background of natural variability.

- 24 SCAR is committed to giving the best, most accurate and up-to-date advice to the Antarctic Treaty Parties. SCAR's goal is a "best effort" within time constraints, but not at the sacrifice of quality. SCAR primarily, if not exclusively, relies on peer-reviewed, publicly available science and information as a quality control/quality assurance mechanism. SCAR does not try to judge the quality of "grey literature" or unpublished data. SCAR encourages all data producers to make information publicly available and accessible in a timely manner utilizing accepted scientific practices. All sources of information are disclosed and attributed as to their origins and the use of proprietary or undisclosed information is counter to this policy. Individual opinions or positions based on less than rigorous scientific principles are not considered. Accepted, proven and peer-reviewed methodologies are utilized when analyses of data are required and these methodologies are fully disclosed. The ATCM Information Paper on SCAR's Role in the ATCM is available from: www.scar.org/strategicplan2011/SCAR_Treaty.pdf
- 25 For a description of Committee on Environmental Protection, see www.cep.aq.
- 26 Broad, inclusive, and open consultation is the basis for producing SCAR advisory documents. The mechanisms for this consultation vary (e.g., emails, workshops, open forums, and others) but an effort is made to solicit advice, within realistic timeframes, to allow for full consultation and feedback. Consultation occurs as early in the process as deemed necessary to achieve the best outcomes. Whenever consultation is requested and comments received, documents are revised accordingly or an explanation of why not is provided. SCAR has ultimate responsibility for the quality and accuracy of its advice, accepts this responsibility, and highly values its reputation as an objective, authoritative and independent source of advice.
- 27 Convention on the Conservation of Antarctic Marine Living Resources (www.ccamlr.org) - The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) is one of the other important advisory entities within the ATS. CCAMLR came into force in 1982, as part of the Antarctic Treaty System, in pursuance of the provisions of Article IX of the Treaty. The aim of the Convention is to conserve marine life in the Southern Ocean. The Convention established a Commission to manage the marine living resources of the area. SCAR is an Observer to the Scientific Committee of CCAMLR and SCAR invites observer from CCAMLR to its meetings.
- 28 Created in 1988 COMNAP is the international association that brings together National Antarctic Programmes from around the world to develop and promote best practice in managing the support of scientific research in Antarctica. See <https://www.comnap.aq/>
- 29 ACAP is a multilateral agreement that seeks to conserve albatrosses and petrels by coordinating international activity to mitigate known threats to albatross and petrel populations. See <http://www.acap.aq/>
- 30 For details, see www.ipcc.ch and <http://unfccc.int>
- 31 Examples include joint support of the SCAR/SCOR Oceanography Expert Group and the design of a Southern Ocean Observing System (SOOS, see above). SCAR also co-sponsors with SCOR the IGBP Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICED, www.iced.ac.uk) programme. SCAR has a Memorandum of Agreement with IGBP's Past Climate Change programme (PAGES, www.pages-igbp.org) and Global Ecosystems Dynamics (GLOBEC, www.pages-igbp.org) programme and has established linkages with ICSU's International Association for Cryosphere Sciences (IACS, www.cryosphericciences.org). Strong links will continue with ICSU's Scientific Committee on Solar-Terrestrial Physics (SCOSTEP, <http://www.scostep.ucar.edu/>) and its Climate and Weather of the Sun (CAWSES, www.cawses.org) programme in support of SCAR's solar-terrestrial physics programme. In other activities, SCAR is assisting ICSU with the redesign of the World Data Centers (WDC) and is contributing to the development of the Polar Information Commons (PIC, www.polarcommons.org). SCAR also maintains strong links with the international Arctic Science Committee (see below and main text).
- 32 SCAR co-sponsors several WCRP activities including: (i) the Climate and Cryosphere Programme (CliC); (ii) the Southern Ocean Implementation Panel shared by CliC (www.cliC.npolar.no) and the WCRP's Climate Variability Programme (CLIVAR, www.clivar.org); (iii) the International Programme for Antarctic Buoys (IPAB, www.ipab.aq); and (iv) the SOOS programme mentioned above.
- 33 Challenge #1: Improve the usefulness of forecasts of future environmental conditions and their consequences for people; Challenge #2: Develop the observation systems needed to manage global and regional environmental change; and Challenge #3: Determine how to anticipate, avoid and cope with dangerous global environmental change.
- 34 For a description of IASC, see <http://www.iasc.info/>
- 35 For a description of APECS, see <http://www.apecs.is/>
- 36 For details, see <http://scadm.scar.org/>.
- 37 SCAGI delivers a range of up-to-date geographic information products through its various projects. These products include the Composite Gazetteer of Antarctica, the Antarctic Digital Database (ADD), and Map and Feature Catalogues. SCAGI promotes an open standards approach to support free and unrestricted data access. <http://www.scar.org/researchgroups/>.
- 38 For details see www.scar.org/strategicplan2011/CBETplan.pdf
- 39 <http://www.scar.org/communications/committee.html>
- 40 The SCAR Fellowship Programme allows PhD students or post-doctoral researchers to undertake research at an institute or programme in a SCAR Member country. Since the inception of the fellowships in 2003, there has been a steady increase in

applications. The Programme is given core funding by SCAR supplemented by voluntary contributions by SCAR Members.

- 41 SCAR is developing a Visiting Professor Programme that will finance visits by leading Antarctic scientists to countries with less well-developed Antarctic programmes for short periods of time to teach, provide lectures and develop networks and linkages. SCAR is investigating various avenues to increase funding for this activity including proposals to philanthropic foundations.
- 42 Opportunities for secondments for an individual from a SCAR Member country to work either at the Secretariat or at an institute working on SCAR activities (e.g. Data and Information, SC-ATS) has been supported by the Delegates, but is dependent on available funding.
- 43 The "Martha T. Muse Prize for Science and Policy in Antarctica" is a US\$ 100,000 unrestricted cash prize presented to an individual in the fields of Antarctic science or policy who has demonstrated potential for sustained and significant contributions that will enhance the understanding and/or preservation of Antarctica. The Muse Prize is a prestigious award that recognizes excellence in Antarctic research by honouring someone in the mid-stage of their career. The Prize is a legacy of the International Polar Year 2007-2008 sponsored by the Tinker Foundation and administered by SCAR until at least 2013. See www.museprize.org.

44 Much of SCAR's contact with the general public, educators, and others is via the SCAR website and various social networking groups (FaceBook, LinkedIn etc.). The website now includes links to a large number of Antarctic education websites sorted by audience and language (see the "Communications" section).

45 SCAR is actively working with the Association of Polar Early Career Scientists (APECS) to engage and promote the careers of the next generation of polar scientists. This has proven to be highly beneficial to both organizations. SCAR works closely with APECS to involve early career scientists in all of its activities including, but not limited to, conferences, meetings, symposia, business meetings and scientific subsidiary bodies and programmes. <http://apecs.is/>

46 SCAR's major set of meetings occur biennially and include: (i) an Open Science Conference, (ii) Business Meetings of the Standing Scientific Groups, and (iii) the Delegates Meeting. Thematic symposia are held every 4 years in the Earth Sciences, Antarctic Biology and Glaciology.

47 The SCAR Communication Plan identifies target communities each of which requires messages tailored in a different way. Because many of these communities are at the national level, the task of communicating SCAR's message is shared between the SCAR Secretariat acting internationally and SCAR National Committees acting within countries. www.scar.org/strategicplan2011/Commplan.pdf

48 The national members of SCAR are the national organizations adhering to ICSU, a national organization nominated by the national organization adhering to ICSU, or by some other means if a country has no national organization adhering to ICSU and is, or plans to be, active in Antarctic research. In addition, relevant scientific Unions of ICSU are also eligible for membership. There are three categories of membership: Full Members, ICSU Scientific Union Members and Associate Members. Full Members are those countries with an active scientific research programme in Antarctica, Union Members are those ICSU scientific unions that have an interest in Antarctic research, and Associate Members are those countries without an independent research programme as yet or those that are planning a research programme in the future.

49 The Delegates elect an Executive Committee that is responsible for carrying out business intersessionally and for overseeing the day-to-day administration of SCAR through the Secretariat. The Executive Committee (EXCOM) comprises the President and four Vice-Presidents, along with the Past President in the first two years following a presidential election, with the SCAR Executive Director serving as a non-voting member. Each Vice-President has responsibility for an element of the SCAR mission, i.e. Science; Capacity Building, Education and Outreach; Data and Information Management; Finance; and Administrative and Constitutional Affairs. The Executive Committee meets immediately prior to and after the Delegates' Meetings and in the years the Delegates do not meet. The EXCOM has authority to act on behalf of the

Delegates. Since SCAR is also a charity, the Officers of EXCOM (minus the Executive Director) serve as the Trustees of the Charity.

50 SCAR conducts and manages its scientific affairs through a variety of subsidiary bodies including the Delegates Committee on Scientific Affairs (DCSA). The DCSA, chaired by the Vice President for Scientific Affairs, recommends strategic scientific research directions, reviews performance against stated programme objectives and goals, and proposes adjustments in SCAR's major research efforts to reflect changing themes and issues. The Standing Committee on Antarctic Data Management (SCDAM) and Antarctic Geographic Information (SCAGI) report jointly to the DCSA and the Secretariat. The DCSA convenes during the biennial Delegates meetings so the joint reporting structure maintains continuity during the intersessional. The DCSA creates efficiency by separately considering those agenda items in its areas of responsibility during the biennial Delegates Meetings.

51 SCAR conducts its administration, management, advisory and outreach activities through subsidiary bodies. The Delegates Committee on Outreach and Administration (DCOA) is chaired by the Vice President for Administration and recommends strategic directions for SCAR's advisory roles; capacity building, education and training activities; finances and budgets; reviewing the Secretariat's performance; interactions with external organizations; and adjusting SCAR's administrative procedures and structures as needed. The Standing Committees on the

Antarctic Treaty System (SCATS) and Finance, and the Capacity Building, Education and Training Committee; the History Action Group; Social Sciences Action Group and the Joint SCAR/IASC Bipolar Action Group (BipAG) jointly report to the DCOA and the Secretariat. The DCOA convenes during the biennial Delegates meetings so the joint reporting structure maintains continuity during the intersessional period. The DCOA creates efficiency by separately considering those agenda items in its areas during the Delegates Meetings.

52 SCAR plans, conducts and manages its science activities through its Standing Scientific Groups (SSGs for Life Sciences, Physical Sciences and Geosciences). The SSGs interface between the Antarctic scientific community, develop new scientific activities and bring perspectives from the scientific communities. SSG subsidiary Expert Groups, Action Groups and Programme Planning Groups serve differing functions. Expert Groups address matters that require an ongoing capability and/or expertise and are expected to continue until that need no longer exists. Action Groups address specific terms of reference that need immediate attention and will normally complete their activities in 2-3 years. Programme Planning Groups (PPG) serve areas where communities of scientists come together to develop plans for major, international and integrative Scientific Research programmes. Planning is expected to take 1 to 2 years and result in a proposal for a Scientific Research Programme or other appropriate mechanism that best fulfils the objectives of the Planning Group.

53 Central administration of all of SCAR activities is carried out by a full-time Secretariat. The SCAR Secretariat is staffed by an Executive Director, an Executive Officer and a part-time Administrative Assistant. The Executive Director helps guide and implement SCAR's vision and objectives; coordinates with the rest of the Executive Committee in the development and implementation of SCAR activities; assists in raising external funds for SCAR's scientific activities; oversees SCAR's communications; represents SCAR at international meetings; and manages the SCAR Secretariat. The Executive Officer and the Administrative Assistant support the Executive Director and take on responsibilities as assigned. The SCAR Secretariat is housed at the Scott Polar Research Institute (SPRI) in Cambridge, UK.

54 Income includes membership fees, external income (from e.g. Foundations or grants) and other general income (e.g. sales or miscellaneous income). Expenditures include scientific activities; scientific advice; capacity building, education and training; routine business meetings; publications; and costs of running the SCAR Secretariat.

55 The Standing Committee on Finance is chaired by a SCAR Vice President. Prior to the Delegates meetings the committee considers all requests for funds and assesses organizational income. With the guidance of the Secretariat, the Committee develops a recommended two-year budget for Delegate approval or revision. The Secretariat and EXCOM jointly review the budgets at least every six months and budgets are revised at

the EXCOM meeting in the years the Delegates do not meet. All budget considerations are based on the principles outlined at the beginning of this section and the over-riding principles are that yearly budgets must be balanced and reserves maintained. Cost savings and budget reductions are the major tool in balancing the organization's budget.

56 In 2008, SCAR income of ~\$1 million USD was derived 50/50 from membership fees and external sources; however, external source funds are often "pass through" or directly associated with additional tasks. SCAR "spendable" funds (~500,000 USD) expenditure were ~42 % for scientific activities, 9% for scientific advice, 6.5% CBET, 4% for meetings, 1.2% for publications and 38% for administrative costs.

57 Examples include: management of the Census of Antarctic Marine Life finances supported by the Sloan Foundation and Memorial University; administration of the Martha T. Muse Prize for Science and Policy in Antarctica supported by the Tinker Foundation; support for continuance of the SCAR Marine Biodiversity Network (SCAR MarBIN) by the Total Foundation, and a travel grant programme for attendance at the IPY Oslo conference supported by the Tinker Foundation as well as various ICSU grants awarded in partnership with other organisations.

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Front cover: Tabular iceberg off Antarctic Peninsula.
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Page 2: A winter trip to the Hinge Zone, Brunt Ice shelf, near Halley Research Station.

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