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POLAR RESEARCH BOARD

ANNUAL REPORT

1987

AND FUTURE PLANS

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Polar Research Board

Commission on Physical Sciences, Mathematics, and Resources

National Research Council

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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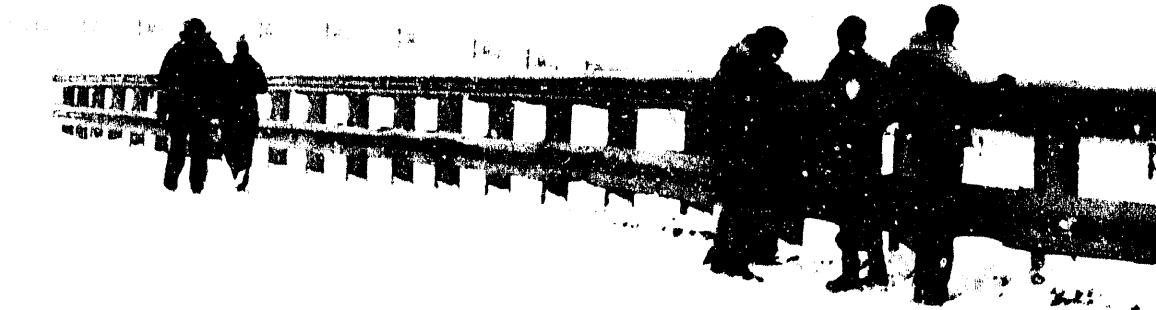
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Board members examining the trans-Alaska pipeline during site visits associated with the Board's 62nd meeting (above); 62nd Board meeting, Geophysical Institute, University of Alaska-Fairbanks (below).

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## PREFACE

This annual report describes the Polar Research Board, its origin and objectives, its work and plans, and its principal activities and accomplishments during calendar year 1987. The Overview presents a concise summary of the various aspects of the Board's program and of its responsibilities as U.S. National Committee for the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions. This section serves as a guide to the more detailed information in the rest of the report.

The second and third sections, "Arctic Activities" and "Antarctic Activities," describe the Board's activities in each region in detail. The fourth and final section outlines the work of the Board's subgroups, including the Board's Strategy studies and the activities of the Board's standing committees.

At the end of the report are lists of those who participated in the work of the Board and its subgroups and of those who represented the United States in the activities of SCAR representing membership during 1987. There are also lists of publications by the Board, reports issued during the past year, and those in preparation.

It is our hope that the report will be a useful resource and will provide a basis for future interaction and cooperation in the effort to maintain a strong and effective U.S. program of polar research. In meeting its responsibilities to the U.S. polar research community and to SCAR, the Board welcomes inquiries and suggestions.

Gunter E. Weller  
Chairman  
Polar Research Board

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## BACKGROUND

In 1958, the National Academy of Sciences established the Committee on Polar Research, subsequently designated the Polar Research Board, in response to a request from the Director of the National Science Foundation for advice on the U.S. Antarctic Program. This action resulted in part from U.S. activities in the Antarctic during the International Geophysical Year (IGY) and from the establishment of the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions (ICSU), as well as from growing recognition of the relevance of scientific and technical activities in both polar regions to national interests.

The Board is a unit of the Commission on Physical Sciences, Mathematics, and Resources (CPSMR) of the National Research Council. The National Research Council serves as an independent advisor to the federal government on scientific and technical questions of national importance. Jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, it brings the resources of the entire scientific community to bear on national problems through its volunteer advisory committees. The CPSMR is broadly concerned with ensuring the health and progress of the physical and chemical sciences; the sciences of the atmosphere, the oceans, and the earth and its resources; the space and planetary sciences; and mathematics, including computer science and statistics. In every case, the range of its concerns is from basic science and research through applications and implications for national policy.

Since its establishment, the Polar Research Board has monitored the status and needs of polar sciences and has assisted U.S. government agencies in the development and maintenance of strong programs of polar research responsive to scientific opportunities and national interests in the Arctic and Antarctic. As U.S. National Committee for SCAR of ICSU, the Board ensures participation of the U.S. polar research community in the meetings and planning activities of this organization and encourages international cooperation in research endeavors recommended by SCAR.

The Board meets semiannually--each spring and fall--to review its program, develop U.S. positions on matters to come before SCAR, and provide a forum for the presentation and discussion of information about federal agency programs in the Arctic and Antarctic and about the activities of other non-federal organizations, such as the Arctic Ocean Sciences Board. Interaction at Board meetings often reveals questions or needs that become the focus for new Polar Research Board studies--either as part of the ongoing Polar Research--A Strategy series, in which various fields of polar research are examined and recommendations are made on future directions, or as specific responses to federal agency requests for advice on some aspect of a program.

The Board is a multidisciplinary body with representation from marine and terrestrial biology, earth sciences, meteorology, oceanography, space physics, atmospheric chemistry, engineering, medicine, physical sciences, and social sciences. Members of the Board and its study committees are drawn from the highest quality talent and expertise in academic institutions, industry, and national laboratories. Federal agencies with programs in the Arctic and/or the Antarctic have liaison representation on the Board. In addition, the Board always has one member representing Canadian research activities. It tries to balance its membership between those with Arctic and Antarctic experience and expertise, and to ensure long-term balance in its program.

Board members are appointed for four-year terms, with appointments staggered so that approximately one fourth of the membership is replaced each year. Appointments are made on the basis of individual professional qualifications. Members of the Board and its study committees serve without pay. Approximately 100 distinguished scientists and engineers serve on the Board and/or its subgroups. Currently, Gunter E. Weller, Geophysical Institute, University of Alaska, is Board Chairman.

The Board conducts much of its work through committees; two of these, the Committee on Glaciology and the Committee on Permafrost, are maintained as standing groups because there is no other national advisory or National Research Council group concerned primarily with these disciplines. Other committees, working groups, and panels are established to conduct specific studies and are discharged on completion of their work and publication of their reports. The Board's structure in 1987 appears in Figure 1. Appendix A presents listings of the membership of the Polar Research Board and its subgroups during 1987.

In 1980 the Board began the Polar Research--A Strategy studies to guide the evolution of polar research over the next decade or so. To date, seven studies in the series have been published, and four others are in progress.

The Board welcomes questions and suggestions about its program and plans, and it will provide more detailed information on any aspect of its work to those requesting it.



FIGURE 1. STRUCTURE OF THE POLAR RESEARCH BOARD IN 1987

## OVERVIEW

During 1987, the Polar Research Board (PRB) continued the high level of productivity that has characterized its activities for more than a decade. The Board and its subgroups have initiated several new studies, and have written reports summarizing findings from completed projects. Nearing publication are reports about (1) polar biomedical research, (2) Arctic marine sciences, (3) physical and chemical oceanography of the Southern Ocean, (4) Arctic solid-earth geosciences, and (5) remote sensing of snow and ice.

In addition, Board members have continued to publish major articles resulting from the Board's work, summarizing polar science issues. "Laboratory Antarctica: Research Contributions to Global Problems," was published in the December 4, 1987, issue of Science.

The Board continued its efforts in the planning for a new international framework for cooperative research on the geosphere and biosphere, with an emphasis on the role of polar processes in the global picture.

At its spring 1987 meeting, the Board sponsored a federal agency liaison session on March 9th. This session gave federal agency representatives ample time to outline their concerns thoroughly and to identify areas in which the Board might be of assistance.

The Board sponsored several special sessions on Arctic topics at its fall 1987 meeting, which was held in Alaska. Board members attended site visits at Barrow and Prudhoe Bay. At the Board meeting held September 21-23 in Fairbanks, the Board organized a forum with members of the scientific community, academic officials, and federal agency representatives to discuss the possible formation of a polar consortium. Such a consortium is now being established under the direction of Louis Proenza, Norbert Untersteiner, and Mark Meier. The Board also organized a session devoted to a preliminary in-depth examination of issues arising from plans to open the Arctic National Wildlife Refuge to petroleum development. The Board will continue to examine timely matters of concern to federal agencies and the scientific community by hosting forums at its Board meetings, and will monitor consortium plans and activities.

The Board and its subgroups scheduled additional meetings in 1987 in connection with their own projects, and also took part in 10 meetings of other organizations concerned with polar research issues. (These meetings are listed in Appendix B.)

In 1987, six agencies joined to provide support for the Board's continuing program. Supporting agencies were the National Science Foundation, the Department of Energy, the Office of Naval Research, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the Department of Transportation. The Board receives supplementary support for specific studies that agencies request; for example, the study on polar biomedical research is funded by the Department of the Army. The overall budget for the Board and its subgroups in 1987 was \$450,000.

#### POLAR RESEARCH BOARD PROGRAM

The Board will provide guidance to federal agencies in the development and implementation of national initiatives in geosciences and coordination with the global change program of the International Council of Scientific Unions (ICSU), and will act as liaison between the Academy's Panel for IGBP and federal agencies to assure that the importance of research in the polar regions on climatic and other global environmental processes receives proper attention as the program evolves. Many elements of recent publications of the Board present a multidisciplinary approach to polar research, i.e., Research Emphasis for the U.S. Antarctic Program (1983), U.S. Research in Antarctica in 2000 A.D. and Beyond (1986), and National Issues and Research Priorities for the Arctic (1985). The Board ensures that polar processes and programs are integrated into global initiatives under consideration by other NRC activities in the oceans, earth, and atmospheric sciences. The preparation of a bi-polar research plan was requested by the National Science Foundation at the Board's September 1987 meeting. The Board plans to finish a document focusing on national research priorities in Antarctica in 1988.

During 1988, in response to suggestions from its principal sponsoring federal agencies, the Board will review major polar research and scientific issues and provide advice and recommendations to each agency. A special session of the spring 1988 Board meeting will be dedicated to discussions of agency topics so that the entire membership of the Board will be able to consider the important issues facing the federal agencies with polar programs.

The Board will review the U.S. capability to support research in polar regions. Many of the research problems in the polar regions have been identified by earlier National Research Council reports. However, the capability of the nation to respond to these research requirements has not been assessed. Existing infrastructure and logistic systems will be examined in terms of support proposed and future research

emphasis for the U.S. polar research effort. This will occur in the context of writing Strategy reports. For example, an ad hoc working group is currently evaluating the upper atmospheric physics community's future Antarctic logistics needs. This group, in response to a request from the National Science Foundation, is formulating a 10-year implementation strategy for upper atmospheric physics research priorities, taking into account programs planned for stations across Antarctica, prospective satellite launch dates, and yearly logistics requirements of the established and prospective programs. The implementation strategy will be based upon the scientific strategies for the disciplines as developed earlier by the Board.

Working with the U.S. Coast Guard, the Board has completed its investigation of the polar research community's views of the configuration and specifications of the proposed new generation of polar-class icebreakers, and its study of the unique disciplines, programs, equipment, and support requirements necessary for improving the science currently being conducted on U.S. Coast Guard ships and for the successful completion of future oceanographic research in the polar regions. The results of these investigations will be summarized in the emerging reports, Quality of Science Support on Existing U.S. Coast Guard Icebreakers: Report of a Survey, and Evaluation of the U.S. Coast Guard's Preliminary Design Document for the Proposed Next Generation of Polar Class Icebreakers. In July 1987, members of the Board provided testimony on these topics at hearings conducted by the Subcommittee on Coast Guard and Navigation of the U.S. House of Representatives.

Over the next year, the Board will continue its evaluation of the disciplines, programs, equipment, and support requirements necessary to maximize the scientific research potential of existing U.S. Coast Guard vessels. In addition, the Board will meet with representatives from the scientific community and federal agencies to formulate recommendations for ship use needs beyond 1990.

The Committee on Glaciology continues to provide advice on the polar ice coring capabilities of the United States and to provide recommendations on the role of snow and ice in global geoscience programs. It will also review the scientific objectives of the Alaskan Synthetic Aperture Radar (SAR) facility, and other high-latitude remote sensing missions to assess operations and future needs.

The ad hoc Panel on the Remote Sensing of Snow and Ice, a working group of the Committee on Glaciology, has prepared a report, "Prospects and Concerns for Satellite Remote Sensing of Snow and Ice," summarizing the applications of the remote sensing of snow and ice, discussing the variety of existing remote sensing systems, and identifying future needs to improve the quality and extent of snow and ice remote sensing.

The Committee on Permafrost will continue to provide scientific and engineering advice on permafrost topics, to improve communication and dissemination of permafrost data among scientists and agencies, and to

promote continued communication with foreign permafrost experts through exchanges and formal working relationships. Over the next year, Committee members are planning a conference on climatic change and permafrost.

The first meeting of the Committee on Arctic Solid-Earth Geosciences was held in February 1987. Following the Committee's evaluation of geophysical research needs on the Arctic Ocean Basin and its perimeter, a delegation of this Committee traveled to the Soviet Union in November 1987 to develop research recommendations with Soviet scientists. The Committee has suggested that members of the Soviet Academy review its final report, and has invited two members of the Soviet Arctic earth sciences community to attend the Committee's final meeting to provide further insights into research needs in the entire circum-arctic region. The Committee's final report will be published in 1988, as an element of the Board's Strategy series.

The ad hoc Committee on Arctic Marine Sciences has completed its Strategy series study on "Priorities in Arctic Marine Science." The study focuses on research needs of the Arctic Ocean Basin and comparative ecosystem studies on high-latitude shelves and ice edges. The Committee also surveyed the needs of the scientific and engineering community for an ice-capable research vessel. The report will be published in 1988.

The Board's ad hoc Committee on Antarctic Physical and Chemical Oceanography is completing the final draft of its Strategy series report, "Physical and Chemical Oceanography of the Southern Ocean," and anticipates publication in early 1988.

The Board's Committee on Polar Biomedical Research produced an appendix to its 1982 report, Polar Biomedical Research: An Assessment, in response to a request from the sponsoring agency, the Department of the Army. This appendix focuses on ways to improve polar biomedical curricula and methods to facilitate access to and use of polar biomedical data. Publication is expected in 1988.

In 1987, Board representatives attended a NASA/NSF-sponsored workshop entitled "The Human Experience in the Antarctic: Applications to Life in Space," and they are currently involved through the SCAR Working Group on Human Biology with an international project that would use Antarctica as an analogue for living in space, to be conducted as a collaborative effort at bases of SCAR member countries. The Board is developing a proposal to undertake a study building on the results of the workshop. This polar and space life sciences study is anticipated to focus on collaborative research projects in the areas of behavioral biology, group dynamics, and human adaptation to isolated stations in polar and space environments.

The Board will continue to encourage and assist the Arctic Ocean Science Board, the Comite Arctique International, and other

international groups in their effort to improve the exchange of information and cooperation among countries engaged in Arctic research. In addition, the Board will identify those areas of research that would benefit from international cooperation.

#### SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR) ACTIVITIES

The Polar Research Board, in its role as U.S. National Committee for SCAR, organized and hosted the XIXth Meeting of SCAR in San Diego, California, June 9-27, 1986. The meeting was attended by about 250 members of the international Antarctic scientific community, representing 25 nations. In addition to delegates' meetings and plenary sessions, eight Working Groups and Groups of Specialists met in the first two weeks of the meeting. These were the SCAR Working Groups on Biology, Geology, Solid Earth Geophysics, Logistics, and Upper Atmosphere Physics; Subcommittees on Conservation and Bird Biology, and the Group of Specialists on Seals. Other meetings held in San Diego included Workshops on Crustal Structure, Cenozoic Geology, and Geomagnetic Conjugate Studies; SCAR Plenary Meeting; several SCAR delegate meetings; several special ad hoc groups; and a meeting of the Finance Committee.

Conducting this significant international meeting is but one example of the active role that the Board plays in the international Antarctic community. The Board ensured that reports from this meeting were made available to interested federal agencies and members of the scientific community.

The Board continues to ensure participation of U.S. scientists in meetings and planning sessions of SCAR Working Groups and Groups of Specialists. The presence of James H. Zumberge, member of the SCAR Executive as past president of SCAR, as well as the rotation system established by the Board for its representatives on SCAR Working Groups, has permitted the United States to maintain its leadership role within SCAR. Under the leadership of Dr. Robert H. Rutherford, the new U.S. Delegate to SCAR, this position of strength will be maintained.

The Board over the next year will examine a series of policy and management options that will be recommended to SCAR to strengthen SCAR's proficiency in dealing with its ever-expanding workload and membership. Since 1978 the number of national bodies adhering to SCAR has increased from 12 to 25 while at the same time SCAR has been increasingly called upon for advice from the Antarctic Treaty System and other international organizations.

The SCAR Executive met in July 1987, at which time the Board presented a series of recommendations to increase the effectiveness and visibility of SCAR. One outcome of the SCAR Executive meeting was a proposal to develop a SCAR document assessing science research opportunities in Antarctica.

In preparation for the March 1988 SCAR Executive meeting, the Board transmitted a letter to the president of SCAR, suggesting strengthening the scientific leadership of SCAR. In this letter, sent in November 1987, the Board noted the establishment of the new ICSU International Geosphere-Biosphere Program, stating that the establishment of this new ICSU body provides SCAR with a unique opportunity to make a compelling statement of the importance of Antarctic science to global studies. The Board will continue to work with the past president of SCAR, James H. Zumberge, to develop U.S. suggestions for the direction such a study should take. The results of the March 1988 SCAR Executive meeting will be presented to the Board at its spring 1988 meeting.

The Board received briefings on other Antarctic activities pertaining to the Antarctic Treaty, implementation of the Convention on Conservation of Antarctic Marine Living Resources, and efforts to develop a regime governing possible mineral resource exploration and exploitation in Antarctica. Briefings were presented by federal agency representatives who participated in these deliberations. The Board's report, The Antarctic Treaty System: An Assessment, examined these issues in detail.

SCAR continues to look for U.S. leadership on complex issues relating to resource and conservation issues. U.S. scientist Sayed El-Sayed is convener of the SCAR BIOMASS Executive Committee Group of Specialists. The Antarctic Ecosystems Group is conducting a series of workshops to analyze and digest data from the BIOMASS Experiments as well as furthering plans for archiving and distributing BIOMASS data under the new Convention on Conservation of Antarctic Marine Living Resources.

The Board supports the U.S. members of the SCAR Working Group on Biology in the development of a conceptual framework for alternative types of protected areas in the Antarctic, the assessment of information and scientific data management for conservation, and the review of waste disposal techniques in Antarctica.

The Board continues its efforts to foster and promote Antarctic conservation by participating in the development of the book of Conservation Areas in the Antarctic, prepared by the SCAR Subcommittee on Conservation.

The Board assembled the data for, published, and distributed the following catalogue of Antarctic research activities:

Report on United States Antarctic Research Activities, February 1986-October 1987; United States Antarctic Research Activities Planned for October 1987-September 1988.  
Report No. 29 to Scientific Committee on Antarctic Research (SCAR).

In addition, the Board continues to

- o Encourage the support of SCAR through annual payments of dues consistent with the amounts agreed on at SCAR XIX.
- o Advise, through SCAR, on development of the international program for climate research in Antarctica.
- o Advise, through SCAR, the Antarctic Treaty nations on the possible impacts of mineral resource exploration and exploitation in Antarctica.
- o Advise, through SCAR, the Antarctic Treaty nations on man's impact on the Antarctic environment.
- o Advise, through SCAR, on the development of an international program of Antarctic sea ice research.
- o Advise, through SCAR, on recommendations for Antarctic waste disposal.

## ARCTIC ACTIVITIES

### GENERAL

Polar Research Board meetings provide occasions for reporting on Arctic as well as Antarctic activities conducted by federal agencies and other organizations. Thus, the Board helps to foster awareness of the nature and emphases of polar research programs.

Over the past few years, the Board has been particularly interested in the evolution of legislation related to Arctic research that has led to the development of the U.S. Arctic Research Plan. The signing into law of the Arctic Research and Policy Act by the President in 1984 and the Presidential Executive Order on Arctic Research provide a policy framework for the formation of a coherent U.S. Arctic Research Policy. The Board's 1982 report A United States Commitment to Arctic Research reviews the unique aspects of conducting Arctic research.

### COMPONENTS OF A FEDERAL FIVE-YEAR ARCTIC RESEARCH PLAN

In 1984 and 1985, at the request of the National Science Foundation (lead agency for implementing the Arctic Research and Policy Act), the Polar Research Board assisted in the development of the components of the Arctic Research Plan. As part of this activity, the Board completed National Issues and Research Priorities in the Arctic in July 1985.

The Board continued to closely watch the evolution of the five-year plan in 1986, and at its October 1986 meeting, the Board critically evaluated Federal Arctic Research, Draft Recommendations for Necessary Programs, the major published component of the Interagency Arctic Research Policy Committee (IARPC) Federal Five-Year Research Plan. A letter addressing the major deficiencies that the Board identified in the Federal five-year plan was sent in November 1986 to Erich Bloch, director of the National Science Foundation, and chairman of the Federal Interagency Arctic Research Policy Committee.

As a follow-up to its October 1986 evaluation of the U.S. Arctic Research Plan, the Board will closely follow the activities of the Interagency Arctic Research Policy Committee as it addresses implementation of the recommendations outlined in the Plan. The Board will also advise participating agencies on the content of the 1989 revision of the U.S. Arctic Research Plan, and will host agency presentations at future Board meetings regarding the Plan and related activities, to foster continued communication among agency, industry, and university scientists regarding U.S. Arctic research policy.

#### 62ND POLAR RESEARCH BOARD MEETING, FAIRBANKS, ALASKA

The Board organized several sessions concerning the Arctic at its 62nd meeting, held in Fairbanks, Alaska. Board members participated in a series of pre-meeting field trips to Barrow and Prudhoe Bay, and along the Dalton and Elliot Highways between Prudhoe Bay and Fairbanks.

In Barrow, Board members visited the NOAA Geophysical Monitoring for Climate Change Laboratory, the Barrow Utilidor System, and new town facilities, and met extensively with administrators and scientific researchers at the UIC/NARL research facility. In addition, Board members met with the Mayor of the North Slope Borough to discuss the community's interest in future scientific research endeavors in Alaska.

The Board traveled to Prudhoe Bay to observe thoroughly modern industrial developments in the Arctic, examining on-shore and off-shore oil drilling technologies including the Prudhoe Bay, Kuparuk, and Endicott oil field production sites. The Board members met with oil company environmental representatives to discuss the impact of recent Prudhoe Bay activities on the area's ecosystem. Board members examined the trans-Alaska pipeline, permafrost-related land forms, and vegetation along the Dalton and Elliot Highways from Prudhoe Bay to Fairbanks.

At the Board meeting, held September 21-23 in Fairbanks, special sessions were devoted to the discussion of the development of a polar research consortium, and an examination of issues arising from plans to open the Arctic National Wildlife Refuge to petroleum development. The Board will continue to examine matters of concern to federal agencies and the scientific community in a timely manner.

#### INTERNATIONAL ARCTIC RESEARCH ACTIVITIES

No organization comparable with SCAR exists for Arctic research activities. However, in 1983 Board members were involved in the formation of an international Arctic Ocean Sciences Board (AOSB). This Board advises concerned agencies and reviews scientific plans for cooperative research programs to study phenomena related to understanding the role of the Arctic Ocean and associated oceanic

regions in climate, including the Air-Sea-Ice Interaction program and its subunits such as the Marginal Ice Zone Experiment (MIZEX). Former Board member Richard Goody serves on this international activity.

A delegation of the Board's ad hoc Committee on Arctic Solid-Earth Geosciences traveled to the Soviet Union in November 1987 to discuss research recommendations with the Soviet Academy of Sciences' Institutes of Oceanology and Geography. The Board may be involved with the development of a continued exchange program with the Soviets on Arctic geoscience topics. Further consideration of such an exchange program will take place through discussions with interested federal agencies in coordination with the National Academy of Sciences Foreign Secretary.

The Panel on Polar Oceans Climate Studies, a joint activity of the Ocean Studies Board and the Polar Research Board, reviewed and advised on the International Marginal Ice Zone Experiment and served as the National Academy of Sciences liaison to the international Arctic Ocean Sciences Board. This panel has completed its charge and was disbanded in October 1987.



During site visits associated with the Board's 62nd meeting, Board members met with George N. Ahmaogak, Sr., Mayor, North Slope Borough, and Nathaniel Olemaun, Jr., Mayor, City of Barrow, to discuss the communities' interests in future scientific activities in the U.S. Arctic.

The Comite Arctique International of the Centre Scientifique de Monaco seeks to improve the exchange of information about Arctic research activities and sponsor international symposia for the presentation of Arctic research findings. Members of the Board participate in its activities.

The Board will continue to encourage and assist international Arctic groups in their effort to improve the exchange of information and cooperation among countries engaged in Arctic research. Of significance are recommendations from meetings of Arctic-rim scientists, held during the SCAR meeting in San Diego, 1986, and in Oslo, 1987, to establish a nongovernmental "International Arctic Science Committee." Additionally, General Secretary Gorbachev, in a speech delivered in Murmansk October 2, 1987, suggested holding "a conference of sub-arctic states on the coordination of scientific research . . . in 1988." The Board will identify promising areas of research that would benefit from international collaboration in the Arctic.

## ANTARCTIC ACTIVITIES

### SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

The National Academy of Sciences is the U.S. organization adhering to the International Council of Scientific Unions (ICSU). In addition to its Unions and Commissions, ICSU has scientific committees, one of which is the Scientific Committee on Antarctic Research (SCAR).

U.S. delegates to SCAR are Robert H. Rutford and the former Polar Research Board chairman, Charles R. Bentley. Figure 2 depicts the U.S. relationship to and representation in SCAR.

SCAR's principal purpose is to foster international cooperation in and coordination of Antarctic research. Its eight standing Working Groups and seven Groups of Specialists carry out much of its work in support of this objective. It also issues a number of publications and sponsors symposia and conferences. Figure 3 presents the SCAR organization and program and the interrelationships among SCAR subgroups.

Although there is no official connection between SCAR and the Antarctic Treaty nations, there is almost a one-to-one correspondence between members of SCAR and the treaty consultative nations. In recent years a number of nontreaty nations have become interested in Antarctic research, and several of these had been accorded Observer status by SCAR. In addition, seven countries have taken advantage of the new Associate membership category established by SCAR in 1986. These countries are Italy, The Netherlands, Spain, Sweden, Switzerland, Peru, and Uruguay. The admission of the People's Republic of China to SCAR at the SCAR XIX meeting increased the number of SCAR member nations to 25.

Since its establishment in 1958, SCAR has served as an unofficial advisory body to the treaty nations in matters of science and technology. During the past few years, SCAR has been increasingly called on to provide information about Antarctic living resources, ecosystems, and related environmental issues.

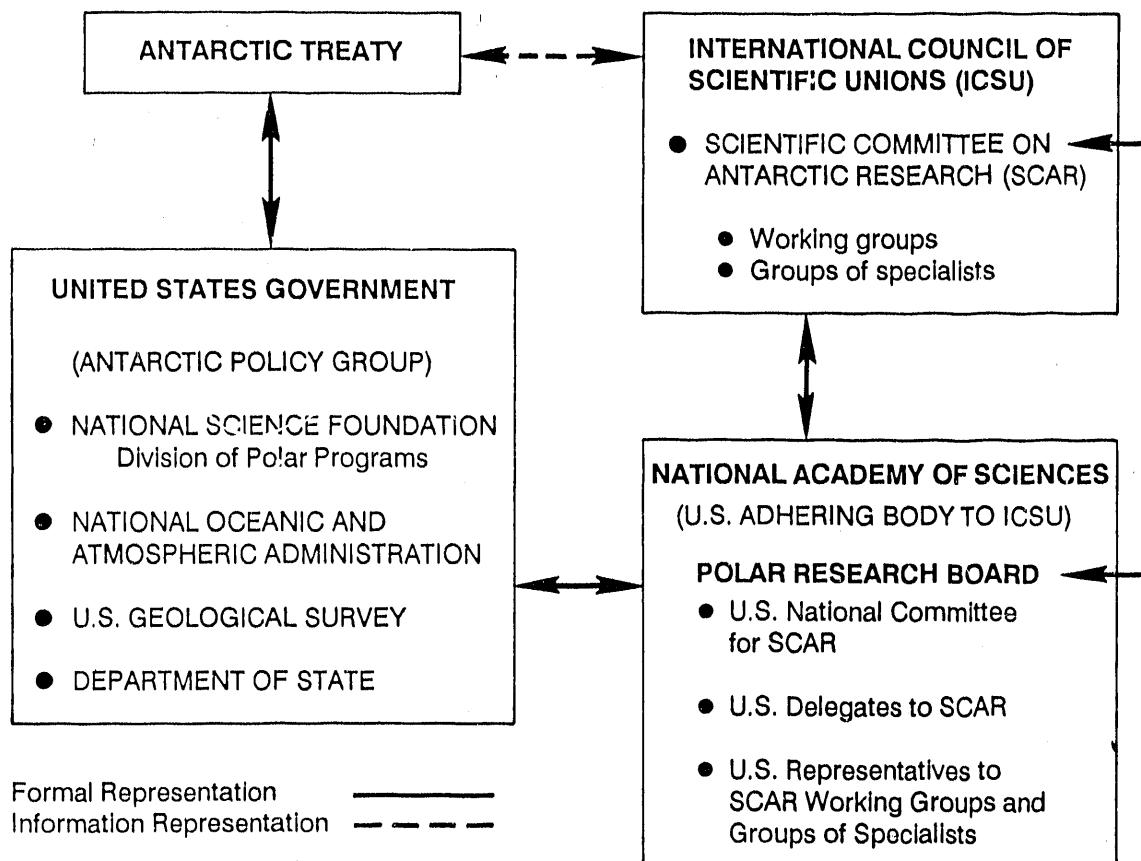


FIGURE 2. U.S. REPRESENTATION IN SCAR

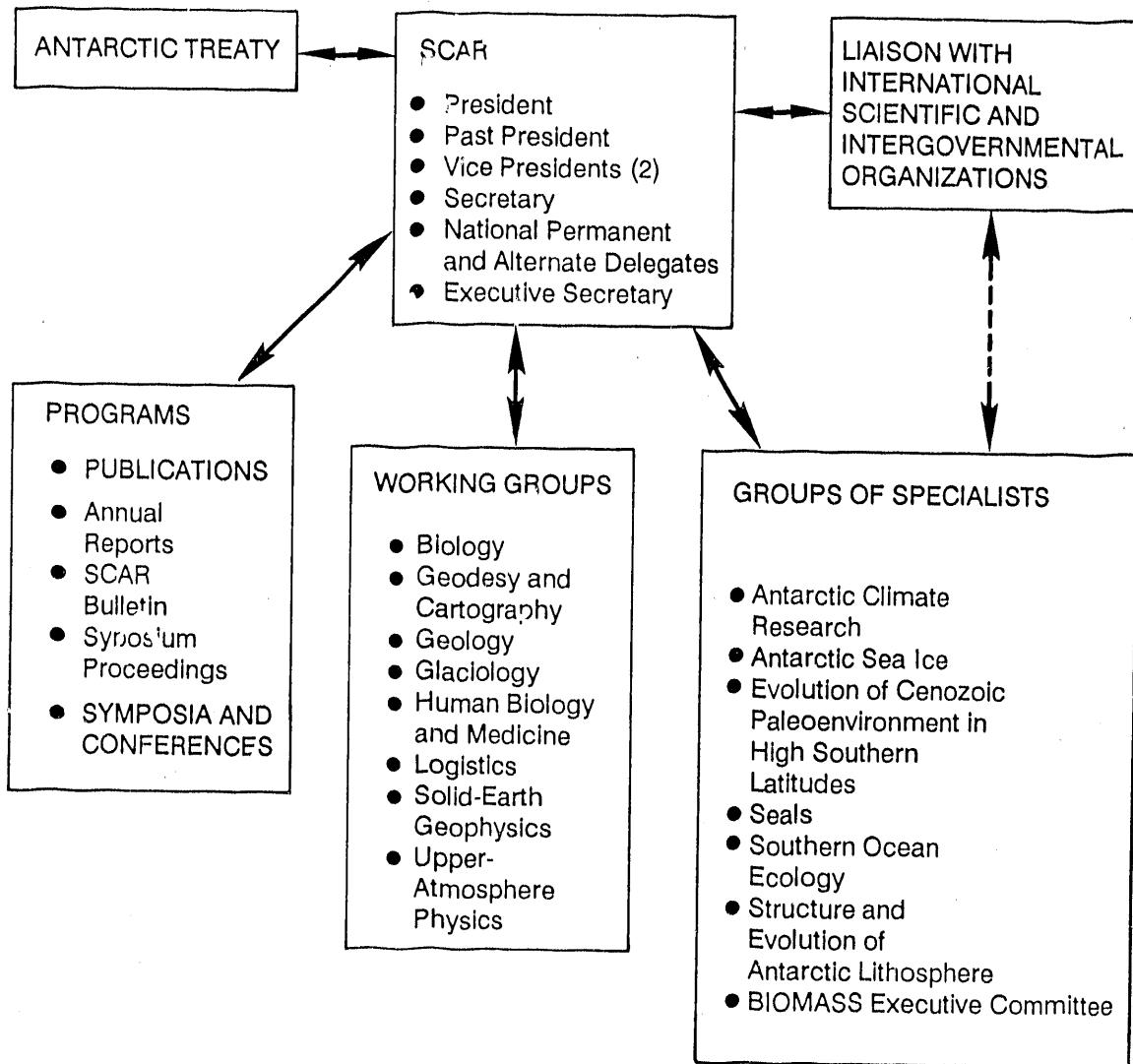


FIGURE 3. SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR):  
ORGANIZATION AND INTERRELATIONSHIPS

U.S. scientists have been selected to lead the activities of several SCAR Groups of Specialists. As the result of actions at SCAR XIX, U.S. scientists now serve as conveners of two new Groups of Specialists. Peter N. Webb is convener of a new group of geologists and paleontologists interested in the evolution of Cenozoic Paleoenvironments of Southern High Latitudes, while Ian Dalziel convenes a group of structural geologists and geophysicists on the Structure and Evolution of the Antarctic Lithosphere.

Sayed Z. El-Sayed, of Texas A & M University, is convener of the BIOMASS Executive; Donald B. Siniff, University of Minnesota, is a member of this group, as well as deputy convener of the Group of Specialists on Seals. H. J. Zwally, National Aeronautics and Space Administration, serves on the Group of Specialists on Antarctic Climate Research. Arnold Cordon, Columbia University, and Norbert Untersteiner, University of Washington, are members of the Group of Specialists on Antarctic Sea Ice. Board member Roger G. Barry has recently been appointed SCAR representative to the ICSU Panel on World Data Centers.

William S. Benninghoff, University of Michigan, focused attention on protection of the environment by preparing the SCAR report Man's Impact on the Antarctic Environment: A Procedure for Evaluating Impacts from Scientific and Logistic Activities. He now serves on the Working Group on Biology's Subcommittee on Conservation, and on the joint IUCN-SCAR Commission on Antarctic Conservation. In addition, he heads a SCAR group examining management of Antarctic scientific information applicable to environmental decision making.

The Board will continue to ensure full and active participation of U.S. scientists in meetings and planning sessions of SCAR, including Working Group and Groups of Specialist activities. In 1987, U.S. Working Group and Groups of Specialists representatives and conveners and other SCAR representatives participated in more than a dozen SCAR meetings.

In 1988, most SCAR meetings will take place in conjunction with XX SCAR, which will be held September 5-16, 1988, in Hobart, Tasmania, Australia. The first week of XX SCAR will be devoted to meetings of the following SCAR Working Groups:

Biology  
Geology  
Logistics  
Upper Atmosphere Physics

Geodesy and Cartography  
Human Biology and Medicine  
Solid Earth Geophysics

During the second week, meetings of the SCAR delegates, and the SCAR Finance Committee are scheduled. Associated activities include the Fifth Symposium on Antarctic Biology, a Colloquium of Antarctic Human Biology and Medicine, meetings of SCAR Subcommittees on Conservation and Bird Biology, and the meeting of the Managers of National Antarctic

Programs. A full report and documents distributed during these meetings will be transmitted to interested federal agencies and members of the scientific community.

The SCAR Executive met in July of 1987. Prior to the meeting, the Board developed a series of U.S. recommendations to increase the visibility of SCAR. Because of the growing interest now being demonstrated in Antarctic scientific research, and the increasing need for Antarctic science to contribute to the solution of global-scale problems, the Board has decided that it may be timely for SCAR to undertake a comprehensive review of Antarctic science trends and requirements, and to determine a future SCAR strategy. One outcome of the Executive meeting was a proposal to develop a SCAR document assessing science research opportunities in Antarctica.

In preparation for the next SCAR Executive meeting, the Board continues to work with the past president of SCAR and member of the SCAR Executive, James H. Zumberge, to develop U.S. recommendations. In a November 1987 letter to the president of SCAR, the Board suggested strengthening the scientific leadership of SCAR, citing the endorsement of ICSU's new "International Geosphere-Biosphere Program: A Study of Global Change." The Board stated that the formation of this new ICSU body provides SCAR with a unique opportunity to make a compelling statement of the importance of Antarctic science to global studies. The Board recommended that the upcoming meeting of SCAR XX in Hobart, Tasmania, Australia, September 1988, be devoted to a discussion of future research needs in Antarctica. A special meeting of the SCAR Executive will be convened in March 1988 to address this proposal. The Board will devote a large portion of its activities in 1988 to this effort, and plans to finish a document focusing on national research priorities in Antarctica by fall 1988.

At its next meeting, the Board will also examine a series of policy and management options for SCAR to strengthen the effectiveness of SCAR in dealing with its ever expanding workload and membership. Some options to be discussed with appropriate federal agency personnel in order to arrive at a U.S. National Committee positions may include the following:

- o streamlining the deliberations of the SCAR Delegates meeting;
- o establishing a steering committee of chairmen of working groups and groups of specialists to provide advice and direction on the many new multidisciplinary research programs being undertaken or considered;
- o devising a mechanism to bring managers of national Antarctic programs more fully into the work of SCAR; and
- o preparing short brochures or reports highlighting present multinational research efforts that address worldwide concerns

such as ozone depletion, conservation practices, and mineral and living resource exploration and exploitation.

These suggestions and other ideas solicited from federal agency representatives will be discussed at the spring Board meeting as the Board develops the U.S. positions on matters to come before XX SCAR in September 1988.

The Board continues to support the U.S. members of the Working Group on Biology in developing a conceptual framework for alternative types of protected areas in the Antarctic, the assessment of information and scientific data management for conservation, and the review of waste disposal techniques. Over the next year, the Board will continue to take the lead on conservation issues and provide advice through SCAR to the Antarctic Treaty System and other international organizations.

In 1988, the Board will assemble the data for, publish, and distribute the annual catalogue of U.S. research activities in Antarctica as called for by SCAR: "Report on United States Research Activities, February 1987-October 1988; United States Antarctic Research Activities Planned for October 1988-September 1989, Report 30 to the Scientific Committee on Antarctic Research." In addition, the Board will ensure that federal agencies and interested members of the research community receive copies of the SCAR Circulars and Bulletins, the SCAR Report Series, and all related Working Group and Group of Specialists publications.

#### U.S. RESEARCH IN ANTARCTICA IN THE YEAR 2000 AND BEYOND

In 1985, the director of the Division of Polar Programs, National Science Foundation (NSF), requested that the Polar Research Board undertake a multidisciplinary analysis of future Antarctic scientific needs, and a thorough review of past accomplishments in U.S. Antarctic science. In response to this request, the Polar Research Board prepared the report, U.S. Research in Antarctica in 2000 A.D. and Beyond: A Preliminary Assessment, and arranged for material to be included in the June 1986 summary issue of the Antarctic Journal of the United States entitled "Advances in Antarctic Geophysical Sciences from the IGY to the Present."

The special 1986 issue of the Antarctic Journal of the United States contained summaries of five post-IGY disciplines by members of the Board and its committees. The presentations were (1) upper atmosphere studies by Louis Lanzerotti, (2) meteorology studies by Gunter Weller, (3) physical oceanography studies by Arnold Gordon, (4) earth sciences studies by David Elliot, and (5) glaciology studies by Charles Bentley (with R. L. Cameron).

The study U.S. Research in Antarctica in 2000 A.D. and Beyond: A Preliminary Assessment builds on the Board's 1983 report Research

Emphases for the U.S. Antarctic Program and develops ideas for a long-range science plan for the United States in Antarctica for the year 2000 and beyond. The report defines the ground rules that frame our national context for Antarctic research and then presents a listing of research objectives that should be met in an optimal U.S. science program. The report also presents a summary of logistics needed to ensure a successful long-range U.S. program.

The director of the National Science Foundation, Erich Bloch, in a letter to Frank Press, president, National Academy of Sciences, September 1986, commended the Board for the usefulness of the report to the NSF planning.

As a follow-up to its recent reports outlining Antarctic scientific research needs, the Board published a multiauthored article entitled "Laboratory Antarctica: Research Contributions to Global Problems," which was published December 4, 1987, in Science. This article discusses the importance of Antarctic research to interdisciplinary studies of the earth's geosphere-biosphere systems, highlighting the special significance of this research to studies concerned with long-term or large-scale changes in global systems.

#### ANTARCTIC CONSERVATION MATTERS

The Board focused much of its attention in 1987 on proposing an additional category of protected areas and on increasing the number of protected areas in the Antarctic. A SCAR ad hoc group on Additional Protective Arrangements met in June 1987 and has proposed that a category, which might be known as an Antarctic Protected Area, be established. The SCAR Executive has discussed this proposal, and agreed that following certain minor amendments, the report should be sent to national committees for review.

The SCAR ad hoc group on Environmental Data Management, chaired by W. S. Benninghoff of the United States, has submitted preliminary notes to the SCAR Executive discussing the kinds of Antarctic biological data bases that are currently available and mapping out the tasks this group will consider.

The SCAR Executive has decided to establish a new multidisciplinary Group of Specialists on Antarctic Environmental Affairs and Conservation, which will deal promptly and authoritatively with the growing number of matters of environmental concern. Originally, matters pertaining to conservation and environment have been the responsibility of the Working Group on Biology. Recently, environmental issues of great importance have required the attention of scientists in other disciplines, and logistics experts. The SCAR Executive will examine draft terms of reference and potential membership at its meeting in March 1988. Many of these gains in Antarctic Conservation have been accomplished in response to the

continued efforts of U.S. representatives to SCAR, in close coordination with the Polar Research Board. The Board will continue to ensure that matters of environmental concern are appropriately addressed through SCAR Working Groups and meetings.

ANNUAL CATALOGS OF ANTARCTIC RESEARCH

Each year since 1968, the Polar Research Board has published two catalogs on Antarctic research, one summarizing earth science investigations, and the other, U.S. Antarctic research activities. In 1986, after consultation with NSF, the Board decided not to compile and publish the summary of earth science investigations.

The Board prepared and distributed Report No. 29 to SCAR, Report on United States Antarctic Research Activities, February 1986-October 1987; United States Antarctic Research Activities Planned for October 1987-September 1988, which describes U.S. Antarctic research projects in all relevant disciplines and indicates their locations, principal investigators, and sources of data and additional information about the research activities.

## POLAR RESEARCH--A STRATEGY

In 1980, ten years after its publication of Polar Research--A Survey, the Polar Research Board began a series of studies dealing with various fields of polar research. The objectives were to evaluate progress since the last survey, to consider current needs and promising opportunities, and to recommend research directions and priorities to guide the evolution of polar research over the next decade or so. Seven studies in the series had been issued by the end of 1986:

An Evaluation of Antarctic Marine Ecosystem Research, 1981

Study of the Upper Atmosphere and Near-Earth Space in Polar Regions: Scientific Status and Recommendations, 1982

Polar Biomedical Research: An Assessment, and the appendix to this report, Polar Medicine--A Literature Review, 1982

Snow and Ice Research: An Assessment, 1983

Permafrost Research: An Assessment of Future Needs, 1983

The Polar Regions and Climatic Change, and its appendix, 1984

Antarctic Solid-Earth Sciences Research: A Guide for the Next Decade and Beyond, 1986

At the end of 1987, four other studies in the series were at various stages ranging from early planning to completion of the final draft. Publication of the next Strategy series volumes, "Priorities in Arctic Marine Science" and "Physical Oceanography and Tracer Chemistry of the Southern Ocean," is expected in early 1988. "Arctic Solid-Earth Geosciences," and "An Assessment of Arctic Social Sciences" are to be completed by late 1988.

## STUDIES ACTIVE IN 1987

### Antarctic Physical and Chemical Oceanography

The ad hoc Committee on Antarctic Physical and Chemical Oceanography selected five research themes for its report: water-mass conversion, dynamics and thermodynamics of the Antarctic Circumpolar Current, coupling of the Southern Ocean with the world oceans, air-sea-ice interaction, and large-scale modeling. This report evaluates progress made during the last decade in physical and chemical oceanography of the Southern Ocean, identifies fundamental research questions and new needs (including facilities and instrumentation, education, and manpower), and develops a strategy and priorities to upgrade the evolution of Antarctic physical and chemical oceanography over the next decade. Support for this study is provided by grants from the Andrew W. Mellon Foundation, the Department of Energy, and the National Science Foundation. The report will be published in early 1988.

### Arctic Marine Sciences

The study by the ad hoc Committee on Arctic Marine Sciences focuses on two aspects of Arctic marine sciences that are not the subjects of other study efforts and that are especially in need of research: studies on the circulation of the Arctic Ocean and comparative ecosystem studies on high-latitude shelves and ice edges, with emphasis on natural variability. The Committee also surveyed the needs of the scientific and engineering community for an ice-capable research vessel. The report is expected to be published in early 1988. The effort is supported by the Andrew Mellon Foundation and the Marine Mammal Commission.

### Arctic Solid-Earth Geosciences

As early as 1979, the PRB discussed initiating a study of the solid-earth geoscience requirements of the Arctic. This study is building on the foundation of the Geological Society of America's Decade of North American Geology (DNAG) project, supplementing aspects of that activity, including gaps in research effort and scientific understanding, needs related to the management and support of required research, and coordination of research effort.

In November 1987, a delegation of this Committee traveled to the Soviet Union to develop research recommendations with scientists from the Soviet Academy of Sciences' Institutes of Oceanology and Geography in Moscow and Leningrad. A final meeting of the Committee with representatives from all circum-arctic nations will take place in 1988. The development of a continued exchange program with the Soviets on Arctic geoscience topics is being considered, and further

discussions will take place with interested federal agencies, in coordination with the National Academy of Sciences Foreign Secretary. This project has received start-up monies from the Academy's Arthur Day Fund, and is supported by supplemental grants from the U.S. Geological Survey and the National Science Foundation.

#### Arctic Social Sciences

To address the numerous concerns about Arctic social sciences that began surfacing as a result of the preparation of National Issues and Research Priorities in the Arctic and the U.S. Arctic Research Plan, the Polar Research Board has established a new committee, the ad hoc Committee on Arctic Social Sciences. This Committee held its first meeting November 20-21, 1987; participants included representatives from eight federal agencies, and congressional representatives.

The Committee will publish a report in the Polar Research Board's Strategy series. This report will address agency concerns raised at its first meeting, including: the need for documents or workshops that demonstrate the importance of social science research in the Arctic to agencies with a physical or biological science orientation; the need to examine the human component of geosphere-biosphere programs; the lack of priorities in the 1987 U.S. Arctic Research Plan; the need to examine the role of education, and residents, in Arctic research planning; and the need for greater agency cooperation and data coordination in the Arctic social sciences. The Committee will also aid the National Science Foundation as it plans implementation of the National Science Board recommendations in The Role of NSF in Polar Regions that NSF be established as the lead agency for Arctic social science research. This report is intended to serve as a major research document for the 1989 revision of the U.S. Arctic Research Plan.

#### STUDIES PLANNED FOR INITIATION IN 1988

##### Polar and Space Life Sciences

On February 21, 1986, the Board sponsored a feasibility meeting to develop a prospectus for a study on polar and space life science. The proposed study will coordinate efforts in space and life sciences to study effects of long-term isolation in the areas of psychosocial support, group isolation and behavioral interactions, and psycho-physiological parameters. The study is planned for initiation in mid-1988.

### Bi-Polar National Research Plan

Because of a growing interest in Antarctic scientific research, SCAR's interests in developing a document recommending future directions for SCAR activities, and an increasing need for a statement outlining an Antarctic science contribution to emerging global programs, the Board plans to undertake a study on U.S. national research priorities in Antarctica. The final report of this study is to be prepared with guidelines used to develop the Board's 1985 report, National Issues and Research Priorities in the Arctic. Both volumes will then serve as a bi-polar research plan for the United States. The Board plans to complete its Antarctic volume by fall 1988.

## ACTIVITIES OF STANDING COMMITTEES

### COMMITTEE ON GLACIOLOGY

This is a standing committee of the Polar Research Board that advises on research on snow, floating ice, and glaciers, and maintains awareness of the status of these fields, calling attention to special needs and problems. The current chairman is Charles F. Raymond of the University of Washington, Seattle, Washington. At its last meeting, April 30-May 1, 1987, the Committee reviewed the status of glaciological research with specific attention to progress of plans for ice coring in Greenland, general issues in remote sensing of snow and ice, and glaciology in relation to global processes. The need for some special concern regarding snow research in North America was identified, and the Committee is now accumulating information to document the recent history and current status of snow research in relation to earlier recommendations from the Committee on Glaciology and the Polar Research Board. In response to recommendations from the ad hoc Panel on Remote Sensing of Snow and Ice, a workshop will be convened in 1988 to bridge the gap between raw remote sensing data and high-level products convenient for research; focus will be on radar altimetry data from ice sheets.

### Ad Hoc Panel on Remote Sensing of Snow and Ice

This Panel is charged with assessing the remote-sensing needs of the snow and ice community, with particular attention paid to anticipated satellite instruments, missions, and data-processing and archiving schemes. The goals of this ad hoc Panel, under the Committee on Glaciology, are to (1) summarize the requirements of the snow and ice community, (2) examine the specifications of future systems, (3) identify those instruments and orbits that will meet some of the requirements, (4) identify those systems that have apparently ignored areas of snow and ice cover, and (5) examine issues relating to data processing and existing data bases for snow and ice. The Panel's report, "Prospects and Concerns for Satellite Remote Sensing of Snow and Ice" will be released in 1988. Chairman of the Panel is Jeff Dozier, University of California, Santa Barbara.

COMMITTEE ON PERMAFROST

This standing committee maintains awareness of the state of permafrost research, particularly in connection with development projects in Arctic regions, and prepares reports that identify research needs and offer recommendations for future research.

In September 1987, the Committee met in Anchorage, Alaska to work on ways to follow up on some of the recommendations of its Strategy report and to evaluate an exchange of permafrost researchers with other countries. The Committee is also planning a conference on permafrost and climatic change. The initial component of this twofold workshop would be a discussion of permafrost as an indicator of climatic change; the second component would be an examination of the implications of climatic change to engineers designing structures in permafrost regions. The chairman of the Committee is Oscar J. Ferrians, Jr., U.S. Geological Survey, Menlo Park, California.

## OTHER ACTIVITIES: NATIONAL RESEARCH COUNCIL INTERACTION

The Polar Research Board works with other National Research Council groups whose interests include polar regions. Among these are the Board on Earth Sciences, the Geophysics Research Forum and its Committee on Geophysical Data, the Board on Atmospheric Sciences and Climate, the Ocean Studies Board, the Board on Mineral and Energy Resources, and the Marine Board of the Commission on Engineering and Technical Systems.

The PRB works with these groups in identifying persons to serve on committees formed to undertake special studies and in identifying qualified reviewers for study reports. It invites presentations at its meetings on relevant activities in other Research Council units and maintains liaison with such activities. Some special studies are joint efforts with other Boards; for example, the first Strategy series study on Antarctic marine ecosystem research was a joint effort with the Ocean Studies Board, and that Board also worked with the Polar Research Board on the recently completed study on physical and chemical oceanography of the Southern Ocean. The Board also provided input to plans for the Strategy study on Arctic marine sciences. In addition, two Board members, Louis Lanzetti and Arthur Lachenbruch, are members of the Committee on Global Change, the U.S. National Committee to ICSU's International Geosphere-Biosphere Program.

Through the National Research Council, the PRB is able to bring the leading U.S. scientific and engineering expertise to bear on its studies and related international activities. A list of those who participated in its work during 1986 appears in Appendix A.

The Board's reports are published by the National Academy Press, and, in accordance with Research Council policy, these are placed in the National Technical Information Service to ensure continuing availability when the Board's limited supply has been exhausted. A list of the reports published by the Board, including those issued in calendar year 1987 and those planned for publication in 1988, appears in Appendix C.

APPENDIX A. MEMBERSHIP OF POLAR RESEARCH BOARD AND SUBGROUPS

Polar Research Board

\*6/89 Gunter Weller (Chairman)  
Geophysical Institute  
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(Meteorology/sea ice)

6/89 Knut Aagaard  
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(Physical oceanography)

12/91 Roger G. Barry  
Cooperative Institute for  
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Sciences  
University of Colorado  
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(Climatology/snow and ice data)

6/89 Mim Harris Dixon  
Health Center Director  
Chief Andrew Isaac Health  
Center  
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(Social sciences)

6/88 David Elliot  
Director, Byrd Polar Research  
Center  
The Ohio State University  
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(Antarctic geosciences)

6/89 Dennis Hayes  
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Observatory  
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(Marine geophysics)

6/88 Arthur H. Lachenbruch  
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(Geophysics/permafrost)

12/90 Louis Lanzerotti  
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(Geophysics/space physics)

6/88 Geoffrey F. Larminie  
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12/91 John P. Middaugh  
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\*Date term expires

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(Zoology, polar ecosystems, marine mammals)

6/90 Kevin E. Trenberth  
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(Petroleum ocean engineering)

6/89 Patrick J. Webber  
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(Terrestrial and arctic ecology)

6/89 Ray F. Weiss  
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(Chemical oceanography,  
atmospheric chemistry)

Ex Officio

Charles R. Bentley  
Alternate U.S. Delegate to SCAR  
Department of Geology & Geophysics  
University of Wisconsin-Madison  
Madison, Wisconsin 53706

Oscar J. Ferrians, Jr.  
Chairman, Committee on Permafrost  
U.S. Geological Survey  
4200 University Drive  
Anchorage, Alaska 99508

Charles F. Raymond  
Chairman, Committee on Glaciology  
Geophysics Program AK-50  
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Seattle, Washington 98195

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U.S. Delegate to SCAR  
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(continued)

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Raymond Watts  
Deputy Assistant Director  
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Peter Wilkniss  
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U.S. Representatives  
to  
SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH (SCAR)  
of the  
INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (ICSU)

U.S. DELEGATES

Robert H. Rutherford  
University of Texas at Dallas

Charles R. Bentley  
University of Wisconsin,  
Madison

WORKING GROUPS

BIOLOGY

Subcommittee on Conservation

Robert W. Risebrough  
University of California,  
Bodega Bay

William S. Benninghoff  
University of Michigan

Sherburne B. Abbott  
Marine Mammal Commission

GEODESY AND CARTOGRAPHY

Lowell Starr  
U.S. Geological Survey

GEOLOGY

David H. Elliot  
Ohio State University

GLACIOLOGY

Douglas R. MacAyeal  
University of Chicago

HUMAN BIOLOGY AND MEDICINE

Chester M. Pierce  
Harvard University

LOGISTICS

Alfred N. Fowler  
National Science Foundation

SOLID-EARTH GEOPHYSICS

Charles R. Bentley  
University of Wisconsin,  
Madison

UPPER-ATMOSPHERE PHYSICS

Louis J. Lanzerotti  
Bell Laboratories

GROUPS OF SPECIALISTS (selected by SCAR)

SOUTHERN OCEAN ECOLOGY  
(SCOR Working Group 86)

Sayed Z. El-Sayed, convener  
Texas A & M University

Donald B. Siniff  
University of Minnesota

ANTARCTIC CLIMATE RESEARCH

H. Jay Zwally  
National Aeronautics and  
Space Administration

ANTARCTIC SEA ICE

Arnold Gordon  
Lamont-Doherty Geological  
Observatory

Norbert Untersteiner  
University of Washington

SEALS

Donald B. Siniff  
deputy convener  
University of Minnesota

SCAR FINANCE COMMITTEE

W. Timothy Hushen  
Polar Research Board

STRUCTURE & EVOLUTION OF THE  
ANTARCTIC LITHOSPHERE

Ian Dalziel  
University of Texas-  
Austin

EVOLUTION OF THE CENOZOIC PALEOENVIRON-  
MENT IN HIGH SOUTHERN LATITUDES

Peter Webb  
Ohio State University

AD HOC GROUP ON ENVIRONMENT/  
DATA MANAGEMENT

W. S. Benninghoff  
University of Michigan  
Ann Arbor

BIMASS EXECUTIVE COMMITTEE

Sayed Z. El-Sayed, convener  
Texas A & M University

COMMITTEE ON GLACIOLOGY

12/88 Charles F. Raymond (Chairman)  
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(Geophysics)

6/87 Robert L. Brown  
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APPENDIX B. POLAR RESEARCH BOARD AND RELATED MEETINGS-1987

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Committee on Arctic Solid-Earth Geosciences  
Monterey, California 14-15

MARCH

Polar Research Board Meeting (61st)  
Washington, D.C. 9-11

APRIL

Committee on Glaciology, Boulder, Colorado 30-1 May

JUNE

Ad hoc WG on Upper-Atmospheric Physics  
College Park, Maryland 24

SCAR Executive Committee  
Grenoble, France 25-July 3

JULY

WG on Polar Ocean Research Platforms Testimony  
Washington, D.C. 28-29

AUGUST

Fifth Antarctic Earth Science Symposium  
Cambridge, England 24-28

SCAR WG Geology  
Cambridge, England 30-31

SCAR WG Solid-Earth/Geophysics  
Cambridge, England 30-31

SEPTEMBER

SCAR WG on Glaciology, Bremerhaven, Germany	6-12
Committee on Permafrost, Anchorage, Alaska	14-15
Site Visits: Barrow, Prudhoe Bay	17-19
<u>Polar Research Board Meeting (62nd)</u> Fairbanks, Alaska	20-23

OCTOBER

Ad hoc Working Group on Upper-Atmospheric Physics, College Park, Maryland	26-27
---	-------

NOVEMBER

Committee on Arctic Solid-Earth Geosciences Moscow, Leningrad, USSR	13-22
Committee on Arctic Social Sciences Washington, D.C.	19-21

DECEMBER

Committee on Arctic Solid-Earth Geosciences- Writing Workshop, San Francisco	9
Ad hoc Committee on Remote Sensing of Snow and Ice, San Francisco	9-10

## APPENDIX C. POLAR RESEARCH BOARD PUBLICATIONS

### PUBLISHED IN 1987

"Laboratory Antarctica: Research Contributions to Global Problems," Science, Volume 238, December 4, 1987.

"Report on United States Antarctic Research Activities, February 1986-October 1987; United States Antarctic Research Activities Planned for October 1987-September 1988," Report Number 29 to SCAR.

"Polar Research Board Annual Report 1986 and Future Plans." 1987. Polar Research Board. 60 pp.

### IN PREPARATION FOR FUTURE PUBLICATION

"Quality of Science Support on Existing U.S. Coast Guard Icebreakers: Report of a Survey." Polar Research Board. 24 pp.

"Evaluation of the U.S. Coast Guard's 'Preliminary Design Document' for the Proposed Next Generation of Polar Class Icebreakers." Polar Research Board. 18 pp.

"Polar Research Board Annual Report 1988 and Future Plans."

"Physical Oceanography and Tracer Chemistry of the Southern Ocean," Committee on Antarctic Physical and Chemical Oceanography.

"Priorities in Arctic Marine Science."

"Data Coordination and Career Stimulation in Polar Biomedical Research," Committee on Polar Biomedical Research.

"Report on United States Antarctic Research Activities, February 1987-October 1988; United States Antarctic Research Activities Planned for October 1988-September 1989," Report Number 30 to SCAR.

"Arctic Solid-Earth Geoscience Research.

"Prospects and Concerns for Satellite Remote Sensing of Snow and Ice."

"Priorities in Arctic Social Science Research."

"Implementation of Future Programs in Antarctic Upper Atmosphere Physics."

COMPLETE PUBLICATIONS OF THE POLAR RESEARCH BOARD

December 31, 1987

"Laboratory Antarctica: Research Contributions to Global Problems," Science, Volume 238, December 4, 1987.

"Report on United States Antarctic Research Activities, February 1986-October 1987; United States Antarctic Research Activities Planned for October 1987-September 1988," Report Number 29 to SCAR.

"Polar Research Board Annual Report 1986 and Future Plans." 1987. Polar Research Board. 60 pp.

"Antarctic Solid-Earth Sciences Research: A Guide for the Next Decade and Beyond." 1986. Ad hoc Committee on Antarctic Geosciences. 40 pp.

"Antarctic Science Since the IGY," Antarctic Journal of the United States, Volume 21, October 1986.

"Arctic Research in the National Interest." Science, Volume 233, August 1986.

"Recommendations for a U.S. Ice Coring Program." 1986. Ad hoc Panel on Polar Ice Coring. 67 pp.

"Report on United States Antarctic Research Activities, February 1985-October 1986; United States Antarctic Research Activities Planned for October 1986-September 1987," Report No. 28 to Scientific Committee on Antarctic Research (SCAR), June 1986. Polar Research Board. 100 pp.

"U.S. Research in Antarctica in 2000 A.D. and Beyond: A Preliminary Assessment." 1986. Polar Research Board. 35 pp.

"Antarctic Treaty System: An Assessment, Proceedings of a Workshop Held at Beardmore South Field Camp, Antarctica, January 7-13, 1985." 1986. Polar Research Board. National Academy of Sciences. 435 pp.

"Documents of the XIX Meeting of SCAR," June 1986. (Reproduced by the Polar Research Board.) 195 pp.

"Polar Research Board Annual Report 1985 and Future Plans." 1986. Polar Research Board. 65 pp.

"Glaciers, Ice Sheets, and Sea Level: Effects of a CO<sub>2</sub>-Induced Climatic Change, Report of a Workshop Held in Seattle, Washington, September 13-15, 1984." 1985. Committee on Glaciology. 330 pp.

"National Issues and Research Priorities in the Arctic," July 1985. Polar Research Board. 124 pp.

"Report on United States Antarctic Research Activities, February 1984-October 1985; United States Antarctic Research Activities Planned for October 1985-September 1986," Report No. 27 to Scientific Committee on Antarctic Research (SCAR), June 1985. Polar Research Board. 101 pp.

"Earth Sciences Investigations in the United States Antarctic Research Program (USARP) for the Period July 1, 1984-June 30, 1985. September 1985. Polar Research Board. Annual Report to SCAR.

"Permafrost, Fourth International Conference, Final Proceedings," 1984. Committee on Permafrost. National Academy Press. 413 pp.

"The Polar Regions and Climatic Change, Appendix." Committee on the Role of Polar Regions in Climatic Change, 113 pp.

"Documents of the XVIII Meeting of SCAR," October 1984. (Reproduced by the Polar Research Board.) 183 pp.

"Ice Segregation and Frost Heaving," October 1984. Ad hoc Study Group on Ice Segregation and Frost Heaving of the Committee on Permafrost. 72 pp.

"Environment of West Antarctica: Potential  $CO_2$ -Induced Changes. Report of a Workshop Held in Madison, Wisconsin, 5-7 July 1983," September 1984. Committee on Glaciology. 236 pp.

"The Polar Regions and Climatic Change," August 1984. Committee on the Role of the Polar Regions in Climatic Change. 59 pp.

"Report on United States Antarctic Research Activities, February 1983-October 1984; United States Antarctic Research Activities Planned for October 1984-September 1985. Report No. 26 to Scientific Committee on Antarctic Research (SCAR), June 1984," August 1984. Polar Research Board. 101 pp.

"Earth Science Investigations in the United States Antarctic Research Program (USARP) for the Period July 1, 1983-June 30, 1984," August 1984. Polar Research Board. Annual Report to SCAR. 99 pp.

"Analysis of Deep Ice Cores from Greenland. Letter Report of a Workshop Held 30-31 January 1984". May 1984, Committee on Glaciology, 96 pp.

"Polar Research Board Annual Report 1984 and Future Plans," February 1984. Polar Research Board. 55 pp.

"Permafrost, Fourth International Conference, Proceedings," December 1983. Committee on Permafrost. National Academy Press. 1,524 pp.

"Antarctic Climate Research," November 1983. Scientific Committee on Antarctic Research Group of Specialists on Antarctic Climate Research. 66 pp.

"Earth Science Investigations in the United States Antarctic Research Program (USARP) for the Period July 1, 1982-June 30, 1983," September 1983. Polar Research Board. 91 pp.

"Permafrost Research: An Assessment of Future Needs," August 1983. Committee on Permafrost. 103 pp.

"Report on United States Antarctic Research Activities, February 1982-October 1983; United States Antarctic Research Activities Planned for October 1983-September 1984. Report No. 25 to Scientific Committee on Antarctic Research (SCAR)," August 1983. Polar Research Board. 99 pp.

"Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluation and Recommendations. Appendix B: Components of an Arctic Terrestrial Environmental Research Program. Report of a Workshop Held in Boulder, Colorado, 21-23 November 1982," July 1983. Committee to Evaluate DOE's Arctic Terrestrial Environmental Research Programs. 18 pp.

"Snow and Ice Research. An Assessment," June 1983. Committee on Glaciology. 126 pp.

"Research Emphases for the U.S. Antarctic Program," June 1983. Polar Research Board. 126 pp.

"Polar Research Board Annual Report 1983 and Future Plans," February 1983. Polar Research Board. 47 pp.

"A United States Commitment to Arctic Research," November 1982. Ad hoc Committee on Arctic Research Policy. 17 pp.

"Polar Biomedical Research: An Assessment," September 1982. Ad hoc Committee on Polar Biomedical Research. 80 pp.

"Polar Biomedical Research: An Assessment. Appendix: Polar Medicine--A Literature Review," September 1982. Ad hoc Committee on Polar Biomedical Research. 85 pp.

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