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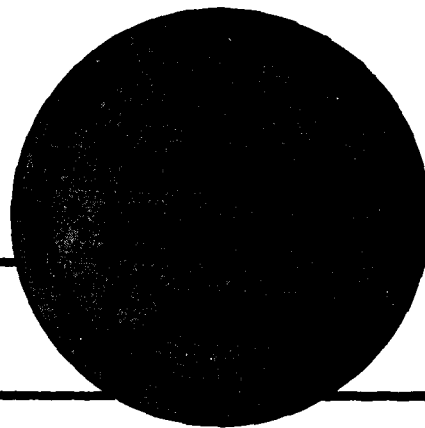
**LEVEL II**



# Annual Report Calendar Year 1978

(January 1, 1978—December 31, 1978)

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Assembly of Mathematical and Physical Sciences

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# Annual Report

of the

Assembly of Mathematical  
and Physical Sciences

for

Calendar Year 1978

(January 1, 1978—December 31, 1978).

Assembly of Mathematical and Physical Sciences  
National Research Council

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NATIONAL ACADEMY OF SCIENCES

Washington, D.C.

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## INTRODUCTION

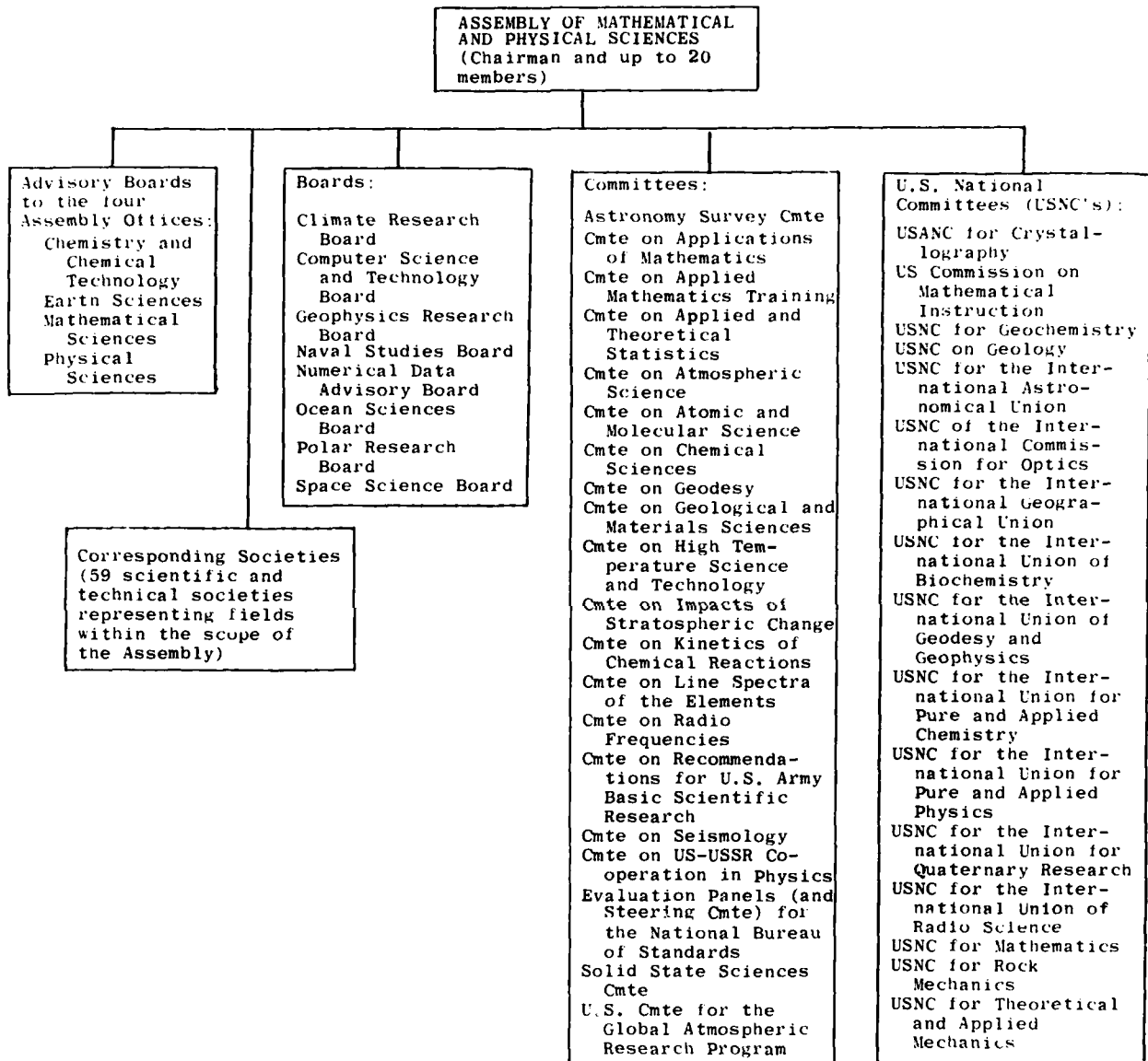
### BACKGROUND AND OBJECTIVES

The scientific disciplines with which the Assembly of Mathematical and Physical Sciences is concerned include astronomy and astrophysics, chemistry and chemical technology, earth sciences, mathematical sciences, physics and its derivative sciences, and space sciences. When the Assembly was established in May 1974, the Governing Board of the National Research Council (NRC) delegated to it responsibility for activities designed to ensure the health of these sciences and their effective application to the solution of national and international problems. The main objectives of the Assembly, therefore, are the following:

1. To maintain awareness of the health and needs of the disciplines within its scope and to stimulate their continued progress.
2. To initiate studies addressed to problems, needs, and opportunities in the disciplines for which it is responsible.
3. To assist the NRC in responding to requests from the federal government and other organizations when these requests relate to knowledge, data, methodology, instrumentation, or approaches of the mathematical and physical sciences.
4. To foster communication and cooperation among the mathematical and physical sciences in the identification of common problems and efforts to solve them.
5. To help the NRC to achieve a closer relationship to national and international scientific and technical societies in the disciplines the Assembly represents.

### ORGANIZATION AND FUNCTIONS (See Figure)

The Assembly consists of a chairman and not more than 20 members in addition to the chairman. These members include representatives of eight Sections of the National Academy of Sciences (NAS)--Applied Physical and Mathematical





Sciences, Astronomy, Chemistry, Engineering, Geology, Geophysics, Mathematics, and Physics--the chairmen of the Advisory Boards to the Assembly's four Offices (Chemistry and Chemical Technology, Earth Sciences, Mathematical Sciences, and Physical Sciences), and up to eight persons not necessarily members of the NAS or the National Academy of Engineering (NAE), who represent various disciplines within the scope of the Assembly.

→ Each year the Assembly must develop and approve a program plan and budget, which its chairman then presents to the Governing Board of NRC, generally at its January meeting. This Annual Report for Calendar Year 1978 is based on material included in the program plan.

The Assembly oversees the implementation of this program, assists in the review of reports resulting from program activities, identifies qualified individuals to serve on boards and committees of the Assembly, and, with Governing Board approval, organizes new activities in response to federal and other requests or to needs and opportunities it has identified. → to page 6

The Advisory Boards to the four Assembly Offices assist the Assembly in meeting its objectives. They provide additional depth and expertise in the various disciplines within the scope of the Assembly and alert the Assembly to problems and opportunities in the disciplines with which they are concerned. They have been sources of ideas for new program activities, a number of which they have helped to plan and organize. They also maintain contact with scientific and technical societies in appropriate disciplines, often enlisting their cooperation in projects of mutual concern.

The *Advisory Board to the Office of Chemistry and Chemical Technology* met in April 1978 to review the status of Assembly activities related to these disciplines and to call attention to any problems that in its view merited NRC concern. In particular, the Board noted the progress made by the recently organized Committee on Chemical Sciences, which is studying and making recommendations on the basic research program in chemical sciences in the Department of Energy. The Board strongly endorsed plans of this Committee to expand its activities, thereby more nearly approximating the goals outlined in its original authorization--to assist federal agencies responsible for funding basic research in chemical sciences in developing long-range plans, identifying potential problems, calling attention to new fields of chemical science that could contribute to the solution of national problems such as energy, preservation of the environment, and availability of materials, indicating problems on which interagency cooperation would be productive, and evaluating research and funding needs in the overall field. Noting the initiation in FY 1978 by the National Science Foundation of a Regional Instrumentation Facilities program, the Board considered the need for a study to develop criteria and methods for reviewing and monitoring the performance of such facilities and to assure the fullest consideration of feedback from the user community. This Board has also been deeply concerned with the status of efforts in this Assembly and the Assembly of Life Sciences to obtain the support of federal agencies for a study on hazardous substances and procedures in the laboratory. It reiterated its belief that such an investigation is urgent because of its importance to the health of laboratory personnel, as well as to the formulation of national policy. Of special concern were the guidelines being formulated by several federal agencies and interagency groups for the use of potentially toxic substances, particularly for the handling of alleged

carcinogenic materials in laboratories. The Board emphasized the need for additional assessment of scientific information and for the identification of any data that could improve the basis for judgment before such guidelines are implemented.

The *Advisory Board to the Office of Earth Sciences* published in two journals a short statement of its objectives and responsibilities and requested suggestions for new initiatives and studies. A number of responses were received, which the Board reviewed at a meeting in fall 1977. Some suggestions were referred to other units of the NRC; two led to short *ad hoc* studies conducted in this Assembly. One dealing with the contributions of geological sciences to the study of climate was organized by the Geophysics Research Board in cooperation with the Office of Earth Sciences; a report of the findings of this two-day workshop was published in July 1978 (*Geological Perspectives on Climatic Change*). A second study addressed the question of whether increased interaction between geological sciences and materials sciences would benefit both fields and the nation as well. An informal report on the findings and conclusions was prepared for the September meeting of the Assembly. In addition to these projects, the Board has established a program with the National Geodetic Survey whereby investigators from academic institutions are invited to send short proposals for geodetic work of interest in geodynamics to the Office of Earth Sciences for review. Proposals are evaluated and sent to the National Geodetic Survey, which carries out the work (to the extent possible within budgetary constraints) and sends the data to the university investigator who proposed the work. The Board has also cooperated with the Geophysics Research Board in organizing its workshop on "Continental Drilling for Scientific Purposes," worked with U.S. national committees in the earth sciences on special problems such as the participation of Taiwan and the People's Republic of China in international activities of unions of the International Council of Scientific Unions (ICSU), assisted in arrangements for the visit of a Soviet scientist to the United States, and fulfilled its ongoing responsibilities for identifying persons to serve on Assembly projects and assisting with the review of reports.

The *Advisory Board to the Office of Mathematical Sciences* has been acutely concerned about the drastic reduction in the number of postdoctoral fellowships and the implications for mathematics. Until a few years ago, all new PhD's who showed outstanding ability and wished to follow a career in basic research could expect to spend several years at the institution of a leading scientist in the field they wished to pursue. The faculty at some 30 leading U.S. universities profited greatly from this opportunity. The Advisory Board believes strongly that the excellence of basic science in the United States today is inextricably linked to these past postdoctoral development opportunities and that if the present postdoctoral pattern in nonapplied areas persists for another decade the quality of many basic scientific fields in leading universities will be jeopardized. The pool of outstanding candidates for professorships at three or four leading universities would probably be sufficient, but a serious decrease in the quality of those finding positions in the next five ranking universities, and an even greater decrease for the next ten to twenty universities, would be likely. Thus the Board believes there is clear need to provide the opportunity for a significant number of outstanding recent PhD's in the basic mathematical and physical sciences to devote

full time to research for a few years in association with a distinguished scientist in a field of their choosing. From this group the most creative future scientists would emerge. The Board developed a letter presenting and documenting its views and offering specific recommendations; this letter was transmitted to M. Kent Wilson, Director, Office of Planning and Resources Management of the National Science Foundation, which is planning to establish a new postdoctoral program.

The Advisory Board also considered and took action on another problem: Formerly, new mathematics PhD's dedicated to continuing their research were encouraged through interaction with other researchers at their own or nearby mathematical centers. However, employment projections suggest that recent mathematics PhD's are much less likely now to find employment in or near established mathematical centers. Many young mathematicians are accepting positions in colleges that have no research activities. Such an environment can cause a potential researcher to abandon this type of work and can also detract from his value as a teacher and one who might stimulate research interest in students. Mathematicians who lack adequate access to major centers could receive intellectual stimulation through periodic attendance at regional colloquia and interaction with active researchers employed within commuting distance. The Board believes strongly that such interaction would be substantially more helpful in stimulating young researchers than would attendance at an annual or semiannual conference or meeting. Thus the Board has considered and endorsed the formation of such regional colloquia and assisted in developing a proposal for an experimental program of this type that will be submitted to the National Science Foundation.

The *Advisory Board to the Office of Physical Sciences* proposed a number of new initiatives shortly after it was established, and during the past two years it has continued its efforts to bring these into being. Budgetary constraints and insufficient interest on the part of potential funding agencies have resulted in little progress. However, as mentioned in the "Highlights" section, a new committee has been organized to update the 1972 survey of astronomy and astrophysics and to suggest priorities for the 1980's. The Board has also been concerned about the need for updating the 1972 physics survey, but without the subfield coverage provided by the former Committee on Nuclear Science (disbanded in March 1978) and without the other subfield-oriented committees that the Board had proposed (optics and quantum electronics, plasma and fluid physics, biophysics), organizing the task becomes somewhat more difficult. In addition, the Board continues its consideration of a number of broad interrelated questions that extend beyond the boundaries of any one discipline, thus making the definition and implementation of a plan of action difficult. Stated in the narrow context of physics, these have to do with balance in the national physical-science enterprise, development of a coherent and well-documented justification for the support of research and the maintenance of a strong base of scientific manpower, and development of new measures and indices to assess the progress of science and its health. Other matters to which the Advisory Board has given attention include some of the problems facing professional societies in this field, foreign travel restrictions and their implications, and the status of the relationship between academic scientists in this field and the Department of Defense.

In addition to its four Advisory Boards, the Assembly has 59 Corresponding Societies. These societies provide, on request, suggestions for membership

on Assembly boards and committees, and they cooperate in various projects, particularly those of the U.S. national committees, with which they are closely associated. In some instances, representatives of appropriate societies participate in the meetings of Office Advisory Boards, for example, the director of the American Institute of Physics serves *ex officio* on the Advisory Board to the Office of Physical Sciences.

All boards, panels, study groups, and U.S. national committees responsible for the conduct of particular projects or studies in the program of the Assembly are considered committees of the Assembly. At least one member of the Assembly maintains general awareness of the work of each committee and provides assistance as needed, for example, in the review of its reports or the planning of new studies. Committee chairmen also periodically visit Assembly meetings to report on the activities and plans of the groups they head and to receive suggestions from the Assembly members.

The section on Highlights of CY 1978 describes major accomplishments of Assembly committees during the past year; it is followed by a section on New Studies Planned for CY 1979. The main body of the Annual Report describes each activity in the Assembly program in greater detail and provides information on membership. Terms of most members conclude on June 30 of the year shown following their names.

Immediately following this introductory section are lists of the members of the Assembly and its four Office Advisory Boards and of the 59 Corresponding Societies with their designated points of contact.

The Appendix to the Annual Report provides a list of documents issued by the Assembly during CY 1978.

#### ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES

Jacob Bigeleisen (Chairman) (1979)  
State University of New York at Stony Brook  
(Physical chemistry)

Charles P. Bean (1979)  
Physical Sciences Branch  
General Electric Research and Development Center  
(Solid-state physics, biophysics)

Richard B. Bernstein (1979)  
Department of Chemistry  
Columbia University  
(Physical chemistry)

William Browder (1981)  
Department of Mathematics  
Princeton University  
(Topology)

Kenneth M. Case (1981)  
Rockefeller University  
(Theoretical physics)

Albert M. Clogston (1979)  
Bell Laboratories  
(Solid-state sciences)

Preston Cloud (1979)  
U.S. Geological Survey  
Biogeology Clean Laboratory  
University of California at Santa Barbara  
(Geology, geosciences)

William G. Dauben (1980)  
Department of Chemistry  
University of California at Berkeley  
(Organic chemistry)

Bradley Efron (1979)  
Department of Statistics  
Stanford University  
(Statistics)

Robert G. Fleagle (1979)  
Department of Atmospheric Sciences  
University of Washington  
(Large-scale atmospheric motions)

Robert Herman (1980)  
Traffic Science Department  
General Motors Research Laboratories  
(Vibration-rotation spectra, molecular structure, cosmology)

George W. Housner (1981)  
Division of Engineering and Applied Science  
California Institute of Technology  
(Civil engineering)

Robert B. Leighton (1979)  
Division of Physics, Mathematics, and Astronomy  
California Institute of Technology  
(Astrophysics)

Richard S. Lindzen (1981)  
Division of Engineering and Applied Physics  
Harvard University  
(Dynamic meteorology)

Jack E. Oliver (1979)  
Department of Geological Sciences  
Cornell University  
(Seismology)

Jeremiah P. Ostriker (1980)  
Princeton University Observatory  
(Astrophysics)

Robert G. Sachs (1980)  
University of Chicago  
(Theoretical physics)

Carl H. Savit (1980)  
Western Geophysical Company  
(Geophysics)

Ralph O. Simmons (1981)  
Department of Physics  
University of Illinois  
(Molecular and solid-state physics)

George W. Whitehead (1979)  
Department of Mathematics  
Massachusetts Institute of Technology  
(Algebraic topology)

Executive Director: Charles K. Reed  
Special Assistant to Executive Director: Bertita E. Compton  
Administrative Assistant: Eva F. Tully  
Editor: Jacqueline Boraks

Advisory Board to  
OFFICE OF CHEMISTRY AND CHEMICAL TECHNOLOGY

Richard B. Bernstein (Chairman) (1979)  
Department of Chemistry  
Columbia University  
(Physical chemistry)

John I. Brauman (1981)  
Department of Chemistry  
Stanford University  
(Organic, physical chemistry)

Ronald Breslow (1980)  
Department of Chemistry  
Columbia University  
(Organic chemistry)

Stuart W. Churchill (1979)  
Department of Chemical Engineering  
University of Pennsylvania  
(Chemical engineering)

Isabella L. Karle (1981)  
Laboratory for the Structure of Matter  
Naval Research Laboratory  
(Crystallography)

Joseph J. Katz (1979)  
Chemistry Division  
Argonne National Laboratory  
(Chemistry)

Charles G. Overberger (1979)  
University of Michigan  
(Organic chemistry)

Sara E. B. Petrie (1980)  
Research Laboratories  
Eastman Kodak Company  
(Polymer physics, physical chemistry)

Monte C. Throdahl (1980)  
Monsanto Company  
(Chemical engineering)

Bert L. Vallee (1981)  
Biophysics Research Laboratory  
Harvard Medical School  
(Biochemistry, biophysics)

*Ex Officio*

William G. Dauben  
Department of Chemistry  
University of California at Berkeley

Executive Secretary: William Spindel  
Administrative Assistant: Peggy Posey

Advisory Board to  
OFFICE OF EARTH SCIENCES

Jack E. Oliver (Chairman) (1979)  
Department of Geological Sciences  
Cornell University  
(Seismology)

Paul A. Bailly (1980)  
Occidental Minerals Corporation  
(Mining and exploration geology)

Wallace S. Broecker (1979)  
Lamont-Doherty Geological Observatory  
(Geochemistry)

W. Gary Ernst (1980)  
Department of Earth and Space Sciences  
University of California at Los Angeles  
(Geochemistry, geology)

John Imbrie (1980)  
Department of Geological Sciences  
Brown University  
(Paleontology)

Cecil E. Leith (1979)  
Numerical Weather Prediction Project  
National Center for Atmospheric Research  
(Fluid dynamics)

Julian Wolpert (1979)  
School of Architecture and Urban Planning  
Princeton University  
(Geography)

*Ex Officio*  
Preston Cloud  
U.S. Geological Survey  
Biogeology Clean Laboratory  
University of California at Santa Barbara

Robert G. Fleagle  
Department of Atmospheric Sciences  
University of Washington

Carl H. Savit  
Western Geophysical Company of America



Executive Secretary: Joseph W. Berg, Jr.  
Administrative Assistant: Elizabeth C. Albanesi

Advisory Board to  
OFFICE OF MATHEMATICAL SCIENCES

William Browder (Chairman) (1981)  
Department of Mathematics  
Princeton University  
(Algebraic, differential, and combinatorial topology)

Richard D. Anderson (1979)  
Department of Mathematics  
Louisiana State University  
(Topology, point set theory)

Gerard Debreu (1979)  
Department of Economics  
University of California at Berkeley  
(Mathematical economics)

Richard C. Di Prima (1981)  
Rensselaer Polytechnic Institute  
(Applied mathematics)

James G. Glimm (1980)  
Department of Mathematics  
Rockefeller University  
(Nonlinear differential equations)

Kenneth M. Hoffman (1981)  
Department of Mathematics  
Massachusetts Institute of Technology  
(Functional analysis)

Alan J. Goldman (1980)  
Applied Mathematics Division  
National Bureau of Standards  
(Game theory, linear and nonlinear programming)

Richard M. Karp (1979)  
Division of Computer Science  
University of California at Berkeley  
(Computer programming, computer system design)

Cathleen S. Morawetz (1981)  
Courant Institute of Mathematical Sciences  
New York University  
(Fluid dynamics)

George D. Mostow (1981)  
Department of Mathematics  
Yale University  
(Lie and transformation groups, representation theory)

*Ex Officio*  
Bradley Efron  
Department of Statistics  
Stanford University

George W. Whitehead  
Department of Mathematics  
Massachusetts Institute of Technology

Executive Secretary: Jacob K. Goldhaber  
Administrative Assistant: Fern G. Steininger

Advisory Board to  
OFFICE OF PHYSICAL SCIENCES

Ralph O. Simmons (Chairman) (1981)  
Department of Physics  
University of Illinois  
(Molecular and solid-state physics)

Joel S. Birnbaum (1980)  
Thomas J. Watson Research Center  
IBM Corporation  
(Computer science)

Eric R. Cosman (1980)  
Department of Physics  
Massachusetts Institute of Technology  
(Nuclear physics)

Edward E. David, Jr. (1979)  
Exxon Research and Engineering Company  
(Microwave techniques, acoustics)

Richard M. Goody (1979)  
Division of Engineering and Applied Physics  
Harvard University  
(Planetary physics)

Frederick Seitz (1980)  
New York, New York (Retired)  
(Theory of solids; nuclear physics)

*Ex Officio*

Charles P. Bean  
Physical Sciences Branch  
General Electric Research and Development Center

Albert M. Clogston  
Bell Laboratories

Robert Herman  
Traffic Science Department  
General Motors Research Laboratories

H. William Koch  
American Institute of Physics

Robert B. Leighton  
Divison of Physics, Mathematics, and Astronomy  
California Institute of Technology

Jeremiah P. Ostriker  
Princeton University Observatory

Robert G. Sachs  
University of Chicago

Executive Secretary: George W. Wood  
Administrative Assistant: Beatrice Bretzfield

CORRESPONDING SOCIETIES  
of the  
ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES  
and  
THEIR DESIGNATED POINTS OF CONTACT

ACADEMY OF PHARMACEUTICAL SCIENCES  
Lloyd Kennon, Executive Secretary  
Academy of Pharmaceutical Sciences  
2215 Constitution Avenue N.W.  
Washington, D.C. 20037

## ACOUSTICAL SOCIETY OF AMERICA

Betty H. Goodfriend, Administrative Secretary  
Acoustical Society of America  
335 East 45th Street  
New York, New York 10017

## AMERICAN ASSOCIATION OF CLINICAL CHEMISTS

William J. Campbell, Executive Director  
American Association of Clinical Chemists  
1725 K Street N.W.  
Washington, D.C. 20006

## AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

Fred A. Dix, Jr., Executive Director  
American Association of Petroleum Geologists  
P.O. Box 979  
Tulsa, Oklahoma 74101

## AMERICAN ASTRONOMICAL SOCIETY

Laurence W. Frederick, Secretary  
American Astronomical Society  
Leander McCormick Observatory  
University of Virginia  
Charlottesville, Virginia 22903

## AMERICAN CERAMIC SOCIETY

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American Ceramic Society  
65 Ceramic Drive  
Columbus, Ohio 43214

## AMERICAN CHEMICAL SOCIETY

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American Chemical Society  
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Washington, D.C. 20036

## AMERICAN CONGRESS ON SURVEYING AND MAPPING

Robert E. Herndon, Jr., Executive Director  
American Congress on Surveying and Mapping  
733 Fifteenth Street N.W.  
Washington, D.C. 20005

## AMERICAN CRYSTALLOGRAPHIC ASSOCIATION

Deane K. Smith, Secretary  
American Crystallographic Association  
Department of Geosciences  
The Pennsylvania State University  
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University Park, Pennsylvania 16802

## AMERICAN FEDERATION OF INFORMATION PROCESSING SOCIETIES

Sylvia Charp, Secretary  
American Federation of Information Processing Societies  
Director of Instructional Systems  
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5th and Luzerne Streets  
Philadelphia, Pennsylvania 19100

## AMERICAN GEOGRAPHICAL SOCIETY

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American Geographical Society  
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New York, New York 10032

## AMERICAN GEOLOGICAL INSTITUTE

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American Geological Institute  
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Falls Church, Virginia 22041

## AMERICAN GEOPHYSICAL UNION

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American Geophysical Union  
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Washington, D.C. 20006

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

F. J. Van Antwerpen, Secretary  
American Institute of Chemical Engineers  
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New York, New York 10017

## AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS

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New York, New York 10017

## AMERICAN INSTITUTE OF PHYSICS

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American Institute of Physics  
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New York, New York 10017

## AMERICAN MATHEMATICAL SOCIETY

Everett Pitcher, Secretary  
American Mathematical Society  
Lehigh University  
Christmas-Saucon Hall  
Bethlehem, Pennsylvania 18015

## AMERICAN METEOROLOGICAL SOCIETY

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American Meteorological Society  
45 Beacon Street  
Boston, Massachusetts 02108

## AMERICAN NUCLEAR SOCIETY

Octave J. Du Temple, Executive Secretary  
American Nuclear Society  
555 North Kensington Avenue  
LaGrange Park, Illinois 60525

## AMERICAN OIL CHEMISTS' SOCIETY

Norris D. Embree  
1139 Knollwood Lane  
Kingsport, Tennessee 37660

## AMERICAN PHYSICAL SOCIETY

W. W. Havens, Jr., Executive Secretary  
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## HIGHLIGHTS OF CY 1978

Calendar year 1978 was busy and productive for most of the boards, committees, and U.S. national committees that make up this Assembly. In this section we will look briefly at some of their studies, recently completed or in progress.

### CLIMATE RESEARCH BOARD

The Climate Research Board organized and conducted two special workshops during CY 1978, both of which can be expected to have a significant effect on the development of international and national climate research programs. The International Workshop on Climate Issues took place in April at the International Institute for Applied Systems Analysis in Laxenburg, Austria. It was held in conjunction with a meeting convened by the World Meteorological Organization (WMO) to plan for the February 1979 World Climate Conference. Principal emphasis in the WMO deliberations was the status of knowledge about climate and its impacts on specific aspects of physical and social systems; the Climate Board Workshop was concerned chiefly with defining and analyzing the fundamental nature of climatic impacts, identifying criteria for international climate research, and debating major issues that should be addressed subsequently at the 1979 Conference. Among the conclusions of the Workshop was that climate is but one element of the constantly changing global ecological system, thus it cannot be dealt with in isolation. Further, climate should be viewed as an economic resource; therefore, methods for determining its economic value should be developed. Socioeconomic effects of climatic change result from a complex set of interactions that are shaped by the economic and social structure of the particular region affected. Thus the Workshop recommended that methods to project socioeconomic effects of possible climatic fluctuations be developed and that systematic and extensive studies of these impacts be conducted. Because of the present inadequacy of information about climate and the ineffective use of what little information is available, long-term economic and natural-resource planning is difficult. The Workshop recommended that ways to incorporate probabilistic knowledge of climate into economic planning be explored. In regard to priorities for international climate research, the Workshop recommended:

1. Establishment and extension of data bases in the developing countries (this was viewed as the most urgent need);
2. Assessment of the implications of the carbon dioxide problem;
3. Improvement of the ability to understand and predict natural climatic variations on monthly, seasonal, and interannual time scales;
4. Development of studies on climatic impacts, including quantitative estimates and diagnostic case studies of historical events.

In regard to methodology, the Workshop stressed that the studies should cover a broad range of climatic and socioeconomic conditions; that analyses of feasibility should be undertaken before commitment of major resources to specific studies; and that interdisciplinary, international teams of researchers, with adequate representation from regions affected by the climatic events being studied, should be developed. It also considered institutional arrangements for climatic impact studies and recommended (a) an intergovernmental lead agency (the UN Environmental Program working under a coordinating body organized by WMO was suggested); (b) a network of interested governmental and nongovernmental, national and international institutions; and (c) a steering committee of experts to plan and recommend specific impact studies. It is expected that the findings and recommendations of the Workshop will assist the WMO in planning the 1979 World Climate Conference and will provide a framework for discussion at that meeting.

Following this internationally oriented effort, the Board next turned its attention to U.S. climate research. In response to a request from federal agencies concerned with climate, the Board organized a workshop in July at the NAS Woods Hole Summer Study Center to assess the status of government planning for the U.S. Climate Program; to consider the overall structure of the Climate Program Plan; and to suggest types of research, services, impact studies, and international aspects that such a Program should include. The report on this study is expected to provide the same kind of guidance to national climate research planning that the international workshop did for worldwide efforts.

#### U.S. COMMITTEE FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM

Closely related to the work of the Climate Research Board is that of the U.S. Committee for the Global Atmospheric Research Program (GARP), in particular its Climate Dynamics Panel and its Advisory Panel for the Global Weather Experiment, which will cover a period from late 1978 through 1979. The latter Panel has been specifically concerned with (a) the specification of the observational and measurement requirements for the Experiment; (b) adequate technical development, evaluation, and testing of scientific platforms, (c) project design, logistical planning, and field work of the several federal agencies participating in the Experiment; and (d) research planning and participation of the scientific community in the Experiment. Now that the observational system for the Global Weather Experiment is nearly complete, the Panel is concentrating on the kinds of research that can be done with

the global data sets that will result from the Experiment. Publication of its report on the observational system and the anticipated data, with recommendations for research, is expected by the end of 1978.

The Climate Dynamics Panel, which was established by the U.S. Committee for GARP in 1975, published in spring 1978 its report on U.S. participation in the GARP Climate Dynamics Subprogram in which it outlined a scientific strategy for development of a climate research program. The report (*Elements of the Research Strategy for the United States Climate Program*) emphasizes the need for better understanding of the annual cycle of climate as a first step in a continuing comprehensive program, a theme that was emphasized in the previously described International Workshop on Climate Issues and the July workshop on the U.S. Climate Program Plan. The Panel participated in the latter workshop, and it will also respond to any requests from the Climate Research Board to evaluate the scientific aspects of the U.S. Program.

#### GEOPHYSICS RESEARCH BOARD

Committees working under the Geophysics Research Board had an especially productive year in 1978. The Geophysics Study Committee, having issued its first four studies in 1977, completed two more in this series in 1978. In *Geophysical Predictions*, an *ad hoc* study panel, having noted that "The good earth not only sustains life, it is also the greatest killer...", went on to discuss in detail the state of the art in the prediction of earthquakes, volcanic eruptions, hurricanes, tornadoes, tsunamis, and other natural disasters that annually cause great loss of life and property. The report emphasizes the wide discrepancy between understanding causal relations and the actual ability to predict, this ability ranging from near certainty for tides to rudimentary attempts to predict earthquakes. In most fields much research lies ahead. The study calls for greater interdisciplinary communication in attacking the problems presented by geophysical predictions and for closer examination of the social, economic, and legal consequences of predictions. For example, should public response to predictions, in certain circumstances, be regulated by law or dictated by emergency authorities? What are the proper means of communicating predictions to those likely to be affected? What types of individual and community preparedness should be considered? The report concludes by calling for greater interaction between geophysical and social sciences in exploring the impact of geophysical disasters and public reactions to the danger of future calamities.

The second study completed in 1978 discusses the relationship between technology and geophysics--the ways in which each fosters progress in the other. Fields in which interaction has been close include meteorology, water resources, mineral resources, ocean resources, and cartography. Rather than attempting to produce an exhaustive catalogue, the study focuses on a number of illustrations of the importance of technology to progress in geophysical research and points to possibilities for future productive interaction such as in weather modification, climate prediction, and earthquake prediction.

The Geophysics Research Board's Committee on Data Interchange and Data

Centers also completed in 1978 a study requested by the National Science Foundation and National Oceanic and Atmospheric Administration that will provide guidance on some of the data problems facing national data centers, in particular those making up the U.S. World Data Center-A complex. The Committee established six *ad hoc* panels that made visits throughout 1977 and early 1978 to the subcenters and associated national data centers of World Data Center-A. Based on their detailed reports on quality control, accessibility, and problems associated with the processing and distribution of data, the parent Committee then prepared a report on the "Status and Effectiveness of National and World Data Center-A Geophysical Data Centers." Based on its findings and the clear need for a unified national policy on the handling of geophysical data, the Committee plans to undertake a follow-up study to outline such a policy and its implications for geophysical research.

The Board's Committee on Solar-Terrestrial Physics organized, conducted, and is preparing reports on two major workshops that it held in CY 1978. With most of the facilities in operation that the Committee had earlier recommended in its detailed plan for U.S. participation in the International Magnetospheric Study (published in 1974), the Committee's IMS Panel held the first of a series of workshops bringing together experimenters (and their data) and theoreticians for a thorough discussion of magnetospheric theory. On some aspects of magnetospheric theory there are sharply differing points of view and no generally accepted one. Some 30 scientists participated in the workshop, held in March 1978, where they discussed possible interpretations of the new data and attempted to reach conclusions about a number of problems in magnetospheric physics. Publication of the findings is expected by the end of CY 1978.

The second workshop sponsored by the Committee took place in July and was concerned in part with research in relation to a new international effort --the Middle Atmosphere Program (MAP)--which has been widely endorsed by national and international organizations. The objective of MAP is the modeling of the stratosphere and the mesosphere as a unitary physical system. This objective will be achieved through coordinated observations of structure, composition, motions, and energetics--factors that interact with each other in the middle atmosphere and across its boundaries. All appropriate techniques, whether with spacecraft, balloons, rockets, or on the ground, will be employed. Therefore, the Committee's study on "Ground-Based Research on the Upper Atmosphere in the 1980's" was extended in scope to include research using balloons, aircraft, rockets, and space facilities, and it dealt with research on both the middle and upper atmosphere. The sponsoring agencies (National Science Foundation and National Aeronautics and Space Administration) are now encouraging the Committee to conduct a complementary study in summer 1979 that will deal with other aspects of solar-terrestrial research not included in the 1978 study. From these two studies will come a research strategy to guide the development of this field during the next decade.

The U.S. Geodynamics Committee of the Geophysics Research Board completed work on a document "Crustal Dynamics: A Framework for Resource Systems" that discusses the origin and evolution of the continents and emphasizes the need for scientific understanding in relation to a variety of societal needs, especially resources development and hazards. Publication

is expected by the end of 1978. In addition, the Committee sponsored in July a "Workshop on Continental Drilling for Scientific Purposes." The objective was to develop detailed recommendations on the scientific value and practical aspects of a continental drilling program; on ways to maximize the scientific value of drilling efforts of various federal programs and industry; and on means of encouraging the development of a research program that will stimulate the cooperation and participation of federal agencies, the academic community, industry, and state geological surveys. A prepublication copy of the conclusions and recommendations of the study was transmitted to the sponsoring federal agencies in October to assist them in budgetary planning. Publication of the report is expected early in CY 1979.

Another activity of the Geophysics Research Board that led to publication of a report in CY 1978 was a small two-day special meeting that it organized jointly with the Office of Earth Sciences. Chaired by Preston Cloud and held in September 1977, the meeting was concerned with the need for an NRC study of the contributions geological sciences could make to the understanding of climate. The group reviewed current research with a view toward identifying opportunities for geological sciences to provide a better picture of the forces that underlie climatic change. The report, *Geological Perspectives on Climatic Change*, summarizes the present understanding of the history of the earth's climate over the last hundred million years, indicates the detail in which each episode is known, and describes the experimental and observational techniques that made possible the synthesis. It then suggests a series of studies to give substance to the sketchy framework of current knowledge and theory and makes a persuasive case for the relevance of these studies to the future ability to monitor and predict climate.

#### NAVAL STUDIES BOARD

A high point in the year's activities of the Naval Studies Board was the Twelfth Symposium on Naval Hydrodynamics, held at the Academy in June. A Program Committee, chaired by George Carrier, selected 41 papers for presentation in the fields of (a) boundary-layer flows, including laminar stability, transition, and turbulent structure; (b) propeller-wake interaction, emphasizing the mutual influences of inflow velocity distributions and propeller-induced flow fields; (c) cavitation (inception, damage, and scaling laws); and (d) geophysical phenomena, emphasizing dynamic processes in the ocean such as internal wave generation, wind-wave interaction, large eddy structure, and background turbulence. The Office of Naval Research (ONR) and the David W. Taylor Naval Ship Research and Development Center shared with the Board in the organization of the Symposium, which attracted an attendance of 215 persons representing 15 countries.

The Board also arranged for U.S. participation in the Sixth International Conference on Numerical Methods in Fluid Dynamics, which took place in the Georgian Socialist Soviet Republic in June 1978. The U.S. delegation consisted of 16 scientists, of whom 12 received grants for travel assistance.

In addition to these conference-oriented activities, the Board, through



a special panel, reviewed the directed-energy weapons investigations of the ONR and the supporting technology. The panel offered recommendations on ways to improve research and development concerned with such weapons, its report being transmitted in March. The Board also established a small task group to explore the feasibility of achieving significant advances in navigational capability of submarines through the use of highly sensitive sensors that have been developed to measure gravity waves. The findings of the task group might lead to the initiation of a new study by the Board. Two other studies begun in 1978 and well under way at this time are concerned with (a) the implications of satellite capabilities for naval systems and (b) applications of science and technology to improve four types of submarine subsystems--hull/structures, life-support systems, hydraulics, and ship service systems.

Projects of a different sort to which the Board gave attention during 1978 are (a) selective updating of the 32-year-old, 22-volume series on research in subsurface warfare, which is still extensively used in many research laboratories, though long out of date, and (b) participation in arrangements for a guest lecture series at the U.S. Naval Postgraduate School and U.S. Naval War College. Senior scientists and engineers would be selected to make presentations on various fields of science and technology in an effort to foster a better understanding among naval officers of the vital roles of these fields in naval operations. Naming the series for Admiral Charles H. Davis, who played a prominent part in establishing the NAS in 1863 while serving as the Navy's Chief of Navigation, is under consideration, for he well exemplifies the role of science and technology in naval affairs that the lecture series would be designed to promote.

#### OCEAN SCIENCES BOARD

In April 1978 the Ocean Sciences Board's Committee on Tropospheric Transport of Pollutants to the Ocean published its final report on a workshop organized late in 1975, the background papers for which appeared in September 1977. A principal conclusion of the Committee was that a comprehensive model capable of predicting the transport of reactive gases and aerosols is *not* close to realization. Further, the frequency of sampling and the duration of individual sampling periods in most monitoring programs are insufficient for model validation purposes. In light of these findings, the Committee offers a detailed set of recommendations on the kinds of studies needed to advance understanding of the transport of metals, halogenated hydrocarbons, petroleum and related natural compounds, nonhydrocarbon gases, and radionuclides. A section on techniques discusses problems of data collection and sampling. The Committee's suggestions of the kinds of research and observations that are needed in the atmosphere, the oceans, and over the continents should have a significant effect on the nature and direction of research in this field over the next several years.

A matter of special concern to the Ocean Sciences Board is that the design and operation of an *Oceanlab* facility ("a federally funded national facility which would provide scientists and engineers with a mobile undersea

laboratory, associated equipment and living quarters, to conduct research, development, and exploration in the ocean for extended periods of time"), if built, would be such as to maximize its value to the marine scientific community. An *ad hoc* group formed at the initiative of the Board reported in April 1978 that what is lacking in the plans for *Oceanlab* is a core of sufficiently detailed proposals to permit a critical review of the science that would be accomplished. The group recommended actions that would remedy this lack and that could provide a sound basis for the scientific use of *Oceanlab*. The National Oceanic and Atmospheric Administration has begun implementation of some of these recommendations and has asked the Board to establish a committee to provide further guidance on scientific needs and options in meeting them.

The Board's Panel on Ocean Science Manpower Trends and Curriculum Needs, after acquiring and analyzing a large amount of data on PhD oceanographers, concluded its efforts with a summer study, the results of which will be published early in 1979. The study documents the characteristics of PhD's associated with four basic ocean-science fields--biological oceanography, chemical oceanography, marine geology/geophysics, and physical oceanography. It shows how and when PhD's in these fields were trained as oceanographers and depicts the patterns of mobility into and from oceanography. It is expected to provide a better understanding of manpower needs and useful data for curriculum planning.

Another major study concluded in CY 1978 was that concerned with large-scale ocean-science research to follow the International Decade of Ocean Exploration, which ends in 1980. Following a series of small discipline-based workshops organized by the National Science Foundation, a committee of the Board organized two workshops of its own, a small one on issues of program management, interdisciplinary research opportunities, and international cooperation and a larger one to which the findings of the previous series provided input. Some 75 ocean scientists, engineers, and program managers participated in this September 1977 workshop. The Committee then developed a report with sections on marine research and society, the conduct of cooperative oceanography, program organization and management, international cooperation, manpower needs, facility and equipment needs, communication of results, and funding requirements. Publication is anticipated by the end of 1978. The Board believes that this report will help to shape the future course of large-scale ocean research in the 1980's.

Late in 1978, the Board also published the report of a study essentially completed during CY 1977 (and summarized in last year's Annual Report) on geological and geophysical research needs on continental margins.

#### POLAR RESEARCH BOARD

Since its inception in 1958, more than 70 percent of the Polar Research Board's recommendations relative to the planning and conduct of research in the Antarctic have been partially or totally implemented, whereas most recommendations pertaining to the Arctic have yet to result in action. This difference results largely from the many government agencies involved in

Arctic research and development, especially energy-related activities; the National Science Foundation is the sole manager of the U.S. Antarctic program. In an attempt to increase the effectiveness of its recommendations on Arctic research, the Board is attempting to broaden its funding base and thereby the receptiveness of concerned agencies to its suggestions. An encouraging step toward greater effectiveness in relation to Arctic problems came about as a result of a workshop organized by the Board's Committee on Permafrost and held in December 1977. Discussion focused on research needs associated with the proposed Alaska Natural Gas Pipeline System and Arctic offshore development. Based on the workshop findings, the Committee strongly urged the initiation of an open dialogue among the concerned parties to the Alaska Natural Gas Transportation System, with the objective of defining the problems yet to be resolved, facilitating development of cost-effective designs, and achieving useful and environmentally acceptable regulations. In a letter to the Assistant Secretary of the Interior, the NAS alerted the federal government to the findings and recommendations of the Polar Research Board and its Committee on Permafrost. As a result, the Board has been invited to assist in the development of such a dialogue, and plans for it are in progress.

The Board's Committee on Glaciology concluded, on the basis of a workshop it organized, that glacier ice probably will have to be used as a freshwater source at some time in the future, but the Committee recommended additional research on iceberg distribution, harvest, and deterioration before any major expenditures on large-scale field tests of towing techniques or protection schemes. The Committee also prepared a draft outline of the contribution of glaciology to paleoclimatology and recommended the establishment of a study group on sea-ice mechanics that would be concerned with research needs related to industrial offshore development in the Arctic. Plans for the latter study were taking shape toward the end of CY 1978.

The Board's Committee on International Polar Relations was chiefly concerned during early 1978 with a conservation regime for the Southern Ocean, which was under consideration at the May 1978 XVth Meeting and Plenary Session of the Scientific Committee on Antarctic Research. The Board's Committee on International Relations prepared a U.S. position paper for this session in which it endorsed the scientific objectives set forth in the SCAR document *Biological Investigations of Marine Antarctic Systems and Stocks* and concluded that the proposed studies were essential to rational and effective guidance in coping with the problems that will result from exploitation of marine living resources of the Southern Ocean. The Committee also strongly urged that the United States maintain its key position in basic research in the Southern Ocean.

#### SPACE SCIENCE BOARD

Among the achievements of the Space Science Board during the past year was completion of a joint effort with the European Science Foundation to review space telescope instrumentation. The joint Review Committee met in March 1978 to consider designs and predicted performance characteristics of the instruments selected by NASA and the European Space Agency. The report resulting

from this session (*NAS-ESF Space Telescope Instrument Review Committee, First Report*, July 1978) concluded that the instrument complement will meet the scientific objectives of the Space Telescope but that more attention must be paid to adequate testing procedures for noise levels and calibrations. The Committee will meet again in January 1979 for a final review of instrument designs before the hardware procurement phase of the project begins.

The Board's *Ad Hoc* Study Committee on Space Plasma Physics published the first half of its report in May 1978 (*Space Plasma Physics: The Study of Solar System Plasmas. Volume I: Reports of the Study Committee and Advocacy Panels.*) The Committee concluded that space plasma physics is intrinsically an important branch of science, that it has contributed to the development of laboratory plasma physics and astrophysics, that a better understanding of solar-system plasmas could have applications in meteorology and terrestrial communications, and that the theoretical component of space plasma physics should be strengthened. Volume II, the technical background papers for the study, will be published early in 1979.

The Board's Committee on Planetary and Lunar Exploration followed its earlier study on a strategy for exploration of the outer planets with a like study of the inner planets, which it completed and transmitted to the Board for approval in May 1978. The goals of the two related studies were (a) to develop a coherent science strategy that was sensitive to foreseeable budgetary constraints but largely detached from, thus independent of, agency mission strategies; (b) to identify the planetary targets and level of investigation that would lead to major advances in knowledge; and (c) to specify the primary science objectives and critical measurements to be achieved. The Committee recommended that the main exploratory emphasis for 1977-1987 be on the atmosphere-bearing planets--Mars, earth, and Venus. The selection of this triad indicates a significant advance in planetary exploration to the point at which comparative planetological study offers the best opportunity to understand the history and evolution of solar-system bodies. To complete its series of strategy studies, the Committee held a summer study in 1978 on the exploration of comets and asteroids, the report on which is currently being prepared.

The Board's Committee on Space Astronomy and Astrophysics also completed its strategy document (summarized in some detail in the 1977 Annual Report) in 1978 and began the planning of two 1979 studies, the first to review the status of the proposed Space Telescope Science Institute and the second on future directions of radio astronomy in light of recent developments in technology and space-based instruments.

Other studies in progress under the Space Science Board include (a) specification of the studies that will be required to advance understanding of the chemical evolution that is necessary for life to emerge and of the interaction of life with its environment (Committee on Planetary Biology and Chemical Evolution); (b) development of a strategy for obtaining experimental and observational evidence bearing on the theory of gravitation (*Ad Hoc* Committee on Gravitational Physics); (c) application of space technology in earth-science disciplines, including oceanography, geology, hydrology, earth's gravitational and magnetic fields, and earth's cryosphere (Committee on Earth Sciences); and (d) development of a ten-year strategy for research efforts in space physics (Committee on Space Physics).

## COMMITTEE ON IMPACTS OF STRATOSPHERIC CHANGE

The Committee on Impacts of Stratospheric Change issued an interim report on January 1, 1978 (*Response to the Ozone Protection Sections of the Clean Air Act Amendments of 1977: An Interim Report*), then, in response to a new request from the Environmental Protection Agency, it began work on a comprehensive study intended to provide the best possible information base for reaching decisions on regulation of human causes of stratospheric ozone depletion. In this effort, the Committee is working with a parallel group under the Commission on Sociotechnical Systems, which will assess the economic and social impacts of various regulatory strategies. As a part of its work, the Committee's Panel on Stratospheric Chemistry and Transport is updating and revising its 1976 report.

## EVALUATION PANELS FOR THE NATIONAL BUREAU OF STANDARDS

The Evaluation Panels for the National Bureau of Standards, which review and evaluate the technical functions and operations of the Bureau, were reorganizing during 1978 to reflect the changes taking place in the NBS structure. However, the Panels published six reports in CY 1978 presenting evaluations of the Institute for Computer Science and Technology, the Office of Standard Reference Data, the Experimental Technology Incentives Program, the Institute for Materials Research, the Institute for Applied Technology, and the Institute for Basic Standards, as well as on the overall operation of the Bureau. Although it was a transitional year, it turned out that the work of the Evaluation Panels and the Steering Committee was as valuable as it has ever been in recent times. Steering Committee and panel representatives had especially productive interaction with the Statutory Visiting Committee in regard to the reprogramming of the Bureau and other problems. Also, panel members provided more testimony before Congressional Committees about the Bureau than ever before. Overall, it was a year of intense and (because of the reorganization) rather demanding activity for these Panels.

## COMMITTEE ON US-USSR COOPERATION IN PHYSICS

The Committee on US-USSR Cooperation in Physics was subject during CY 1978 to factors that introduced a significant element of uncertainty into the planning and conduct of its program. The VIIth Joint US-USSR Symposium on Condensed Matter Theory, which was to have taken place in the Soviet Union from May 21 to June 3, was cancelled at the last minute by a decision of individual members of the U.S. delegation as a result of the trail and conviction of dissident Soviet scientist Yuri F. Orlov. A 70-day visit in the United States by a delegation of Soviet astrophysicists, which was to have

begun on July 7, was then postponed by the Soviet participants, finally being reduced to only 30 days, with but six of the original delegation taking part. Visits by individual scientists of one country to the other also declined during CY 1978.

On the other hand, the first of a planned series of annual workshops on "Absorption and Transport Phenomena in Laser-Produced Plasmas" took place in the Soviet Union in August and September as scheduled, with no undue difficulties or problems. The principal subjects of discussion were (a) resonant absorption processes and scattering instabilities, (b) incoherent turbulent processes including heat-flow instabilities and flux limiting, and (c) effects of spontaneous magnetic fields in heat flow and absorption. Participants report productive interaction and a useful meeting.

A further encouraging development was the organization under the Soviet Academy of a Commission on Cooperation in Physics, which is a counterpart of the U.S. Committee. These two groups met in Moscow in December 1978 to plan activities for the CY 1979 Program Year. These activities include a Joint Research Group Meeting on Condensed Matter Theory, a Joint Research Group Meeting on Dynamics of Non-Abelian Gauge Fields, a Joint Workshop on Absorption and Transport Phenomena in Laser-Produced Plasmas, a Joint Symposium on Mathematical Physics, a Workshop on Quantum Dynamics and Reactivity of Large Molecules, and several visits by individual U.S. and U.S.S.R. scientists to one another's countries.

#### SOLID STATE SCIENCES COMMITTEE

Among the most active of the smaller committees of the Assembly in 1978 was the Solid State Sciences Committee. As is its custom, the Committee held two workshops, the first in June at Oak Ridge National Laboratory, where participants reviewed the Materials Research Program of the Laboratory then heard papers by key scientists on topics such as implantation metallurgy, advances in semiconductor implantation, ion beam techniques in materials analysis, and microfocused ion beams. The second took place at the Academy in December and was concerned with the status of the synthesis and characterization of advanced materials.

In addition to these workshops, panels of the Committee completed several studies. One panel was formed to work with the Space Applications Board of the Assembly of Engineering on an assessment of the NASA Materials Processing in Space Program. The report of the joint Committee on Scientific and Technological Aspects of Processing Materials in Space was published in June 1978. The main conclusion was that the Space Shuttle, because of the low-gravity environment that it will provide in earth orbit for long periods of time, does offer some new opportunities for research and development in processing materials; however, the Committee emphasized that any experiments proposed for this space environment should have "a sound base in terrestrial research." In some instances there was not enough "earth-bound" research to determine whether additional effort and improvements in it would yield results similar to or surpassing those achieved in space. The Committee identified a number

of specific fields in which experimentation in space might contribute meaningfully to the understanding of the properties and processing of materials, but it did not find any examples "of economically justifiable processes for producing materials in space."

The Panel studying the role of small university-based programs in materials research in relation to the national effort in this field also completed its work in 1978. The Panel attempted to ascertain the factors that lead to a viable small research program, specifically those that can be influenced by universities and funding organizations and would produce a more productive atmosphere for small research programs. It also explored the types of funding (hierarchy, portfolio, and individual) that might be most appropriate to and effective for small research programs. Publication of the report is expected in January 1979.

The Panel on Research Facilities and Scientific Opportunities in the Use of Low-Energy Neutrons, a follow-on to the Committee's earlier study of research opportunities with synchrotron radiation facilities, completed its report at the end of 1977. It recommended continued support of the highest-flux steady-state reactors, with particular attention to enhancing instrumentation at these facilities so that they could continue to compete at the forefront of science. It also noted the importance of medium-flux reactors and the probability that new types of steady-state reactors would eventually be needed. The Panel recommended an immediate commitment for procuring a high-flux pulsed neutron source of about  $10^{16}$  thermal neutrons per square centimeter per second peak--a peak flux about a factor of 10 greater than the highest steady-state flux currently available in the United States. It also emphasized the need for implementing an instrument development phase in parallel with facility development.

The Panel on High Magnetic Field Research and Facilities began its study in May 1978, with completion of its report expected by November 1978. The Panel considered both the science and the technology for the generation of high magnetic fields and the research and technological opportunities these fields offer. The study includes an assessment of facilities and needs for upgrading or for advanced new facilities. Sections of the report deal with (a) scientific opportunities, (b) technological opportunities, (c) facilities and users, and (d) magnetic design and materials.

The Committee also initiated yet another study in summer 1978, this one dealing with thin-film microstructure science and technology. Concern about an insufficient level of basic research underlying microstructure fabrication in the United States stimulated the study. The report, which should be completed by early 1979, will deal with (a) materials, phenomena, fabrication, and characterization; (b) integrated circuit engineering and technology; and (c) organizational and educational considerations.

#### COMMITTEE ON GEODESY

The Committee on Geodesy completed its three-year study and published its report (*Geodesy--Trends and Prospects*) in mid-1978. The Committee reviewed

scientific and technological advances in geodesy, planning for spaceborne instrumentation pertinent to geodesy, geodetic control for the oceans, educational opportunities, current work in plane surveying and mapping, and current work in traditional geodesy. Its report recommends an increase in the transmission of procedures and technology of geodesy from the public sector to the private sector; the improvement of geodetic methods for application to geophysics, including crustal motion and earthquake hazard studies; a greater effort in the development of instrumentation; and greater awareness in federal agencies of the educational and organizational needs of this science. The Committee concluded, in addition, that there were a number of questions requiring more detailed technical study before useful recommendations could be offered; for example,

1. What geodetic instrumentation and observing programs are required for geodynamic purposes such as improving the understanding of tectonic motions and the prediction of earthquakes?
2. How should the Department of Defense Global Positioning System be used for geodesy and surveying?
3. What is the appropriate role of federal geodetic and mapping agencies in cooperating with the states to establish a multipurpose cadastre?
4. How can present and planned geodetic technology be most effectively transferred to users?

The Committee plans to establish panels to undertake special studies of such problems.

In response to a recommendation in the report of the Committee on Geodesy in regard to the need for a dedicated gravity satellite and the accuracy requirements and other specifications for such a satellite, the National Aeronautics and Space Administration requested the Committee to provide fuller details. As a result, the Committee organized a follow-up workshop (a) to examine the accuracies to be expected from satellite systems in determining the short-wavelength (100 km to 300 km) components of the earth's gravity field and (b) to establish the basic scientific and applications requirements for use of these data. A report on this activity is expected by June 1979.

#### COMMITTEE ON ATMOSPHERIC SCIENCES

A principal activity of the Committee on Atmospheric Sciences in CY 1978 was its review of priorities in this field over the coming decade. The Committee decided to approach the examination of the goals and direction of atmospheric research through an analysis of the current status of the interaction of atmospheric sciences with society--the variety of predictive regimes employed and their potential and implications, and both the intended and inadvertent modification of the atmosphere by human activities. Research opportunities for the 1980's were evaluated in relation to scientific criteria and to their immediate or likely long-term contribution to improved predictive capability and better understanding of the effects of man on the atmosphere. Twelve



task groups studied problems and opportunities in specific subdisciplines, with the reports they produced serving as background for a June 1978 workshop. The main objective of the workshop was to arrive at consensus on opportunities and priorities and to prepare a preliminary report to assist federal agencies in 1980 budget planning. The national goals for the next decade recommended in this report are

1. To improve understanding and prediction of atmospheric precipitation processes;
2. To achieve a fuller understanding of the climate system and its response to various influences;
3. To elucidate the biogeochemical cycles and budgets and their relationship to atmospheric processes.

Plans for new Committee studies in CY 1979 related to these priorities are beginning to take shape. In addition, the Committee will continue its efforts to foster better public understanding of the nature and goals of atmospheric research and development.

In CY 1978, in response to a request from the National Oceanic and Atmospheric Administration, the Committee on Atmospheric Sciences established a panel to assist the federal government (i.e., NOAA, the Department of Energy, and the Department of Agriculture) in the development of a practical statistical test that could be used by the government for an experimental evaluation of long-range forecasts. The panel's task is to develop a statistical verification procedure for use in the specific case of forecasts of mean weekly temperatures, which are prepared one month in advance, for alternate weeks at a prescribed series of stations in the United States. In its report, *Evaluation Procedures for Long-Range Weather Forecast Experiments*, the panel outlines the capabilities and limitations of the statistical test it proposes, explains what the results would mean in terms of degree of skill, and specifies the limitations on its application and interpretation. Neither the panel nor the parent Committee will participate in any federal evaluation program or in any *post facto* interpretations of the results of the test. The panel's concern was solely development of a statistical procedure--a tool--and the guidelines for its use.

#### COMMITTEE ON APPLIED MATHEMATICS TRAINING

This Committee, which was established early in 1977, completed its study of a variety of problems related to the mathematics training of undergraduates and, with publication of its report early in 1979, will be discharged. The Committee's objective was to determine what curriculum changes are needed, what obstacles there are to effecting these changes, and what means might be employed to overcome these obstacles. Committee members and task groups developed position papers for presentation at the January 1978 joint annual meeting of the Mathematical Association of America and the American Mathematical Society and also initiated discussions at the May 1978 meeting of the Society

for Industrial and Applied Mathematics. Further, at the Committee's March 1978 meeting, representatives of various mathematical organizations were present and there was wide-ranging discussion on possible Committee recommendations. Having obtained a variety of reactions and suggestions from the mathematical community, the Committee is developing its final report and recommendations, with publication expected at the beginning of 1979.

#### COMMITTEE ON CHEMICAL SCIENCES

The Committee on Chemical Sciences expects to issue the first of two reports on its review of the chemical sciences program of the Department of Energy's Office of Basic Energy Sciences by early 1979, with the second report following a year later. Subjects covered in this first report include analytical chemistry, combustion research, coal science and related chemistry, research related to fuel reprocessing and waste management, review procedures and funding, use of DOE laboratories by university chemists, isotope production for research, and needs for evaluated data.

In addition to completing this extensive study, the Committee is attempting to broaden its base of support and thereby better fulfill its objective of assisting federal agencies that fund basic research in chemical sciences in developing long-range plans, identifying promising new fields of chemical research, and locating gaps in support and opportunities for interagency cooperation. As a part of its broader effort, the Committee has organized a Subcommittee on Nuclear and Radiochemistry, which will carry on the work of the Subcommittee of Radiochemistry of the former Committee on Nuclear Science. The Committee also plans to undertake a study of information storage and retrieval in chemistry in line with the recommendations of an *ad hoc* panel convened in 1977 to consider the need for such a study.

#### COMMITTEE ON LINE SPECTRA OF THE ELEMENTS

The recent work of the Assembly's Committee on Line Spectra of the Elements is summarized in the News section of the June 1978 issue of *Laser Focus*, under the title "New Compilation of 41,000 Atomic Lines is Outgrowth of Recommendations in '74." When this Committee's 1974 Survey showed that the spectral tables most widely in use by scientists were those found in old (mid-1940's) editions of the *Handbook of Chemistry and Physics*, tables that the *Handbook* had ceased to publish because they were out of date, the editors of the *Handbook* approached the Committee about preparation of a new updated table for future publication. The Committee developed a plan for such a table, which was accepted by the *Handbook*, after which Committee members and other scientists identified by it began work on this project. The resulting new tables will appear in the 1978-1979 edition of the *Handbook*. The first table includes spectra for all neutral and singly ionized atoms for which spectra are known, 98 elements in all. The spectra of many doubly, triply, and

quadruply ionized atoms are also included. These data on more than 41,000 spectral lines will cover some 85 pages of the *Handbook* and include references to the original literature. A second table contains transition probabilities together with estimated uncertainties for about 4000 spectral lines of atoms in various stages of ionization and covers 15 pages in the *Handbook*. With this project completed, the Committee began the planning of the next in its series of international symposia, which will take place in September 1979.

#### ASTRONOMY SURVEY COMMITTEE

A new committee of the Assembly, the Astronomy Survey Committee, began its work late in 1978. This Committee's task is to update the "Greenstein Report" (*Astronomy and Astrophysics for the 1970's*). The new survey will cover both ground-based and space-based techniques. Its report, which should be available by summer 1981, will recommend priorities for the 1980's in this field. In addition to the Survey Committee, there will be panels concerned with observations in the radio, infrared, optical/ultraviolet, and high-energy wavelength regions, as well as on theoretical astrophysics. The report will include sections on solar studies, planetary studies, facilities, instrumentation and detectors, data reduction, and modeling. Approximately 50 scientists will be involved in the work of the Committee and its working groups, with as many as 50 additional consultants.

#### COMMITTEE ON NUCLEAR SCIENCE

To include the demise of a committee in a section on Highlights is perhaps odd. Yet the Committee on Nuclear Science, which was discharged in March 1978, continues to have an impact on activities in this field, as evidenced in the first report of the Department of Energy-National Science Foundation Nuclear Science Advisory Committee (*Recommendations for FY 1980 Facility Construction*, April 1978). In his letter of transmittal, the Chairman of the DOE-NSF Committee states:

"In transmitting these recommendations, NUSAC notes that the Subcommittee acted within the framework of the first priorities for major new construction and facility-improvement programs specified in the Friedlander Report on the *Future of Nuclear Science*. In broader context NUSAC wishes to take this opportunity to affirm its strong support in principle for Recommendation A of the Friedlander Report, which places highest priority on an immediate step increase in operating support for nuclear science. An independent evaluation of this problem by NUSAC has confirmed the serious effects of the low level of current operating funds, instrumentation, user group support, and capital equipment budgets at nuclear science laboratories, particularly at the universities."

The conclusions and recommendations set forth in this report in general reflect and reinforce those published by the Committee on Nuclear Science's Panel on the Future of Nuclear Science in May 1977. Thus the last major study of this Committee has, in effect, been adopted by the new in-house Advisory Committee and can be expected to influence the direction of research in this field for some years to come.

### U.S. NATIONAL COMMITTEES

U.S. national committees for international organizations, generally unions, commissions, or committees of the International Council of Scientific Unions (ICSU) provide a link between the U.S. scientific and technical community and the international organization representing a particular discipline or set of disciplines. They ensure the representation of U.S. views in the deliberations of the international body, assist in the planning and conduct of its meetings and related activities, and encourage, usually through travel grant programs, U.S. participation in them. In addition, many undertake special studies to foster progress nationally as well as internationally in the disciplines they represent. In fulfilling these responsibilities, they often work closely with U.S. scientific and technical societies--Corresponding Societies of this Assembly--thereby providing the Assembly's most vital and effective link with these groups. The level of activity of U.S. national committees varies, depending on the frequency of the General Assemblies or International Congresses of the international organization with which they are associated.

During CY 1978, U.S. national committees of this Assembly provided for U.S. representation in and assisted with program planning for ten international meetings. Also during 1978, eight U.S. national committees were already engaged in the planning of U.S. participation in international congresses and meetings that will take place in 1979, and seven were making preliminary plans for 1980 meetings.

A few U.S. national committees have rather extensive programs of special studies; for example, the U.S. National Committee for Geochemistry has a standing subcommittee on the geochemical environment in relation to health and disease under which four studies by *ad hoc* panels are in progress. This U.S. National Committee is also cooperating with the Geophysics Study Committee in a panel study on the research needed to improve understanding of the fundamental processes that determine the location of ores.

Perhaps the most active of the U.S. national committees during the past year was the U.S. National Committee for Rock Mechanics. In addition to cooperating with the Mackay School of Mines of the University of Nevada in the organization and conduct of the 19th Annual Symposium on Rock Mechanics in April 1978, the Committee issued two reports. *Limitations of Rock Mechanics in Energy-Resource Recovery and Development* (the content of which was summarized in the CY 1977 Annual Report) was published in January 1978. In June, the Committee issued its status report on rock mechanics titled *Report for 1977*. This report includes the reports of two *ad hoc* panel studies, as well as a summary of the published study mentioned above.

The report of the Committee's Panel on Rock Mechanics Problems related to Underground Construction and Tunneling identifies four areas in which greater research effort is required:

1. Identification and quantification of rock properties, including rock mass discontinuities, shear zones, and folds;
2. Determination of support requirements in relation to such conditions as overstress, loosening, and swell; prediction of support requirements prior to construction; design of support elements; and range of applicability of support systems;
3. Moleability (support of difficult ground and sudden ground changes);
4. Documentation of field behavior (quantification and correlation with geologic setting, documentation of solutions to particular problems, development of case histories).

The Panel on Rock Mechanics Problems related to Seismology and Earthquake Engineering also identified key problems in its field and recommended the following research approaches to their solution:

1. A continued research program aimed at understanding the physics of basic processes in earthquake movements, including friction, seismic-wave attenuation, dilatancy, diffusion, mechanical properties of fault gouge, slow rate effects, and mixed brittle plastic processes;
2. An expanded effort to solve the scaling problem through carefully designed, medium- and large-scale experiments and a continued effort to improve numerical modeling techniques;
3. An increased field observation and instrumentation program designed to improve the ability to collect meaningful data from deep boreholes.

The U.S. National Committee, having reviewed the work of its three panels and their findings, concluded that six technical problems in rock mechanics were critical in relation to energy resource recovery, construction, and seismology: (a) porosity/permeability determination, (b) *in situ* stress determination, (c) fracture pattern mapping, (d) thermo-properties determination, (e) rock fragmentation, and (f) laboratory-to-field test scaling. Further, numerical modeling was identified as a related problem. Although millions of dollars are spent on such simulations, their adequacy to handle realistic boundary conditions in this field is questionable.

The Committee then began the planning of a follow-up study to the three previous ones, with the objective of developing a detailed rock-mechanics research program to recommend to federal agencies. The study will specify types of research that are needed, guidelines for the conduct of this research and for determining what organizations are best equipped to undertake it, and projections of costs and time scales. Subpanels will address each of the problems outlined in the previous paragraph. Work on the study of rock-mechanics research requirements is scheduled to begin in October 1978, with a report to be issued in March 1980.

The U.S. National Committee for the International Union of Pure and Applied Chemistry (IUPAC) assisted in the planning and conduct of the "World Conference on Future Sources of Organic Raw Materials," which took place in Toronto,

Canada, in July 1978 under the joint sponsorship of IUPAC, the Chemical Institute of Canada, and the American Chemical Society. This Conference (called CHEMRAWN I) was the first project under a new IUPAC program, originally proposed by the U.S. National Committee for IUPAC, on Chemical Research Applied to World Needs. The objective of the program is to apply nongovernmental resources to the identification and solution of chemical problems that have an impact on world needs. The goals of the initial conference were to define the factors determining the supply of organic raw materials necessary to support world chemical industries through the end of this century and to encourage more effective long-range planning.

Approximately 790 individuals from 48 countries, including 34 from developing nations, attended. Judging from the comments of those who attended, the Organizing Committee, the officials of the three sponsoring organizations, the press, and others, CHEMRAWN I can be considered a great success. However, the ultimate value of the Conference will not be known until the effects of its recommendations and the extent to which they are implemented can be assessed. Post-Conference activities are currently directed toward devising the best way of placing the recommendations in the hands of major decision makers worldwide and beginning the planning of a follow-up Conference, CHEMRAWN II, which will be held in 1981 and will deal with "Chemistry, Agriculture, and World Food Supply."

#### OTHER ACTIVITIES

Other committees and boards of the Assembly were midway in the conduct or planning of studies during CY 1978 or were engaged in their customary ongoing responsibilities, for example, preparing responses and recommendations on proposed allocations of radio frequencies for scientific research (Committee on Radio Frequencies), evaluating some 420 proposals for basic research submitted to the Army Research Office (Committee on Recommendations for U.S. Army Basic Scientific Research), and cooperating with scientific and technical societies in the organization of symposia and conferences on special discipline-based subjects (Committee on High-Temperature Science and Technology and Committee on Kinetics of Chemical Reactions). The results of the work of a number of these committees will be the subjects of next year's "Highlights" section.

## NEW STUDIES PLANNED FOR CY 1979

At the close of CY 1978, many boards and committees of the Assembly had plans for new studies that they hoped to begin in 1979. Although some of these plans are still tentative and preliminary, this section will give an indication of the types of new activities likely to get under way during the coming year.

### CLIMATE RESEARCH BOARD

This Board is establishing an *ad hoc* panel that will conduct a one-year study of the present system of providing information on climate to federal agencies. The study will examine the decision-making process in a selected set of situations and will review plans of federal agencies for improving their systems for obtaining climate information and the use of such information. The panel will offer recommendations on ways to improve the handling and retrieval of data on climate and its application to federal decision making.

In addition, the Board is establishing a standing committee charged with conducting an on-going appraisal of the planning and implementation of the World Climate Program and advising the U.S. Government on scientific and institutional matters related to this Program. The Committee on International Climate Programs will also assist the Board in its efforts to increase and facilitate the participation of U.S. scientists in the international research effort. One of the first tasks of this Committee is to work with the Board and the Commission on International Relations in the organization and conduct of a workshop in June 1979 to consider the institutional framework for international climate programs. The goals of the workshop are

1. To define the objectives and scope of international programs dealing with climatic variability and the interactions between climate and society;
2. To identify and analyze the characteristics, capabilities, and deficiencies of various national and international, government and nongovernment, and bilateral and multilateral arrangements by which these objectives might be pursued;
3. To review plans for the WMO World Climate Program and make recommendations on U.S. participation in it;

4. To develop a conceptual basis for the development of international institutional approaches to the problem of possible climatic change resulting from the emission of carbon dioxide and other industrially related gases.

### GEOPHYSICS RESEARCH BOARD

The Board's Geophysics Study Committee has another in its series of studies beginning in the final months of CY 1978, with two more planned for 1979. The increasing scarcity of many essential elements has called attention to the urgent need for a better understanding of the fundamental processes that determine the location of ore bodies. The Board's new study on Mineral Resources, a joint effort with the U.S. National Committee for Geochemistry, will deal with the level of effort of present research, inadequacies in data, the current understanding of processes of mineral concentration, and the relationship of research on these processes to future supplies of critical minerals.

Planned to begin early in 1979 is a study of Sun, Weather, and Climate, which will address this question: Do changes in the sun influence weather or climate, and if so, how? Past studies have produced confusing results because of the statistical methodology employed and the lack of identifiable physical mechanisms relating solar parameters to weather and climate. The Geophysics Study Committee believes that re-examination of this question is timely, thus a panel is being formed to consider solar variability, empirical evidence for meteorological effects, and possible physical mechanisms.

A second panel study planned for CY 1979 will deal with Hydrological Sciences and Water Management. Advances in the application of management science to hydrologic systems tend to emphasize the interactions of statistics, economics, operations research, and public-policy analysis and to obscure those connections with physics, chemistry, and biology that make hydrology a substantive discipline in its own right. As social and economic pressures for the use of natural resources become more intense, and as technology demands more renewable resources, a better understanding of the basic processes of the hydrologic cycle and of ways these processes might be adjusted for the benefit of humanity will be essential. The objective of the study will be to identify some of the problems in hydrological science, to show how these problems affect water-resource management, and to identify strategies for their solution.

The Geophysics Research Board's Committee on Solar-Terrestrial Research is engaged in plans for U.S. cooperation in two international research programs planned for the early 1980's. The main objective of the Middle Atmosphere Program (MAP) is to develop a model of the stratosphere and mesosphere as a unitary physical system. This goal will be achieved through coordinated observations of structure, composition, motions on all scales, and energetics--factors that interact in the middle atmosphere and across its boundaries. All appropriate techniques, whether with spacecraft, balloons, rockets, or on the ground, will be employed. The period of maximum effort will be in 1982-1985. The Committee on Solar-Terrestrial Research has appointed a U.S. Panel for MAP to guide U.S. participation in it.



The second international effort is the Solar Maximum Year, which is a program to coordinate, on very short time scales, a great variety of terrestrial observations of the sun and interplanetary medium with observations made from spacecraft (chiefly NASA's Solar Maximum Mission satellite) during the interval from August to February 1981, which is expected to coincide with the next solar maximum. The program will emphasize investigation of the solar-flare process, including preflare processes and postflare phenomena that are propagated through the interplanetary medium to planetary atmospheres and magnetospheres. The Committee on Solar-Terrestrial Research is cooperating in the planning of this program.

Further, because the last comprehensive review of the entire field of solar-terrestrial physics (which includes astrophysics, plasma physics and magnetohydrodynamics, physics of neutral gases, chemistry, solar physics, cosmic rays, geomagnetism, ionospheric studies, aeronomy, and meteorology) occurred in 1969, the Committee organized a summer study in 1978 as a first step toward meeting the need for a new review and for recommendations on priorities for the 1980's. The scope of this study was limited to the neutral atmosphere from the tropopause upward and to the direct interaction of the neutral atmosphere with the ionized atmosphere and magnetosphere. The report "Upper Atmosphere Research in the 1980's (Ground-Based, Rockets, Balloons, and Aircraft)" is nearing completion, and the Committee has now begun the planning of a follow-up study for summer 1979 that will build on the results of the initial study and on related work of the Space Science Board. The 1979 study will consider principally ground-based and airborne or rocketborne techniques. It will identify the physical variables that should be measured and indicate the techniques applicable to each. Most important, it will offer recommendations on the direction solar-terrestrial research should take in the next decade.

#### NAVAL STUDIES BOARD

In cooperation with the Ocean Sciences Board, the Ocean Policy Board of the Commission on International Relations, and the Marine Board of the Assembly of Engineering, the Naval Studies Board is organizing a Panel on Naval Oceanography, which is expected to begin its studies early in 1979. Its objectives are (a) to evaluate the present status of ocean science and technology in the Navy, including manpower and institutional needs and the relationship of ocean sciences to physics, chemistry, applied mathematics, computing, and engineering; (b) to recommend specific initiatives that the Office of Naval Research, either alone or in cooperation with other agencies, could take to extend the national capability in ocean sciences; and (c) to alert the Office of Naval Research to any subfields of ocean science warranting greater attention and effort because of their potential for its program.

Another new project of the Board is the sponsoring of a lecture series at the U.S. Naval Postgraduate School and the U.S. Naval War College. The lectures, which would be presented by senior scientists and engineers, would treat various fields of science and technology and would be designed to help naval officers (present and future) understand and have a better appreciation

of the vital role of science and technology in naval operations. Plans are to name the lecture series for Admiral Charles H. Davis, if his heirs approve. Admiral Davis played a prominent part in the establishment of the National Academy of Sciences in 1863 while serving as the Navy's Chief of Navigation; he well exemplifies the understanding of the role of science and technology in naval affairs that the series would attempt to illustrate and preserve. Navy personnel are enthusiastic about the plans for this lecture series, and it is likely that the first lecture will take place in fall 1979.

#### OCEAN SCIENCES BOARD

A problem of concern to the Ocean Sciences Board and the focus of one of its planned studies is ocean fishery resources management. Unilateral pronouncements in which coastal nations assert jurisdiction over coastal fisheries in a region extending some 200 miles to sea are increasing. In the case of the United States, the Fishery Conservation and Management Act of 1976 provides that the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration shall exercise such management responsibilities for U.S. coastal waters. The Act requires that management decisions be reached on the tonnage allocations for U.S. and foreign fisheries in U.S. coastal waters. These decisions must take into consideration economic, political, and ecological factors. Currently, the data on which such decisions are based are exceedingly limited. The Board believes that an in-depth examination of the interdependencies of biological species and of their responses to oceanographic factors is needed. There is also need for new theoretical approaches, including methods of handling large quantities of loosely related data, that would facilitate research on specific links between the physical and chemical properties of the ocean and the reactions of multiple biological species.

As a result of its review of the *Oceanlab* Project and completion of the Post-IDOE (International Decade of Ocean Exploration) study, the Ocean Sciences Board has also become concerned about the extent to which future ocean-science research might be limited by inadequate facilities and technologies. Several large-scale ocean-research activities that will require technological developments are now under way or in the planning stage, including the *Oceanlab* (a mobile undersea laboratory), long-coring, deep-sea drilling, deep-water/sediment interface studies, and exploration of continental margins. The Board plans to assemble a small group of experts in ocean science and ocean technology to consider the science that needs to be done in the next decade and the technologies that will be required. Such technologies would include manned and unmanned, direct and remote sensing, expendable or reusable instrumentation, or some combination of these.

## POLAR RESEARCH BOARD

The Board is considering a study to develop a strategy for polar research in the 1980's. The means of arriving at this strategy would be a series of reports each focusing on research opportunities and problems unique to the polar regions and providing guidance to universities, research organizations, and funding agencies on the kinds of information that must be sought, not only to ensure the orderly advance of this field but to guide decisions on resource management and environmental protection as nations turn increasingly to the polar regions in the search for solutions to problems of food, energy, water, and other resources. In undertaking such a study, the Board would be following the example of a number of other Assembly committees that currently have such studies in progress or have recently completed them.

## SPACE SCIENCE BOARD

The Board has become increasingly aware of the need for a study of potential problems and future technological directions in data acquisition, handling, and computation. In particular, imaging data will soon become an important information-processing problem. The Board, therefore, plans to organize a Committee on Data Management to investigate these problems. The Committee, to be formed by the end of 1978, would operate for some three years, issuing a report on its findings by 1981. Issues it would investigate include data system planning for space missions, location and degree of preprocessing of data, methods of data distribution to users, data standardization and fidelity techniques, timeliness of software development, distribution of computational facilities, mass data storage and retrieval practices, and desirability of interactive processing. Disciplines to be represented on the committee would be geophysics, oceanography, meteorology, atmospheric physics, solar physics, astronomy, high-energy astrophysics, and other related earth and space sciences.

## U.S. COMMITTEE FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM

A panel of this Committee assisted in the planning and conduct of the 1974 GARP Atlantic Tropical Experiment--the first major GARP field program--and has since worked to stimulate research based on the data sets from this Experiment. It is now planning a 1979 summer study to review the impact of these data on large-scale numerical modeling. It is anticipated that the results of this study will be especially important to those scientists who are planning research based on the data from the Global Weather Experiment, which will be in progress from late 1978 through 1979.

## COMMITTEE ON ATOMIC AND MOLECULAR SCIENCE

In 1971, the Committee published a detailed review of this field--its past contributions, current status, promising new lines of research, and funding needs. Subsequently, it published two brief special studies dealing with the contributions of atomic and molecular science to energy research and the opportunities afforded by accelerators for research in atomic physics. The Committee now proposes to update its earlier survey with a two-year study to characterize the present state of research in atomic and molecular science. It will collect information on numbers of researchers in this field, the nature of their work, their geographical location, the organizations in which such research is performed, manpower and curriculum needs, and levels and sources of support. Based on its findings, the Committee will prepare a report on the health and future directions of the field, with recommendations on policies that would ensure its continuing progress. In addition to the report, a directory of atomic and molecular scientists currently active in the United States will be generated. The anticipated audience for the report includes the community of researchers in this field and the federal agencies and other organizations that support such work.

## COMMITTEE ON CHEMICAL SCIENCES

The Committee plans the organization of two new subcommittees, one of which would be concerned with nuclear and radiochemistry. It would follow up and extend the work of the former Subcommittee on Radiochemistry of the now disbanded Committee on Nuclear Science. Among the specific activities proposed for the new subcommittee are

1. To alert federal agencies to instructional and research needs in nuclear and radiochemistry, to needs for radiochemical standards, and to needs for low-background materials for construction of instruments;
2. To provide assistance to federal agencies on problems relating to nuclear and radiochemistry;
3. To continue the publication program of the former Subcommittee on Radiochemistry (which issued a series of more than 60 monographs on radiochemistry of the elements and the application of radiochemical procedures in other fields);
4. To organize workshops, conferences, symposia, and special studies in response to needs that it identifies.

The second proposed subcommittee would conduct a study of information storage and retrieval in chemistry, in line with the recommendations of an *ad hoc* group convened by the Advisory Board to the Office of Chemistry and Chemical Technology in October 1977 to consider the need for such a study. The study would be limited initially to secondary services (i.e., abstracting, indexing, and special alerting and awareness services). It would examine the

economic impact of future information technology on these services, the intellectual impact of future information technology, educational problems resulting from modern information storage and retrieval methods, support of research in information science, and problems relating to the storage and retrieval of numerical data.

### COMMITTEE ON GEODESY

In the course of its study on the status of this field, the Committee encountered a number of questions requiring more detailed study before useful recommendations could be offered. Accordingly, it is now planning to follow up its initial broad overview with a number of *ad hoc* panel studies addressed to such questions as these:

1. What geodetic instrumentation and observing programs are required for geodynamic purposes, in particular, to improve understanding of tectonic motions and to enhance earthquake prediction capability?
2. How should the Department of Defense Global Positioning System be used for geodesy and surveying?
3. What should be the role of federal geodetic and mapping agencies in working with states to establish a multipurpose cadastre?
4. What are the applications of the gravity field, and what observations are required to satisfy these applications?
5. What are the applications of the satellite altimetry data, and what should be done to ensure that these data are effectively applied?
6. How can present and planned geodetic technology be most effectively transferred to users?
7. What is the economic benefit of geodesy?
8. What is the present status of the 1973 Report of the Federal Mapping Task Force on Mapping, Charting, Geodesy, and Surveying, and what further actions might be taken to improve the health and vitality of geodesy and related sciences?

Based on the findings of the various panel studies, the Committee will then prepare a report and recommendations.

Another new project of the Committee on Geodesy results from a recommendation made by the Ocean Sciences Board in its report to the National Oceanic and Atmospheric Administration (*The Quality of NOAA's Ocean Research and Development Program--An Evaluation*). As recommended, the National Ocean Survey has requested a peer review of its research and development programs in geodesy and related areas; it has asked the Committee on Geodesy to undertake this review. Thus the Committee plans an evaluative study that would include assessment of (a) the relative quality of research and development in relation to the scientific and engineering state of the art; (b) the strengths and weaknesses of each program area; (c) the adequacy of support for the research and development programs and the likelihood of achieving program objectives; and (d) the adequacy of communications between NOAA scientists and engineers and

others, outside government, engaged in similar or related research and development. The Committee will also consider whether the research and development programs in geodesy and related areas are responsive to the needs of the agency and, more broadly, the nation. The study will require site visits, the preparation of draft reports on various aspects of the program, and development of a comprehensive final report.

#### NUMERICAL DATA ADVISORY BOARD

The Board plans a conference in 1979 to explore problems related to the validation of various interdisciplinary and new types of data that are needed for decisions in fields such as energy, environment, health, housing, and transportation. Examples of these kinds of data are relationships between energy alternatives and economic measures, comparisons among various fuel forms, and comparisons of energy-conversion processes. These data do not lend themselves readily to, and usually have not been subjected to, the types of evaluation applied to the fundamental constants of physics and chemistry. Yet there is urgent need to establish the reliability and validity of the data that will be used as a basis for decisions on national problems. The Board believes that bringing together experts in the handling of the more traditional types of numerical data and those attempting to work with and evaluate these other types of data would result in a useful interchange and improved handling and assessment of the newer, interdisciplinary types of data. Objectives would include defining and characterizing the types of data to which present numerical data methods can be applied, exploring ways in which the handling and evaluation of interdisciplinary, sociotechnical, and nonphysicochemical data can be improved, and minimizing any duplication of effort in data-handling and -assessment methods.

#### COMPUTER SCIENCE AND TECHNOLOGY BOARD

The Board plans a two-year study of the conduct of basic research in computer science and engineering in academic and nonacademic settings and of the effects of possible shifts in research funding on the course of basic research in this field. The study would be conducted by an *ad hoc* panel composed of representatives of various computer-science subfields and principal segments of the computer industry. Work would begin with a survey of the present distribution of U.S. research effort in computer science and engineering among hardware design, computer architecture, programming, artificial intelligence, advanced computer applications, and theory of computation and numerical analysis. The status of research in each of these fields would be characterized in detail--number, age distribution, and training of researchers; facilities and support requirements; scope of academic, industrial, and government research funding; any short- or long-term impact of the research on productivity;

and the like. Following the data-collection phase, the panel would be able to describe the research styles and paradigms in academic and nonacademic organizations working in these various fields and to identify institutional factors that influence the successful performance and application of basic research. The panel would next attempt to determine the likely effects of shifts in research funding on (a) the quality of education in computer science and engineering, (b) the supply of trained specialists in various fields of computer science and engineering, (c) the quality of computing facilities in the universities and industry, and (d) the development of closer cooperation between university computer-science departments and industrial laboratories. A comprehensive report on the data, findings, and projections of the panel would be issued. Such a report should be of interest to the computer science and engineering community as well as offering helpful guidance to federal agencies in their efforts to make judicious selections among policy alternatives.

#### U.S. NATIONAL COMMITTEE FOR GEOCHEMISTRY

The term "asbestos" is being applied to a variety of minerals occurring in an even greater variety of rocks mined for many different purposes (from vermiculite and talc to serpentinites quarried for construction stone). Quite specific regulations in regard to limits for asbestos content of air are being promulgated, although clear-cut answers to such questions as the following are lacking: Are all fibrous minerals carcinogens? Are those that are carcinogenic so because of their chemical or their physical properties, or both? Is the fiber merely a carrier or a carcinogenic agent? Is the human body susceptible to harm from both ingestion and inhalation of fibers? Concern about this situation has led to plans for a panel study under the Subcommittee on the Geochemical Environment in Relation to Health and Disease of the U.S. National Committee for Geochemistry that would evaluate the evidence relating exposure to mineral particles to diseases experienced by "asbestos" workers, identify gaps in the data base, and recommend research to provide a sounder basis for studying cause-effect relationships. The NRC Assembly of Life Sciences will work with the Subcommittee in the planning and conduct of this study.

#### COMMITTEE ON HAZARDOUS SUBSTANCES IN THE LABORATORY

The need for an NRC study of procedures for the safe handling and disposal of toxic substances in the laboratory was recognized late in 1975 at a meeting convened by the Advisory Board to the Office of Chemistry and Chemical Technology. The planning session resulted in a proposal for a study to appraise the character and magnitude of laboratory hazards, to suggest procedures that would minimize risk without crippling laboratory operations, and to prepare a

report on findings and recommendations that could be used by laboratory scientists and administrators to ensure that laboratory operations would not adversely affect the health and safety of their personnel and the neighboring community. Difficulties in obtaining support for such a study delayed its organization until the final weeks of 1978, although in the chemical community there was growing concern about the need for better data and guidelines as a basis for proposed regulatory measures. The planned two-year study is now expected to get under way at the beginning of CY 1979. The Assembly of Life Sciences is cooperating with this Assembly in the planning of the study.

#### COMMITTEE ON GEOLOGICAL AND MATERIALS SCIENCES

As a result of a planning effort sponsored by the Office of Earth Sciences, the Assembly approved late in 1978 the organization of a new *ad hoc* committee to stimulate greater interaction between the geological and materials sciences communities. The Committee, which is charged with the following tasks, is expected to begin its work in 1979. It will

1. Identify barriers to effective interaction between these fields in universities, industry, and government;
2. Examine ways to bring basic interdisciplinary research into long-range planning for large geoscience projects;
3. Consider the need for regional or national centers that would provide special facilities for interdisciplinary research;
4. Foster greater interaction between geoscientists and materials scientists through conferences, symposia, lecture series, workshops, and the like;
5. Stimulate the publication of state-of-the-art reviews, with special emphasis on interdisciplinary research opportunities.



## THE ASSEMBLY PROGRAM IN CY 1978

This section presents the organizational structure, studies completed and planned, and membership of Assembly boards, committees, and U.S. national committees. Within these three categories, activities are arranged alphabetically. In the membership lists, the dates following names indicate the year in which a member's term will be completed, usually on June 30, although some U.S. national committees operate on slightly different schedules geared to the occurrence of international meetings. *Ad hoc* committees and groups convened for single, short-term studies are not generally assigned specific terms, for such groups are discharged on completion of their work.

Reports issued by Assembly boards, committees, and U.S. national committees are listed in the Appendix.

### BOARDS

#### CLIMATE RESEARCH BOARD

Concern about the increasing sensitivity of society to variations in climate and the possibilities for human intervention in climate led to the creation of the Climate Research Board in 1977. The Board's task is to act as a channel for interaction between the scientific community and the federal government in the development of effective, comprehensive, and well-coordinated climate programs. Within the NRC, the Board serves as the focus for the climate-related activities of many other units, ensuring the development of a coherent, well-coordinated overall program and providing a channel for consistent and authoritative advice to the federal government on climate-related problems. In particular, the Board expects to assist the government in the planning and implementation of the currently evolving National Climate Program.

Specific functions of the Board include the following:

1. To assess the effectiveness of, and need for, climate services, the state of understanding and ability to predict climatic variations, the impacts of climatic change on society, and the extent to which man's activities influence climate;
2. To foster the development of a comprehensive National Climate Program encompassing climate services, research, and applications;
3. By employing the resources of the scientific and technical communities,

to provide guidance to the federal government in the development of a National Climate Program;

4. To foster the development of international programs in climate by international scientific and intergovernmental agencies and to participate in the planning and development of these efforts;

5. To provide, on behalf of the NRC, a coherent and authoritative source of information for government, the news media, and the public.

During the past calendar year, the Board organized two workshops, the first an International Workshop on Climate Issues, took place April 24-28, 1978, at Laxenburg, Austria. Its objective was to identify climate issues of international concern to be addressed by the World Climate Conference and the World Climate Program. The second was a Workshop on Assessment of U.S. Climate Program Planning, held July 12-19, 1978, at Woods Hole, Massachusetts. The goal was to assess the present status of federal agency planning for the U.S. Climate Program, with particular attention to FY 1980.

An initial task of the Board was to review climate plans and programs of federal agencies as background for the definition of its work in CY 1978 and CY 1979. Based on its findings, the Board approved the establishment of a panel on Effective Use of Climate Information in Government Decision Making, which will review the effectiveness of the use of climate data and services in decisions of federal agencies, and a standing committee on International Climate Programs, which will advise the federal government on U.S. participation in the World Climate Program.

#### International Workshop on Climate Issues

In accordance with its charge to encourage international cooperation on climate-related matters, the Board convened an International Workshop on Climate Issues in April 1978, at facilities of the International Institute for Applied Systems Analysis, conjointly with a meeting of the World Meteorological Organization, to prepare for the World Climate Conference, which will be held in February 1979, in Geneva, Switzerland. Approximately 40 experts from developed and developing nations examined the full range of climatic impacts on various aspects of the economy and discussed the implications of such assessments for the World Climate Conference and the World Climate Program. The Workshop highlighted the need for much greater understanding of these climatic impacts and recommended approaches to organizing and carrying out an effective international program to improve understanding and the ability to cope with climate-related problems. The examination of case histories clearly showed that the impacts of climatic variability are complex and depend directly on the economic and political infrastructure in the regions affected. Workshop participants also considered scientific priorities for the World Climate Program in light of the socioeconomic impacts of climatic variability and change and the state of present scientific knowledge. They recommended that the World Climate Program focus on a small number of issues. In particular, they thought that the problems associated with (a) increasing carbon dioxide, (b) seasonal and inter-annual climate prediction, and (c) the establishment of climatic data bases

in developing nations deserved the highest priority. A report on this study was published late in 1978.

#### Workshop on Assessment for U.S. Climate Program Planning

In response to a request from federal agencies concerned with climate, the Board undertook an assessment of the status of governmentwide planning for the U.S. Climate Program. The shortness of the required response time led to a decision to carry out this assessment at a Summer Workshop at Woods Hole, Massachusetts, in July 1978. Workshop participants considered the overall structure of the Climate Program Plan, as well as the planning for research, services, impact studies, and international aspects of the Program. The Board's recommendations, based on this intensive study, will provide input to the preparation of U.S. Climate Program plans for FY 1980. Publication of the report on the workshop is expected by the end of 1978.

#### Panel on Effective Use of Climate Data in Government Decision Making

The task of this Panel (membership not yet appointed) is to conduct a one-year study of the present system of providing climatic information to federal agencies. It will examine the decision-making process in a selected set of situations and will review plans of federal agencies for improving the climatic information system and decision-making process. The Panel will explore ways to improve the effectiveness of the use of climate data and services in government decision making and offer recommendations to the relevant agencies.

#### Committee on International Climate Programs

This Committee, which will hold its first meeting in January 1979, will be a standing committee of the Board, with the responsibility to conduct a continuing appraisal of the planning and implementation of the World Climate Program, as well as to advise the U.S. Government on scientific and institutional matters related to this Program. The Board and its Committee will attempt to increase and facilitate the participation and contribution of U.S. scientists to the international climate effort and also to coordinate NRC participation in this effort. One of its first tasks will be to organize and oversee the work of a steering committee for a study of the institutional framework for international climate programs, described in the following section.

#### Study of the Institutional Framework for International Climate Programs

In an address to the Climate Research Board at its March 1978 meeting, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, Patsy T. Mink, called attention not only to the need for international cooperation in climate research but also to the many problems of institutional arrangements for such programs. Governmental and nongovernmental organizations, specialized agencies of the United Nations, bilateral agreements,

and special institutions such as the International Institute for Applied Systems Analysis--all have a part to play in international cooperative climate programs, but their coordination to achieve an effective program is difficult. This problem was also emphasized at the Board's International Workshop on Climate Issues, where an institutional framework for one component of a World Climate Program was proposed.

In cooperation with the NRC Commission on International Relations and with the encouragement of the Office of Environmental Affairs, U.S. Department of State, the Board has begun the planning of a 1979 workshop to review and evaluate various institutional arrangements for the conduct of international climate programs, with particular attention to the relationship of such arrangements to U.S. national objectives and to their effectiveness in dealing with problems of large-scale climate changes resulting from carbon dioxide emissions. Climatic changes could benefit some nations while harming others; therefore, the development of effective regulatory and compensatory measures becomes exceedingly complex.

The Board plans to convene a group of about 20 experts in June 1979 to (a) define desirable objectives and the scope of international programs on climate variability and the interaction between climate and society; (b) identify and analyze the characteristics, capabilities, and deficiencies of various international institutions and arrangements for working toward these objectives; (c) review plans for the World Meteorological Organization (WMO) World Climate Program and make recommendations on U.S. participation; and (d) develop a conceptual basis for international institutional approaches to the problem of possible climatic change as a result of emission of carbon dioxide and other industrially related gases. A report on the findings of the workshop would be issued by the end of CY 1979.

#### Membership

Robert M. White (Chairman)  
Assembly of Mathematical  
and Physical Sciences  
National Research Council

Francis Bretherton (1979)  
National Center for Atmospheric  
Research  
(Geophysical fluid dynamics)

Dayton Clewell (1980)  
Formerly, Mobil Oil Corporation  
(Energy)

Herbert Friedman (1980)  
Space Science Division  
Naval Research Laboratory  
(Astrophysics)

J. Herbert Hollomon (1980)  
Center for Policy Alternatives  
Massachusetts Institute of Technology  
(Public policy, systems analysis)

Charles Howe (1980)  
Department of Economics  
University of Colorado  
(Economics)

John Imbrie (1981)  
Department of Geological Sciences  
Brown University  
(Paleoclimate)

Francis S. Johnson (1979)  
Center for Advanced Studies  
University of Texas at Dallas  
(Upper atmosphere)

John E. Kutzbach (1979)  
Center for Climate Research  
University of Wisconsin  
(Climatology)

Cecil E. Leith, Jr. (1981)  
National Center for Atmospheric  
Research  
(Atmospheric dynamics)

Thomas F. Malone (1979)  
Holcomb Research Institute  
Butler University  
(Meteorology)

William A. Nierenberg (1981)  
Scripps Institution of Oceanography  
University of California at San Diego  
(Oceanography)

Joseph Smagorinsky (1980)  
Geophysical Fluid Dynamics Laboratory  
Princeton University  
(Atmospheric dynamics)

Frederick E. Smith (1981)  
Graduate School of Design  
Harvard University  
(Ecology)

Executive Secretary: John S. Perry  
Staff Associate: Barbara L. Neff

Verner E. Suomi (1981)  
Space Science and Engineering Center  
University of Wisconsin  
(Meteorological satellites)

Karl T. Turekian (1980)  
Department of Geology and Geophysics  
Yale University  
(Geochemistry)

John Waelti (1981)  
Water Resources Research Center  
University of Minnesota  
(Agricultural economist)

Sylvan H. Wittwer (1981)  
Agricultural Experiment Station  
Michigan State University  
(Agriculture)

*Assembly Liaison Representatives*  
Preston Cloud  
U.S. Geological Survey  
University of California at  
Santa Barbara

Robert G. Fleagle  
University of Washington

Richard S. Lindzen  
Harvard University

#### COMPUTER SCIENCE AND TECHNOLOGY BOARD

This Board is concerned with scientific and discipline-oriented issues in computer science, as well as related problems in associated fields of technology. The Governing Board authorized its creation in September 1976, and its membership was selected and appointed in spring 1977.

The Board held its second meeting in November 1977, during which it agreed that, initially, it should make an assessment of one or more of the following:

1. The nature and dynamics of hardware/software/algorithms;
2. The coherence of research and development for robot and remote handling of sensors/effectors;
3. The effect on the "white collar" segment of the work force caused by changes in productivity resulting from the evolution of computer/communications technology;
4. The effectiveness of federal funding of computer science and engineering research at universities;

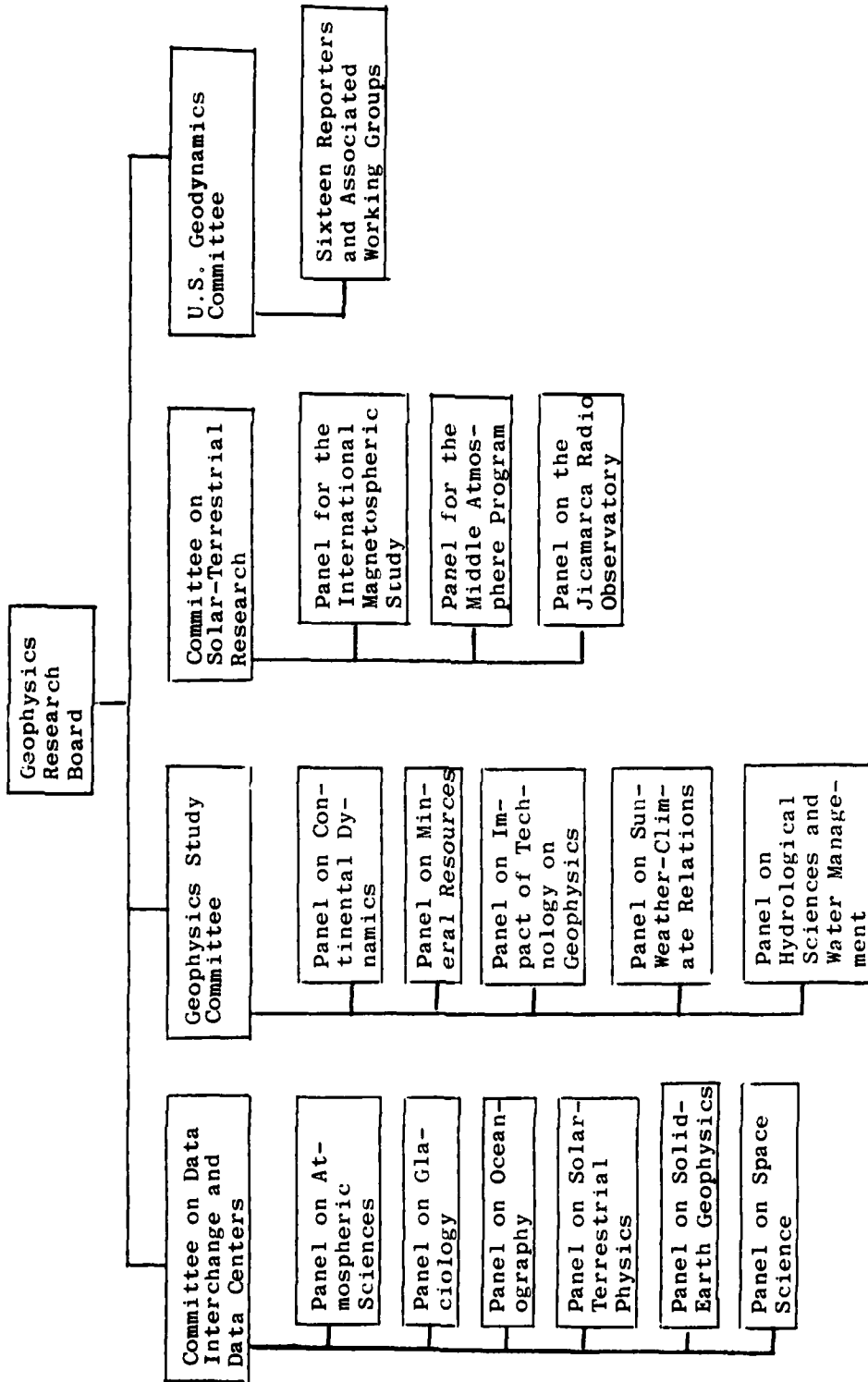
5. The impact on software economics of the restrictions on procurement of computer equipment.

The National Science Foundation has indicated an interest in a study that would focus on the conduct of basic research and its interaction with applied research and development. One of the objectives of such a study would be to attempt to characterize in each of the various computer-science subfields the prevailing research styles and paradigms and the institutional factors that influence successful performance and exploitation of research.

#### Membership

|   |   |
|---|---|
| Victor Vyssotsky (Chairman) (1979)<br>Bell Laboratories<br>(Computer science)   | Arthur J. Levenson (1979)<br>Silver Spring, Maryland<br>(Retired, National Security Agency)   |
| Frederick P. Brooks, Jr. (1980)<br>Department of Computer and<br>Information Science<br>University of North Carolina<br>(Design of digital computers,<br>interactive computer graphics) | Anthony Ralston (1979)<br>Department of Computer Science<br>State University of New York at Buffalo<br>(Education in computer science, numerical<br>analysis, programming languages)  |
| George G. Dodd (1979)<br>Department of Computer Science<br>General Motors Research Laboratories<br>(Research in computer systems,<br>languages, artificial intelligence)                | Jacob T. Schwartz (1980)<br>Courant Institute of Mathematical<br>Sciences<br>New York University (on leave to<br>Stanford University)<br>(Functional analysis, quantum theory,<br>spectral theory of operators, com-<br>puters) |
| Bernard A. Galler (1979)<br>Computer and Communications Science<br>University of Michigan<br>(Digital computers, automatic<br>programming, mathematical logic)                          | Ivan E. Sutherland (1980)<br>Department of Computer Science<br>California Institute of Technology<br>(Computer science, electrical engineer-<br>ing)  |
| Jerrier A. Haddad (1980)<br>IBM Corporation<br>(Management in engineering, program-<br>ming, and technology areas)  | <i>Assembly Liaison Representatives</i><br>Albert M. Clogston<br>Bell Laboratories  |
| Richard M. Karp (1980)<br>Computer Science Division<br>University of California at Berkeley<br>(Computer science, computational<br>complexity, combinatorial algorithms)                | Bradley Efron<br>Department of Statistics<br>Stanford University  |
| Joshua Lederberg (1979)<br>Rockefeller University<br>(Genetics and evolution, science policy,<br>computer science)  | Carl H. Savit<br>Western Geophysical Company of<br>America  |
| Executive Secretary: Jacob K. Goldhaber   |   |

GEOPHYSICS RESEARCH BOARD



## GEOPHYSICS RESEARCH BOARD

The Geophysics Research Board was established in 1960 to effect participation by U.S. scientists in the activities of international geophysical organizations and to stimulate and encourage research in geophysics and related fields. The Board is composed primarily of the chairmen or representatives of relevant NRC committees. Several committees and panels work directly under the Board. The principal ones are the Geophysics Study Committee, the Committee on Data Interchange and Data Centers, the Committee on Solar-Terrestrial Research and its Panel on the International Magnetospheric Study, and the U.S. Geodynamics Committee.

At its September 1978 meeting, the Board addressed various matters, including the following. It reviewed the series of Studies in Geophysics and encouraged the Geophysics Study Committee to undertake several new studies. It reviewed the report of the Committee on Data Interchange and Data Centers, strongly supporting the recommendation that a national geophysical data policy be developed. It also supported the proposal that the Special Committee on Solar-Terrestrial Physics (of the International Council of Scientific Unions) be converted to a Scientific Committee of ICSU with an indefinite term of activity. The Board further recommended that the U.S. Geodynamics Committee be continued (without change of name) to carry forward the new program in geodynamics in the 1980's. The Board expressed strong support for the basic recommendation of the Workshop on Continental Drilling for Scientific Purposes, namely, that a national program be established, especially to provide for coordination and communication.

The following sections describe the activities of the Board's committees and their panels during CY 1978.

## Geophysics Study Committee

In 1973, the Geophysics Research Board discussed the need for a survey of geophysics along the lines of *Physics in Perspective*. Because of the particularly wide-ranging character of geophysics, the Board decided that a series of studies over an extended period of time would be preferable. These studies would treat questions bearing on societal problems or on science policy related to geophysics. The Geophysics Study Committee was established in 1974 to guide the studies.

The purpose of the studies is twofold: to provide assessments from the scientific community to aid policymakers in reaching decisions on societal problems and on science policy issues that relate to geophysics and to evaluate the adequacy of research strategies to provide the information required for these decisions. The following studies have been completed and published: *Energy and Climate; Estuaries, Geophysics, and the Environment; The Upper Atmosphere and Magnetosphere; Climate, Climatic Change, and Water Supply; and Geophysical Predictions*. Studies in progress include "Impact of Technology on Geophysics," "Continental Dynamics," "Principles of Element Concentration," and "Sun-Weather-Climate Relations." A study on hydrological sciences and water management is in the planning stage. Other topics under consideration



by the Geophysics Study Committee are paleoclimatology and large-scale monitoring of the ocean surface.

Some of the principal findings and recommendations of the studies thus far completed follow.

### Energy and Climate

A principal conclusion of the report is that the climatic effects of carbon dioxide release may be the primary limiting factor on the use of fossil fuels over the next few centuries. On the basis of a scenario for growth of energy use for the next century, an increase in carbon dioxide concentration in the atmosphere by a factor of from 4 to 8 is foreseen for the latter part of the twenty-second century. The report anticipates that the threat of a corresponding increase in world temperatures of over 6°C would lead to a curtailment in the growth of fossil-fuel use long before this scenario could fully unfold. The study offers scientific recommendations for research to reduce uncertainties and to achieve a fuller knowledge of the physical and biological processes involved.

### Geophysics of Estuaries

Compared with the science of rivers and lakes and that of deep oceans, the science of estuaries is extraordinarily complex. If we consider strictly the geophysics of water bodies, there is a recognizable group of scientists--hydrologists--studying the inland water and a corresponding group--deep-sea oceanographers--studying the oceans. There is not an analogous, identifiable group working in a traditional discipline to study estuaries and their associated coastal waters *per se*. The study includes recommendations for dealing with this recurrent theme: division of responsibility among many agencies and of research effort among many disciplines.

### Upper-Atmosphere Geophysics

Rockets and satellites have probed the upper atmosphere and magnetosphere for the last two to three decades. It is natural to wonder whether, after such extensive study, most of the interesting and important problems have been solved. The understanding of phenomena in the upper atmosphere and space, documented in the papers of this study, is impressive, but, in fact, new and important physical processes taking place in the upper atmosphere continue to be discovered. A principal conclusion is that many significant problems remain.

### Water and Climate

Lack of water hampers economic and population growth in some areas of the world, but even in these areas it is common to think of water as a renewable resource, within the bounds imposed by a stationary regional climate. Unexpected, prolonged, and widespread shortages of water resulting from climatic

change could have an unsettling and depressing effect on regional, possibly even the national, economy. However, for a number of reasons, including institutional factors associated with water-resource design (in the context of climatic change), the rate at which climatic change can be expected to occur, and the ability to predict it, the study group preparing this report did not believe that a radical revision in current water-resource design practices was appropriate. Yet a dramatic change in climate that would place the validity of this reasoning in doubt is quite possible. A great deal could be done now that would allow for mitigation of the effects of possible climatic changes on future water supplies. Thus the study's examination of the relationship between hydrology, water supply, climate, and climatic change, calling particular attention to deficiencies in knowledge that make rational water-resource decision making more difficult than it need be, should provide some useful guidelines for those concerned with the management of water supplies.

### Geophysical Predictions

This study deals principally with those geophysical predictions intended to reduce loss of life and to protect property, for example, prediction of earthquakes. Other hazards discussed in the report include volcanic eruptions, hurricanes, tornadoes, and tsunamis. The report emphasizes the wide discrepancy in the understanding of causal relations and the actual ability to predict, ranging from the near certainty of tidal predictions to rudimentary attempts to predict earthquakes. In most fields, much research lies ahead. The study calls for greater interdisciplinary communication in attacking the problems presented by geophysical predictions and for closer examination of the social, economic, and legal consequences of predictions. For example, should public response to predictions, under certain circumstances, be regulated by law or dictated by emergency authorities? What are the proper means of communication of predictions to those potentially affected? What types of individual and community preparedness should be considered? The report concludes by calling for greater interaction between geophysical and social sciences in exploring the impact of major geophysical disasters and of public reactions to the threat of future calamities.

### Impact of Technology on Geophysics

Technology has a profound impact on geophysical research, primarily through the instrumentation and research techniques that it makes possible. In turn, geoscience contributes extensively to technology and to practical applications. Fields in which this interaction has been especially evident include meteorology, water resources, mineral resources, ocean resources, and cartography. Future possibilities for the productive interplay of geophysics with technology and *vice versa* are weather modification, climate prediction, and earthquake prediction. The study focuses on the importance of technology to progress in geophysical research and gives examples; it does not attempt to create an exhaustive catalogue. The report was completed by the end of CY 1978.

Studies in progress or at an advanced stage in planning include the following.

## Continental Dynamics

Continental areas of the world are the natural human habitat, thus it is reasonable that a significant research effort should be directed toward obtaining greater knowledge of land areas and their interface at continental margins with the marine environment. A major goal of earth sciences during the next decade will be improved understanding of continental geology, in its broadest sense--all processes that affect the continents, within and below the lithosphere. The majority of material resources accessible during the next decade will come from the continents; therefore, the formation of metallic and non-metallic ore deposits in relation to continental evolution should be a principal focus of study. Papers on continental dynamics were presented at the April 1978 meeting of the American Geophysical Union. Currently, the Panel is developing its conclusions and recommendations based on these papers, with its report to be issued during CY 1979.

## Mineral Resources

Because of the increasing scarcity of a growing number of essential elements, an improved understanding of the fundamental processes that determine the location of ore bodies is essential. A study of this subject will be a joint effort of the Geophysics Study Committee and the U.S. National Committee for Geochemistry. It will include sites and level of effort of present research; inadequacies in data and research; implications of level of research for supplies and critical minerals; and evaluation of the understanding of processes of mineral concentration. Panel members presented papers at the October 1978 meeting of the Geological Society of America. The Study will continue through CY 1979.

## Sun, Weather, and Climate

This study will address the question: Do changes in the sun influence weather or climate, and if so, how? Past studies on this topic have produced confusing results because of the statistical methodology employed and the lack of identifiable physical mechanisms relating solar parameters to weather and climate. The Geophysics Study Committee, thinking that re-examination of this question would be timely, established a panel to consider solar variability, empirical evidence for meteorological effects, and possible physical mechanisms. Panel members presented papers at the December 1978 meeting of the American Geophysical Union. The study will continue in 1979.

## Hydrological Sciences and Water Management

Recent advances in hydrology have emphasized the interaction of hydrologic science with other disciplines important in water-resource management, including particularly statistics, economics, operations research, and public-policy analysis. These important advances in the application of management science

to hydrologic systems have obscured the fact that hydrology, with its connections to physics, chemistry, and biology, is a substantive discipline in its own right and that it subtends questions that can be answered by laboratory and field investigations, by the construction of causative models based on first principles, and by the use of established scientific methodology. As social and economic pressures for the use of natural resources become more intense, and as technology demands more renewable resources, a better understanding of the basic processes of the hydrologic cycle and of ways these processes might be adjusted to better serve mankind becomes essential. The objective of this study is to identify some of the main problems in hydrological science, to show how they affect water-resource management, and to identify strategies for solutions of these problems. The study will be conducted during CY 1979.

#### Committee on Data Interchange and Data Centers

This Committee was established in 1967 to deal with problems in the international exchange of geophysical data through the World Data Centers (WDC's) and to advise the Geophysics Research Board and the Director of WDC-A (the U.S. center) on ways to increase the effectiveness of the services of the WDC-A complex (seven discipline-based subcenters and the Data Center Coordination Office) and other U.S. data centers. The Committee is concerned with coordination, quality control of the data, and services to the scientific community.

In January 1977, the Committee membership was slightly modified to achieve a one-to-one correspondence between the scientific field represented by each committee member and the principal national and associated World Data Center. These fields are atmospheric sciences, glaciology, oceanography, solar-terrestrial physics, solid-earth geophysics, and space-science techniques.

It was also early in 1977 that the Chairman of the Committee was informed in discussions with representatives of the National Oceanic and Atmospheric Administration and the National Science Foundation that previous reports of the Committee had been extremely useful and that further guidance on data problems facing national and WDC-A data centers and on their effectiveness was needed. Consequently, with the approval of the Geophysics Research Board, the Committee established six *ad hoc* panels, each chaired by a member of the Committee, to make detailed studies. These panels visited the WDC-A subcenters and associated national data centers throughout 1977 and early 1978. Their reports were reviewed by the Committee at its November 1977 and March 1978 meetings. Based on these panel reports, the Committee then drafted a consolidated report on the "Status and Effectiveness of National and World Data Center-A Geophysical Data Centers," publication and distribution of which are expected early in 1979.

The principal recommendation in this report is that there is a clear need for a unified national policy with regard to geophysical data. The Committee plans next to develop a report recommending such a policy. This task will occupy it during CY 1979.

### Committee on Solar-Terrestrial Research

This Committee of the Board was established in 1965 to plan and coordinate research programs in solar-terrestrial physics, to keep under review the status of the U.S. research in this field, and to develop recommendations on the national programs and the international coordination of such programs. In this latter capacity, the Committee acts as the U.S. National Committee for the ICSU Special Committee on Solar-Terrestrial Physics (SCOSTEP), the secretariat for which is housed at the Academy and staffed part-time by Board personnel.

The Committee conducted a summer study on "Ground-Based Research on the Upper Atmosphere in the 1980's" in July 1978, with some 30 experts participating. Partly in connection with planning for the Middle Atmosphere Program (MAP), the scope of the Committee's summer study was extended to include research using balloons, aircraft, and rockets and their relation to space-research opportunities.

The MAP, referred to above, is a program proposed by SCOSTEP in 1977 and now widely endorsed nationally and internationally. Its central objective is the modeling of the stratosphere and the mesosphere as a unitary physical system (the middle atmosphere). It intends to achieve this objective through coordinated observations of structure, composition, motions on all scales, and energetics--factors that interact with each other in the middle atmosphere and across its boundaries. All appropriate techniques, whether with spacecraft, balloons, rockets, or on the ground, will be employed. The MAP is being organized (much like the International Magnetospheric Program before it) to provide means to coordinate the large amount of research (mostly stratospheric) already in progress or planned, with the years from 1982 through 1985 as the period of maximum effort. An inter-Union steering committee under SCOSTEP will manage MAP. The Committee on Solar-Terrestrial Research has appointed a U.S. Panel for MAP, which has drafted a preliminary report on potential U.S. participation in this program.

The Committee is also cooperating in another international effort (coordinated by SCOSTEP with the help of the International Astronomical Union, the ICSU Committee on Space Research, and other organizations) called the "Solar Maximum Year," which is a program to coordinate, on very short time scales, a great variety of terrestrial observations of the sun and interplanetary medium with observations made from spacecraft (especially NASA's Solar Maximum Mission satellite) during the interval from August through February 1981. This interval is expected to coincide with the next solar maximum. The Program will emphasize investigation of the solar-flare process and the study of preflare processes and postflare phenomena as propagated through the interplanetary medium to planetary atmospheres and magnetospheres.

The most recent comprehensive review of solar-terrestrial research covered the period from 1969 through 1979. The Committee's 1978 summer study dealt only with research on the middle and upper atmosphere. With the encouragement of the National Science Foundation, the Committee has decided to conduct a complementary study in CY 1979 on the other aspects of solar-terrestrial research not included in the past year's summer study. From these two studies and a parallel and coordinated study on space-research missions on solar-terrestrial physics being conducted by the Committee on Space Physics of the Space Science Board will come a research strategy to guide the development of this field during the 1980's.

### Panel for the International Magnetospheric Study

This Panel of the Committee on Solar-Terrestrial Research has been concerned with SCOSTEP's main international program from 1976 to 1979, the International Magnetospheric Study (IMS). The Panel has reviewed the program to identify any gaps or inadequacies, suggested U.S. projects to meet these needs, and worked closely with federal agencies and the U.S. IMS Coordination Office to implement proposals to this end. Almost all of the major recommendations of the IMS Panel's 1974 report (*International Magnetospheric Study: Detailed Plan for a U.S. Ground-Based Research Program*) were carried out.

With most recommended facilities for the IMS in operation, including the joint NASA-European Space Agency International Sun-Earth Explorers A, B, and C (a set of spacecraft designed for the IMS following earlier recommendations by the U.S. IMS Panel and SCOSTEP's international IMS Steering Committee), the IMS Panel turned its attention to ways of maximizing the scientific return on the large correlative data sets that are accumulating. In 1976, it began planning a series of workshops at which experimenters with their data and interested theoreticians would gather to discuss results and try to interpret the data. The expectation was that sounder conclusions about a number of problems in magnetospheric physics might be reached more quickly than would be the case with a single experimenter working alone. The initial workshop planning session was recast as a real workshop devoted to thorough discussion of magnetospheric theory, about some aspects of which there are divergent and no completely accepted views. The reformatting of the workshop not only fulfilled the original plan in that it defined areas of uncertainty and the data needed to resolve these problems (subjects for future workshops) but also gave the workshop a unifying and exciting scientific theme. About 30 persons participated in the workshop, which, because of its reorganization, was postponed from 1977 to late March 1978.

In addition to its own activities, IMS Panel members have participated in several workshops and shorter working sessions organized by others, principally the U.S. Coordinator for the IMS, and in the international workshop in Innsbruck, Austria, in June 1978.

### Panel on the Jicamarca [Peru] Radio Observatory

This Panel of the Committee on Solar-Terrestrial Research last met in April 1978. The Panel's purpose is to review periodically the scientific program and needs of the Observatory, which is used by several U.S. research groups. Its most recent review reconfirmed its high opinion of the quality of the science being carried out at Jicamarca; therefore, the Panel continues to encourage the partial support of that facility by U.S. sources of funds.

### U.S. Geodynamics Committee

This Committee was established by the Geophysics Research Board in 1970 to develop long-range plans for research on the dynamics of the earth's interior and the effects on surface layers. Later that year, ICSU approved the International Geodynamics Project as one of its programs. As a result, the charge

to the U.S. Geodynamics Committee was amplified to include "development of a program for U.S. participation in the Geodynamics Project, surveying as necessary current activities in relevant areas of science and coordinating with government agencies, private institutions, and industry to ensure that a coherent program evolves responsive to needs in basic research and in applications."

In 1973, the Committee issued *U.S. Program for the Geodynamics Project: Scope and Objectives*. Shortly thereafter, the Federal Council for Science and Technology established "a committee to coordinate U.S. federal activities in the International Geodynamics Project and to serve as a focal point for liaison with the U.S. Geodynamics Committee."

The U.S. Geodynamics Committee then appointed ten reporters corresponding to the topics that had been designated "initial priorities" in its report. These reporters were asked to formulate recommendations regarding implementation of the priorities identified by the U.S. Committee. The specially designated Geodynamics Project correspondents in some 170 geoscience departments were notified of the activities of these reporters and invited to inform colleagues in their departments and to communicate with the reporters. Subsequently, six additional reporters were designated.

In response to recommendations of the Geophysics Research Board and the Inter-Union Commission on Geodynamics, the U.S. Geodynamics Committee prepared progress reports for 1975, 1976, and 1977. These reports are devoted almost entirely to accomplishments in the areas of responsibility of the Committee's Reporters, that is, on implementation of the recommended priorities for the Project. In 1976, the Federal Council's committee issued its report on current and planned activities in federal agencies, an effort that complements those of the U.S. Geodynamics Committee.

The International Geodynamics Project continues formally through 1979. The responsibilities of the U.S. Committee include long-range planning in solid-earth studies, taking especially into account the revolution in earth sciences during the 1960's, which opened the way for study of the solid earth as a system. It is evident that the 1970's have been a transitional period in which scientists were learning how to develop new insights and techniques for the study of the solid earth. The next step, which the Geophysics Research Board requested the U.S. Committee to undertake in May 1976, was development of a rationale for research in this field in the 1980's. To this end, the U.S. Committee held several meetings and developed and circulated a draft document "Crustal Dynamics: A Framework for Resource Systems." That document emphasizes the origin and evolution of the continents, with increased attention to basic scientific understanding pertinent to a variety of societal needs, especially resources and hazards. The draft should be ready for formal review in the latter part of 1978, with release following by the end of the year. The U.S. Geodynamics Committee also gave strong encouragement to the Geophysics Study Committee in the planning of its study on "Continental Dynamics," a study closely related to the plans set forth in "Crustal Dynamics."

In September 1978, the Board formally recommended that the U.S. Geodynamics Committee should carry forward the new program of geodynamics in the 1980's and, further, that its name remain the same.

As a result of developments in federal agencies, the Interagency Committee on Solid Earth Sciences urged the U.S. Geodynamics Committee early in 1978 to undertake the organization of a "Workshop on Continental Drilling for Scientific

Purposes," the objective being to develop recommendations on the scientific value and practical aspects of a continental drilling program, ways to maximize the scientific value of the drilling efforts of various federal programs and of industry, and means to encourage coordination and communication in achieving a program of wide appeal among the federal agencies, academic community, industry, and state geological surveys. The report, including extensive statements of six panels, was completed at the July 1978 workshop. Following review and approval of the report by the U.S. Geodynamics Committee, the main conclusions, together with the six panel reports as appendixes, were transmitted to the sponsoring agencies in early October in prepublication form. Publication is expected early in 1979.

Because of the continuing nature of the activities that the U.S. Committee was established to consider and of those that it has stimulated and encouraged, it proposes to prepare a final report on activities for the Geodynamics Project that will be devoted largely to a forward look at geodynamics problems in the 1980's. This report will not be completed and issued until the latter part of CY 1979.

#### Ad Hoc Committee on Geology and Climate

At the request of the Advisory Board to the Office of Earth Sciences, a two-day meeting of an *ad hoc* Committee on Geology and Climate, chaired by Preston Cloud, took place in September 1977. The main objective of the meeting was to determine whether a detailed study by the NRC of the bearing of the geological sciences on understanding climate would be timely. Because of the relation of this question to studies under consideration by the Geophysics Study Committee, the meeting was sponsored by the Geophysics Research Board. The *ad hoc* group reviewed current research in the field with a view toward identifying opportunities for the geological sciences to contribute to improved understanding of the forces that underlie climate change. The group prepared a report that was received enthusiastically by relevant NRC groups. Although originally intended as an internal document, both the Advisory Board to the Office of Earth Sciences and the Assembly of Mathematical and Physical Sciences were of the opinion that the document should be made more generally available, especially to the earth-sciences community. Consequently, *Geological Perspectives on Climatic Change* was published in summer 1978.

The report provides a summary of the current state of understanding of the history of the earth's climate over the last hundred million years, of the detail in which each episode is known, and of the experimental and observational techniques that have made possible this synthesis. It also offers a relatively detailed agenda of future studies that would give substance to the somewhat sketchy framework currently available, and it makes a compelling case for the relevance of such understanding to the future ability to monitor and predict climatic change.



## Membership

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Herbert Friedman (Chairman) (1979)  
Space Science Laboratory  
Naval Research Laboratory  
(Physics)

Kei-iti Aki (1981)  
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*Representatives of U.S. National Committees*

Richard K. Cook (1979)  
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Gordon A. Newkirk, Jr. (1979)  
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John S. Nisbet (1980)  
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*Committee on Solar-Terrestrial Research*

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Executive Secretary, committee and panels: Edward R. Dyer, Jr.

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 (Theoretical plasma physics)

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 Geophysical Institute  
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 (Geophysics)

John V. Evans (1979)  
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Walter J. Heikkila (1978)  
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 (Physics)

Robert A. Helliwell (1979)  
 Stanford Electronics Labs  
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*Ad Hoc Panel on Jicamarca Radio Observatory (Terms end in 1979)*

Sidney A. Bowhill  
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George K. Parks (1978)  
 Department of Geophysics  
 University of Washington  
 (Geophysics, physics)

Masahisa Sugiura (1979)  
 Goddard Space Flight Center  
 National Aeronautics and Space  
 Administration  
 (Geophysics, space science)

Donald J. Williams (1978)  
 Space Environment Laboratory  
 National Oceanic and Atmospheric  
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 (Space physics, nuclear physics)

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*Geophysics Study Committee (Terms end in 1979)*

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*Panel on Impact of Technology on Geophysics*

Homer E. Newell (Chairman) (1979)  
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Earl Barrett (1979)  
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 Department of Geology and Geophysics  
 University of Minnesota  
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Jonathan Berger (1979)  
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Daniel B. DeBra (1978)  
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Robert C. Liebermann (1979)  
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*Panel on Mineral Resources* (Terms end in 1980)

Paul B. Barton (Chairman)  
U.S. Geological Survey  
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Samuel S. Adams  
Anaconda Copper Company  
Salt Lake City  
(Geophysics)

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Ursula B. Marvin (1979)  
Smithsonian Astrophysical Observatory  
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Hans-Thomas Rossby (1979)  
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Martin Walt (1979)  
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U.S. Geological Survey  
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Stewart R. Wallace  
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David Watkinson  
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*Continental Tectonics Panel* (Terms end in 1980)

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University of Pittsburgh  
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Clarence R. Allen (1981)  
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Executive Secretary: Pembroke J. Hart

*Workshop on Continental Drilling for Scientific Purposes*  
Elburt F. Osborn (Chairman) (1979)  
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*Ad Hoc Committee on Geology and Climate*  
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Roland von Huene (1979)  
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(Discharged July 1978)  
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(Meteorology)



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(Invertebrate paleontology)

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University of Arizona  
(Geology)

Estella B. Leopold  
Quaternary Research Center  
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Staff: Joseph W. Berg, Jr., Pembroke J. Hart, and Donald C. Shapero

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*Agency Liaison Representatives*  
Eugene W. Bierly and  
Alan D. Hecht  
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Edward Flinn  
National Aeronautics and Space  
Administration

Keith Howard  
U.S. Geological Survey

George A. Kolstad  
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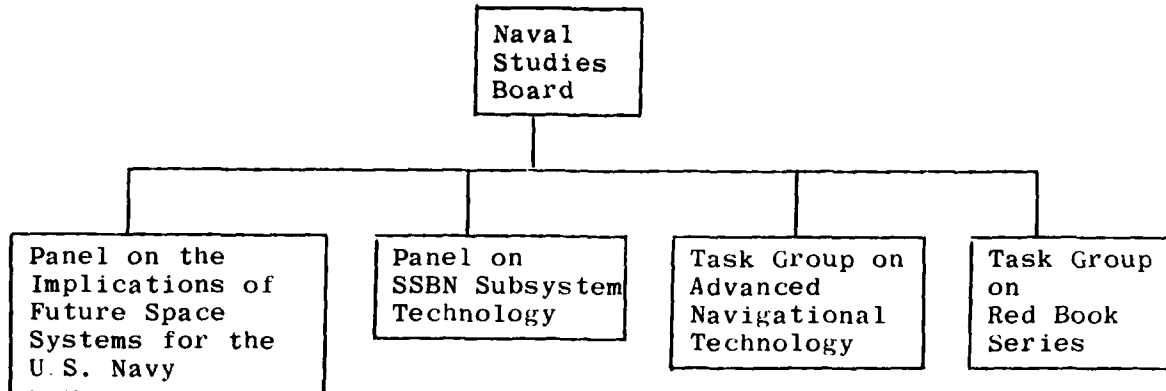
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Walter Telesetsky  
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Administration

#### NAVAL STUDIES BOARD

The Naval Studies Board was established in 1974 at the request of the Chief of Naval Operations to serve as "...a broadly based committee to which the Navy could turn for independent and outside counsel on any area of its responsibilities involving the interplay of scientific and technical matters with other national issues." When the Board came into being its charge was expanded as follows: "As mutually agreed upon between the Chief of Naval Operations and the President of the National Academy of Sciences and with appropriate attention to the influence of the domestic economy, national objectives, social imperatives and anticipated military requirements, the Board for Naval Studies will conduct and report upon surveys and studies in

## NAVAL STUDIES BOARD



the field of scientific research and development applicable to the operation and function of the Navy."

During the past year, the Board continued its practice of holding at least one full meeting each quarter to maintain its familiarity with evolving naval issues and programs, to review ongoing projects of its various panels and task groups, and to initiate new studies. In addition, a number of smaller meetings on specific topics, involving designated members and invited participants, were held to review the status of work and planning in greater detail.

In cooperation with the Office of Naval Research (ONR), the Board sponsored a Symposium on Science and the Future Navy in October 1976 to celebrate the Thirtieth Anniversary of the ONR. Four thousand copies of the proceedings of this well-attended and well-received symposium were published in January 1978. Of these, 2500 copies were distributed immediately to an established distribution list. Individual requests continue to be filled from the reserve supply. Experience suggests that the demand will continue for several years.

More recently, the Board shared with the ONR and the David W. Taylor Naval Ship Research and Development Center in the organization and conduct of the Twelfth Symposium on Naval Hydrodynamics. This highly regarded biennial series of symposia was initiated by the ONR in 1956 (the Academy, through its Committee on Undersea Warfare, participated in the first and second symposia) to serve as a forum for discussion and the exchange of advanced research results in fluid dynamics. International participation is encouraged by the alternate selection of sites in the United States and abroad for successive meetings and by drawing on a representative cross section of the relevant international scientific and engineering communities in developing the program.

The Board began preparations for the symposium in early 1977 by organizing a program committee that was chaired by George F. Carrier, a member of

the Board. In accordance with recommendations of this committee, it was decided to hold the symposium at the NAS in June 1978, with papers presented in the following fields: (a) boundary-layer stability and transition, (b) ship boundary layers and propeller hull interaction, (c) cavitation, and (d) geophysical fluid dynamics. Forty-one papers were selected for presentation, and a total of 215 persons representing 15 countries attended.

The Board has agreed to participate--together with the Office of Naval Research and the Shipbuilding Research Association of Japan--in the organization and conduct of the Thirteenth Symposium on Naval Hydrodynamics to be held in Tokyo, Japan, in October 1980. Planning meetings, with Navy and Japanese representatives were held in the latter part of CY 1978 and will continue, at intervals, during 1979 and 1980.

In response to a request from representatives of the ONR in early 1978, the Board also agreed to ensure appropriate U.S. participation in the Sixth International Conference on Numerical Methods in Fluid Dynamics, which took place in Tbilisi, Georgian Socialist Soviet Republic, June 20-25, 1978. The objective of this series of international conferences is to encourage the application of theoretical and applied mathematics in the solution of fluid-dynamics problems and to provide a forum for the exchange of research results achieved through the numerical approach. The U.S. delegation to the Sixth Conference consisted of 16 scientists. From funds made available by the ONR and the Air Force Office of Scientific Research, 12 of these scientists received travel grants to help to defray the costs of attending.

During the early part of CY 1978, two new projects related to the interests and responsibilities of the Board were suggested. The first of these, a Panel on Naval Oceanography, was the subject of a February 1978 letter from the Technical Director (acting) of the ONR to the President of the Academy. In it, he suggested that such a panel be established in the NRC's Assembly of Mathematical and Physical Sciences and that it draw on the joint efforts and cooperation of the Naval Studies Board, Ocean Sciences Board, Ocean Policy Board (of the Commission on International Relations), and the Marine Board (of the Assembly of Engineering). Its purposes would be

1. To evaluate the present status of ocean science and technology in the Navy and to review aspects of manpower and institutional needs that affect it, taking into account the interrelationship of ocean sciences with physics, chemistry, applied mathematics, computing, and engineering;
2. To recommend specific initiatives that might be considered by ONR, either alone or together with other federal agencies, to extend the national capability in ocean sciences;
3. To review broad ocean-science fields and alert the ONR to subfields of potential significance to the Navy.

Discussions are under way in regard to the responsibilities of the proposed panel, its method and schedule of operation, and its initial membership.

The second recently suggested project is an educational endeavor. Because the twentieth-century Navy functions in a technical environment of ever greater complexity, it becomes increasingly important for Navy personnel to keep pace with changing technology. Conversations with Navy representatives during the past year have revealed an interest in establishing a guest lecture series at the U.S. Naval Postgraduate School and the U.S. Naval War College. The

lectures, which would be presented by senior scientists and engineers, would treat various fields of science and technology and would be designed to help naval officers (present and future) to understand and have a better appreciation of the vital role of science and technology in naval operations. The suggestion that the series be named for Admiral Charles H. Davis stems from the prominent role he played in the establishment of the National Academy of Sciences in 1863 while serving as the Navy's Chief of Navigation. Admiral Davis well exemplifies the understanding of the role of science and technology in naval affairs that the lecture series would attempt to illustrate and to preserve. Preliminary discussions about initiation and structuring of the proposed lecture series continue, with a decision on implementation likely before the end of 1978.

More recently, in September 1978, the Chief of Naval Operations expressed an interest in having the Board convene a panel of experts to assist the Navy in formulating its research and development programs in support of subsurface surveillance and related naval missions. The Board has agreed to work with the Navy to develop the terms of reference for the requested panel. When this preliminary phase is concluded, the Board will initiate the required steps for organizing the panel, probably sometime during CY 1979.

In addition to its various panels and task groups, whose work is described in the sections that follow, the Board assisted in the organization of two activities attached to other units of the NRC. One of these, the Committee on Biosphere Effects of Extremely Low Frequency (ELF) Radiation, was organized in response to a request from the Assistant Secretary of the Navy in June 1975. The Board worked with the Assembly of Life Sciences to establish this committee under that Assembly. Its task was to review the status of knowledge about the biological and ecological effects of ELF radiation associated with the Project Seafarer antenna transmitter system. The study would assist the Navy in reaching a decision on the construction of the Seafarer system. Following issuance of the Committee's report in early 1977, the Assistant Secretary requested a small additional study, which was begun at the end of 1977, with the report issued in March 1978. In neither study was the Committee able to identify any significant harmful effects of exposure to ELF radiation.

The second activity, a Panel on Applied Mathematics Research Alternatives for the Navy, was organized in response to a September 1975 request from the ONR. The Board worked with the Office of Mathematical Sciences of this Assembly and the Committee on Applications of Mathematics to create this Panel, which assists the ONR with the continuing formulation of a dynamic and innovative research program in applied mathematics and computer science. Although the Panel operates under the Committee on Applications of Mathematics, the Board maintains close liaison with it through George F. Carrier, who chairs the Panel and also serves on the Board.

In the coming year, the Board will continue to devote part of its effort to keeping abreast of the latest developments in the Navy's programs and any related problems, thus enabling it to respond promptly and effectively to the Navy's requests for advice and counsel. A number of special projects have been completed or initiated during CY 1978, as described below. It is likely that additional tasks that cannot yet be identified will be undertaken in CY 1979.

### Ad Hoc Panel on the Military Implications and Use of Directed Energy Weapons

In October 1977, the Office of the Chief of Naval Operations requested the Board to conduct a review of the technology supporting investigations into the feasibility of practical directed energy weapons and to recommend ways in which the research and development effort might be improved. The Board accepted the task and established an *ad hoc* panel composed entirely of Board members to review the program and its documentation. The Panel's findings were submitted to the Navy in a letter report dated March 27, 1978, after which the Panel was disbanded as no further effort in this field is expected at present.

### Panel on the Implications of Future Space Systems for the U.S. Navy

At its meeting in December 1977, the Board accepted a request from the Navy to establish a panel on space technology. Specifically, the request called for a long-range assessment of rapidly evolving satellite capabilities and the implications of present and potential developments for the Navy, and in particular for several of its missions. The terms of reference for the Panel were developed through detailed discussions with Navy representatives. The study will require one year, with a report to be issued during CY 1979. This report will recommend a course for the Navy to follow in effectively and efficiently using and developing space capabilities.

### Panel on SSBN Subsystem Technology (Nuclear Ballistic Submarine Systems)

Navy representatives met with the Board on several occasions during 1977 to discuss the possibility of a study to identify the best way of employing current science and technology to reduce the costs of constructing new strategic submarines and of maintaining those currently in the fleet without sacrificing operational capability and systems reliability. The requested study would seek cost-effective subsystem alternatives in four areas: hull/structures, life-support, hydraulics, and ship-service systems. The weapons and propulsion systems were specifically excluded from consideration. The Board accepted this task and established a Panel, chaired by David C. Hazen, a member of the Board, that is expected to deliver an interim report by the end of CY 1978 and a final report by mid-1979.

### Task Group on Advanced Navigation Technology

At the December 1977 meeting of the Board, it was suggested that some of the very sensitive sensors being developed to measure gravity waves might provide the basis for a significant advance in the navigational capability of naval platforms--especially submarines. To explore this subject more fully, the Board approved the establishment of a small task group. The Task Group on

Advanced Navigational Technology presented its preliminary findings to the Board at the March 1978 meeting, when it was then directed by the Board to continue its work, reviewing and refining its preliminary effort and developing a recommended plan of action for the Navy, which the Board would review at its July 1978 meeting. After incorporating the ideas resulting from discussion at this meeting, and after NRC review, the findings and recommendations of the Task Group will be transmitted to ONR.

### Task Group on Red Book Series

The 22-volume series produced in 1946 by the National Defense Research Committee, which summarized its wartime research in subsurface warfare (Division 6), has been immensely helpful to the antisubmarine warfare research program in the postwar years. Although the volumes are 32 years old and long out of print, the series is still used extensively in many research laboratories. Widespread interest in a selective updating of the series was brought to the attention of the Naval Studies Board, which then established the "Red Book" Task Group, under the leadership of Chester M. McKinney, Jr., to develop a plan for selecting and updating the appropriate volumes.

The Task Group reviewed the technologies documented in the field of submarine warfare, particularly underwater acoustics and magnetics, and, with the approval of the Board, initiated discussions with Navy representatives concerning the development and funding of a recommended program. These discussions are currently in progress.

### Membership

#### *Naval Studies Board*

Eberhardt Rechtin (Chairman) (1980)  
Aerospace Corporation  
(Electrical engineering)

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Applied Science  
Yale University  
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Benjamin B. Bauer  
Audio-Metric Laboratories, Inc.  
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John C. Calhoun, Jr.  
Texas A & M University  
(Petroleum and natural gas engineering)

George F. Carrier (1980)  
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Applied Physics  
Harvard University  
(Applied mathematics)

Eugene P. Cronkite  
Medical Research Center  
Brookhaven National Laboratory  
(Medicine)

Willis H. Flygare  
School of Chemical Sciences  
University of Illinois  
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Ivan A. Getting  
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(Physics)

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 Princeton University  
 (Aeronautical engineering)

John C. Hopkins (1980)  
 Los Alamos Scientific Laboratory  
 University of California  
 (Nuclear physics)

John A. Hornbeck  
 Bell Laboratories  
 (Physics)

Jeffrey C. Kitchen (1980)  
 International Business Consultant  
 (International affairs)

Vincent V. McRae (1980)  
 IBM Corporation  
 (Mathematics)

William J. Moran (1980)  
 Ford Aerospace and Communications  
 Corporation  
 (Military affairs)

William H. Pickering  
 California Institute of Technology  
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Joseph M. Reynolds  
 Louisiana State University  
 (Physics)

Harrison Shull  
 Indiana University  
 (Physical chemistry)

*Assembly Liaison Representatives*  
 Albert M. Clogston  
 Bell Laboratories

Robert G. Sachs  
 University of Chicago

Executive Secretary, board and panels: Lee M. Hunt

*Panel on the Implications of Future Space Systems for the U.S. Navy* (All terms end in 1980)

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Fred E. Bradley  
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 Company  
 (Mechanical engineering)

Donald C. Forster  
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 Retired, U.S. Navy  
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 (Aeronautical engineering)

John C. Hopkins  
 Los Alamos Scientific Laboratory  
 University of California  
 (Nuclear physics)

Donald B. Jacobs  
 Boeing Aerospace  
 (Mechanical engineering)

Ray F. Larson  
 Rockwell International  
 (Missiles and spacecraft)

William J. Moran  
 Ford Aerospace and Communications  
 Corporation  
 (Military affairs)

William A. Nierenberg  
Scripps Institution of  
Oceanography  
University of California at  
San Diego  
(Physics)

Robert M. Powell  
Lockheed Missiles and Space  
Company, Inc.  
(Electrical engineering)

George S. Sebestyen  
Defense Systems Inc.  
(Aerospace sciences)

H. Wayne Terbush  
Martin Marietta Aerospace  
(Electrical engineering)

Robert L. Walquist  
TRW/Defense and Space Systems  
Group  
(Electrical engineering)

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Louisiana State University  
(Physics)

Daniel B. DeBra  
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and Astronautics  
Stanford University  
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*Ad Hoc Panel on the Military Implications and Use of Directed Energy Weapons*

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Aerospace Corporation  
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George F. Carrier  
Division of Engineering and  
Applied Physics  
Harvard University  
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Philip M. Diamond  
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James A. Tate  
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William O. Hamilton  
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Willis H. Flygare  
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John C. Hopkins  
Los Alamos Scientific Laboratory  
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*Panel on SSBN Technology (All terms end in 1979)*

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 Princeton University  
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 Tyco Laboratories, Inc.  
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*Task Group on Red Book Series*

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 University of Texas at Austin  
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 MAR Associates  
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 Scripps Institution of Oceanography  
 (Acoustics)

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 TRACTOR, Incorporated  
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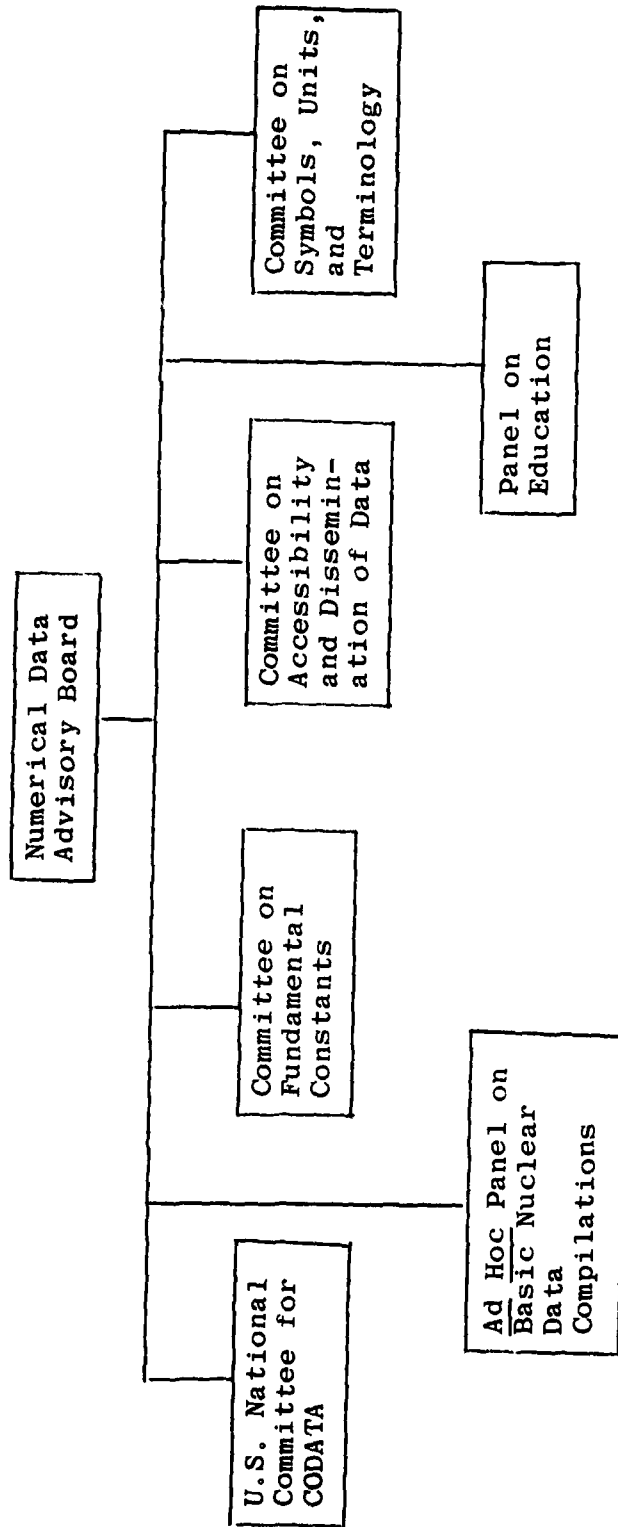
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## NUMERICAL DATA ADVISORY BOARD

The Numerical Data Advisory Board was organized in 1969 to assess the adequacy of efforts to compile and evaluate numerical data in the physical sciences and to encourage the use of such data in science and technology. The Board has both national and international responsibilities. It undertakes special studies on topics of concern to the Office of Standard Reference Data, of the National Bureau of Standards, and to other government agencies. One such study was conducted by an *ad hoc* committee established by the Board (Committee on Status, Needs, and Benefits of Data Compilations), which completed its work late in 1977 and published its final report in March 1978, after which it was discharged. The Committee's conclusions were consistent with those reached in earlier studies of data compilation efforts, but it documented in considerably greater detail than ever before the needs for, costs of, and benefits derived from evaluated data. The Committee especially emphasized the benefits resulting from the activities of continuing data centers and recommended a substantial increase in the support of such centers by the federal government.

NUMERICAL DATA ADVISORY BOARD



International responsibilities of the Board are handled through a number of standing committees. The U.S. National Committee for CODATA (the Committee on Data for Science and Technology of the International Council of Scientific Unions) provides for U.S. input to the activities and programs of this international committee. It meets with the U.S. national delegate to CODATA to consider the U.S. positions on questions before that body. The Committee on Fundamental Constants makes recommendations to the National Bureau of Standards, to the U.S. representative on the CODATA Task Group on Fundamental Constants, and to other interested groups. The Committee on Symbols, Units, and Terminology maintains liaison with activities of the International Organization for Standardization. The Committee on Accessibility and Dissemination of Data works with the CODATA Task Group on Accessibility and Dissemination of Data and with the International Council of Scientific Unions' Abstracting Board.

In addition to these committees, the Board has a Panel on Education that has been very successful in stimulating the establishment of appropriate short courses on data evaluation and the use of data for college science teachers. During the past year the Panel organized a new type of course in which teaching modules covering techniques of data analysis were developed. The success of these courses in the United States has stimulated CODATA to initiate similar courses in Europe.

Following the discharge of the Assembly's Committee on Nuclear Science early in CY 1978, the Board agreed to assume responsibility for that Committee's *Ad Hoc* Panel on Basic Nuclear Data Compilations. This Panel was established to (a) monitor data compilation and evaluation efforts in basic nuclear science; (b) interact with the basic research community, professional societies, data centers, and funding agencies to ensure the usefulness of the nuclear-data-compilation program; (c) recommend priorities, procedures, scheduling of compilation work, and improvements in any of these; and (d) be alert to nuclear-data needs in applied fields. The Panel provided helpful input to the planning of a National Nuclear Data Center at Brookhaven National Laboratory and continues to advise on various aspects of the operation of the Center and on coordination of national and international data compilation efforts in this field.

The Board and its U.S. National Committee for CODATA held joint two-day meetings in July and December 1977, with one day devoted to Board affairs and the other to those of the U.S. National Committee. A continuing review of future needs for data and of ways that the Board and the U.S. National Committee could assist in meeting these needs occupied much of the time and attention of the Board during the past year. A consensus is emerging that the most effective role for the Board will be to concentrate on identifying problems in data evaluation that are common to several disciplines and to develop and distribute information on how those problems might be met.

Stimulated in part by the findings of the Committee on Data Needs and in part by a searching self-examination of its objectives, the Board plans to take the initiative during the coming year to place itself in an overview position relative to national-data-compilation and -evaluation efforts. The primary purpose of such an overview role will be to guide, assist, and encourage U.S. numerical-data-evaluation efforts and to provide a focus for such work that can reinforce the efforts of the groups engaged in data compilation and evaluation to obtain adequate support. At present, the Office of Standard

Reference Data is the primary, broadly multidisciplinary data-evaluation and data-management group in the United States. The Board believes that this Office meets a real and growing need and that it should continue and its programs be enlarged by being given quantitative supportive backing from the Board. The overview and supporting role can be accomplished only if the Board itself acquires visibility and credibility with funding agencies such as the National Science Foundation, the Department of Energy, the Department of Defense, and the National Aeronautics and Space Administration, as well as others that have major requirements for evaluated data bases in a wide variety of scientific and technological fields, many of which are so new that there is hardly enough reliable information to build on.

In fall 1978, the Board began the planning of a conference to encourage the application of numerical-data-assessment and -handling methods from the physical and chemical sciences disciplines to sociotechnical fields and programs. Sound decision making on problems of energy, environment, health, housing, and transportation depends critically on the reliability of the available data. To respond to new needs, many federal and other organizations are creating data bases, frequently interdisciplinary ones, for example, measures of efficiency of conversion processes, cost-benefit data on various options, and performance data on systems or components. Such data often provide the basis for regulatory and legislative decisions and policies relating to energy, environment, health, and so on. In physical and chemical sciences, processes of numerical-data manipulation, evaluation, and validation have been developed over many years. Persons concerned with development of new types of data bases often are not aware of these data-handling methods, which could help to eliminate inefficiencies and improve the quality and application of the data. Thus the objective of the conference would be to bring together representatives of the numerical-data-handling community and persons concerned with the development of new types of data bases to exchange information on data needs; approaches to the compilation, evaluation, application, and interpretation of data; and ways to improve the processing and use of nonnumerical sociotechnical and socioeconomic data. The Board would prepare a report on the conference and offer recommendations for future action.

#### Membership

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Shell Development Company

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Rockwell International

*Committee on Fundamental Constants*

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*Committee on Symbols, Units, and Terminology*

Chester H. Page (Chairman) (1979)  
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*Ad Hoc Panel on Basic Nuclear Data Compilations*

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University of Rochester  
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Specialized Information Services  
National Library of Medicine

Thomas F. Malone  
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Howard J. White, Jr.  
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Oak Ridge National Laboratory  
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(Nuclear chemistry)

*Committee on Data Needs (Discharged March 31, 1978)*

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Edward P. Bartkus  
Information Systems Division  
E.I. duPont de Nemours and  
Company, Inc.

John L. Margrave  
Office of Advanced Studies and  
Research  
Rice University

Carlos M. Bowman  
Computation/Inorganic Laboratories  
The Dow Chemical Company

John W. Murdock  
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Department of Chemistry  
University of California at Berkeley

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Los Alamos Scientific Laboratory

Kurt L. Wray  
Physical Sciences, Inc.

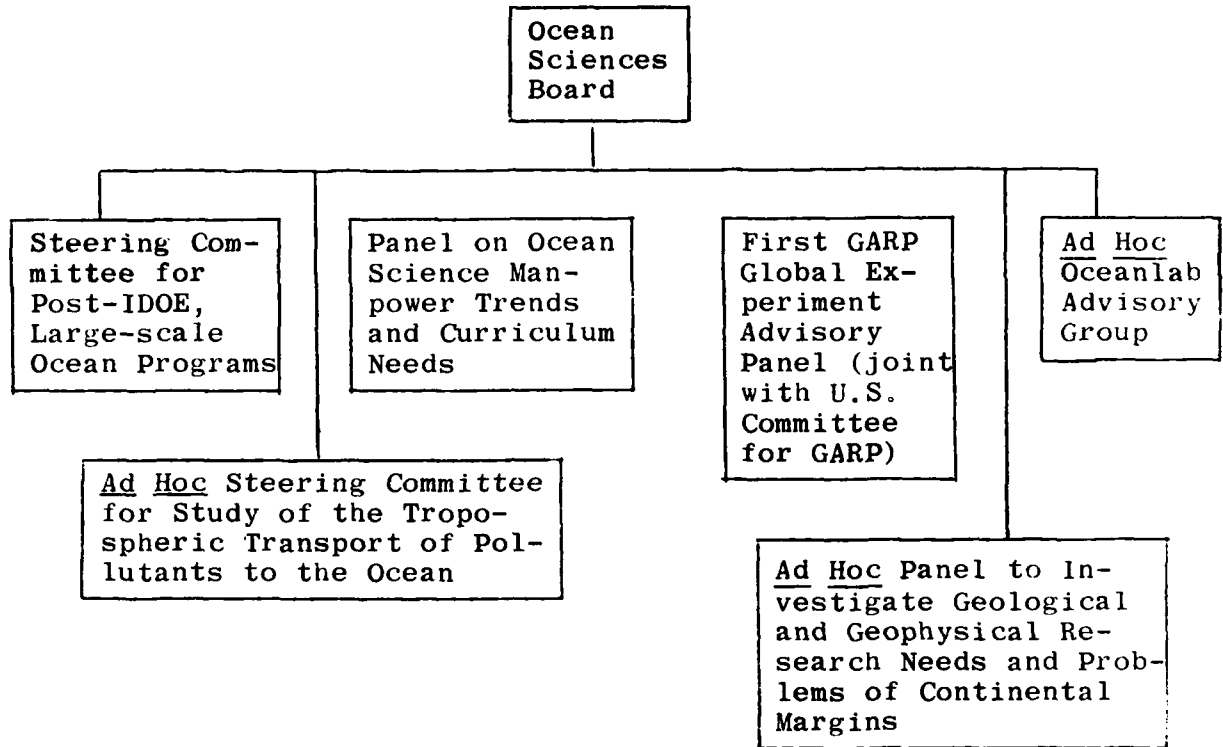
Staff Consultant: Everett R. Johnson

#### OCEAN SCIENCES BOARD

The Ocean Sciences Board evolved from the former Committee on Oceanography, which was formed in 1957 in response to a request from several federal agencies for advice on their ocean programs. In 1970, the Committee's scope was expanded to form a group called the Ocean Affairs Board. The need for a stronger focus on ocean science led to the organization of the Ocean Sciences Board in 1976, with the primary objective of advancing scientific understanding of the oceans.

The Board meets about four times a year to continue its general examination of problems that influence the health of ocean sciences and to plan and initiate major studies, such as the one (described in a subsequent section) on large-scale ocean studies for the 1980's.

## OCEAN SCIENCES BOARD



In addition to projects described in the sections that follow, the Board advised and assisted several groups in the NRC and the federal government on a broad range of ocean-science issues and projects including radio frequencies for oceanography (Committee on Radio Frequencies); effects of federal reorganization on ocean science (Ocean Policy Committee); ocean disposal of radioactive waste (Committee on Radioactive Waste Management); oceanographic data (Geophysics Research Board); deep-sea drilling and ocean technology (Marine Board); organization of a U.S. oceanography delegation to the People's Republic of China (Committee on Scholarly Communication with the People's Republic of China); ocean dumping, pollution, and data (National Oceanic and Atmospheric Administration); the GEOS-3 satellite and SEASAT-A (National Aeronautics and Space Administration); proposed Western Pacific International Cooperative Activities (National Science Foundation); and U.S. interaction with the Inter- and inputs to the Intergovernmental Oceanographic Commission (Department of State). The Board also cosponsors (with the U.S. Committee for the Global Atmospheric Research Program) a panel to advise on plans for the First GARP Global Experiment.

The Board serves as the U.S. National Committee to the Scientific Committee on Oceanic Research (SCOR) of the International Council of Scientific



Unions. In this capacity, it provides an annual contribution to the support of SCOR from its general operating funds and interacts with SCOR on a number of issues. During the past year, the Board strongly supported the formation of a SCOR working group on the carbon budget of the oceans and identified individuals who might serve on such a group. U.S. members participated in the January SCOR Executive Committee meeting and the November SCOR General meeting in Brest, France. Activities of SCOR of special interest to U.S. oceanographers are brought to their attention through the Board's newsletter *Ocean Sciences Log*.

#### Steering Committee for Post-IDOE, Large-Scale Ocean Programs

In February 1977, the National Science Foundation asked for advice and guidance on the kinds of large-scale, long-term, multidisciplinary, multi-institutional ocean-science studies that should follow the International Decade of Ocean Exploration (IDOE), which ends in 1980. The Board responded by organizing a Steering Committee to conduct a study and prepare a report in cooperation with other NRC units, including the Marine Board (Assembly of Engineering) and the Ocean Policy Committee (Commission on International Relations).

During spring 1977, four NSF-organized and -sponsored, discipline-based workshops (in physical, biological, chemical, and geological/geophysical marine sciences) were held. The Steering Committee then organized a fifth workshop to examine issues of program management, interdisciplinary research opportunities, and the international aspects of post-IDOE programs. The findings of these workshops provided input for another larger one held in September 1977, with more than 75 ocean scientists, engineers, and program managers participating.

The Steering Committee then developed its report, which covers such topics as marine research and society, the conduct of cooperative oceanography, program organization and management, international cooperation, manpower needs, facility and equipment needs, communication of results, and funding requirements. Publication of the report is expected before the end of 1978.

#### Panel on Geological and Geophysical Research Needs and Problems of Continental Margins

This Panel was established in response to recommendations of a March 1976 workshop on research needs and problems of continental margins, which was sponsored by the Office of Earth Sciences. In its report, in press at the end of 1978, the Panel discusses the nature and future needs of geological and geophysical research on the continental margins. The Panel considered wide transition zones between oceanic (deep water) realms and exposed continental realms (land). Therefore, in addition to chapters on *submarine* topography, sedimentation, geochemistry, stratigraphy, geophysics, types of margins, drilling, and seismic techniques, the report shows how ancient margin rocks that outcrop on land (e.g., in mountain ranges) relate to the features and processes below the sea.

An appendix to the report discusses the research history and recent activities of those federal agencies that have, or are likely to have, an

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NATIONAL RESEARCH COUNCIL WASHINGTON DC ASSEMBLY OF --ETC F/G 5/1  
ANNUAL REPORT OF THE ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIE--ETC(U)  
1978

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interest in continental-margins research. Another appendix contains individually authored papers that discuss advanced geophysical and technological knowledge. A third appendix contains a detailed description of a state-of-the-art geophysical research vessel.

The report offers a detailed plan for geological/geophysical research on margins, emphasizes the conduct of such research on domestic margins, discusses scientific questions and the technology needed to seek answers, and presents priorities for research on continental margins through the next decade. The report is likely to have a significant impact on the direction of marine geology/geophysics in the 1980's.

The Panel completed nearly all of its work by the end of CY 1977 and, with publication of its report in 1978, was discharged.

#### Steering Committee on the Tropospheric Transport of Pollutants to the Ocean

At the request of SCOR, the Board established a Steering Committee late in 1975 to organize a study and an international workshop to assess the state of knowledge about the transport, through the troposphere, of pollutants and other substances to the oceans. The background papers for the study were published in fall 1977, with the final report of the Steering Committee following in April 1978. A principal conclusion is that a comprehensive model capable of predicting the transport of reactive gases and aerosols *is not* close to realization and that in many programs, including most routine monitoring programs, the frequency of sampling and the duration of individual sampling periods are such as to preclude the use of the resulting data for model validation purposes. In the light of these findings, the report presents detailed and specific recommendations on the kinds of studies needed to advance understanding of the transport of metals, halogenated hydrocarbons, petroleum and related natural compounds, nonhydrocarbon gases, and radio-nuclides. A section on techniques focuses on problems of data collection and sampling. The Committee concludes that the principal effort for the next several years must be directed along *research* lines and identifies the kinds of research and observations that are needed in the atmosphere, the oceans, and over the continents. The findings and recommendations of the report should have a significant impact on research in this field during the next several years.

#### Ad Hoc Oceanlab Advisory Group

At the request of the Ocean Sciences Board, an *ad hoc* group composed of three Board members and a member of the Marine Board (Assembly of Engineering) met in December 1977 to discuss ways to ensure that the design and operational philosophy of an *Oceanlab* facility, if built, would be such as to maximize its value to the marine scientific community. *Oceanlab* is described by the National Oceanic and Atmospheric Administration (NOAA) as "a federally funded national facility which would provide scientists and engineers with a mobile undersea laboratory, associated equipment and living quarters, to conduct

research, development, and exploration in the ocean for extended periods of time." It was planned for use in the period from 1980 through 2000 and would be available "to all sectors of the U.S. ocean science and engineering communities." The *ad hoc* group issued its report in April 1978 (*The Proposed NOAA Oceanlab Project*) in which it stated that what is lacking in the planning for *Oceanlab* is a core of proposals containing sufficient detail to allow a critical review of *Oceanlab* science. The report recommends several actions that would remedy this deficiency and that could establish a sound basis for the scientific use of *Oceanlab*. The NOAA Manned Undersea Science and Technology Office has begun to implement some of these recommendations.

Although a great deal of planning has gone into possible configurations of a manned undersea laboratory, and a preliminary survey of ocean scientists has indicated many problems that might require or substantially benefit from the availability of such a facility, to date no careful study has been made to determine whether the facility would provide the best approach to the solution of a specific set of scientific problems. The Board has organized an *ad hoc* group to examine this question and to review the scientific potential of an *Oceanlab* (or *Oceanlab*-type) facility. The group's findings might lead to a redirection of the present program--a broader base of scientific activities and modification of the kinds of facilities that might be constructed. NOAA has indicated a need for continued guidance in the planning of its undersea science and technology program, particularly in regard to scientific needs and options in meeting them; therefore, continuation of follow-up activities to the initial report is expected throughout CY 1979. A closely related Board activity, likely to be initiated in 1979, appears in a subsequent section on "Future Ocean Science Needs and Facilities."

#### Panel on Ocean Science Manpower Trends and Curriculum Needs

During the past several months this Panel has acquired and begun to analyze a relatively large amount of primary data on PhD oceanographers. Data on other ocean scientists have also been obtained.

Because the population of PhD oceanographers is reasonably well defined and specific, because the Panel is mainly concerned with the health and vitality of ocean science, and because PhD's make a major commitment to their education for a career in ocean science, the initial task of the Panel was to design a study, based on the available data, that would show how and when PhD's become trained as oceanographers and the patterns of mobility into and from this field.

Support for an intensive, two-month summer study in 1978 was obtained from the National Science Foundation. The study emphasized comparison of the population of PhD oceanographers as a whole with those in other major science fields and identification of the main similarities and differences in four basic ocean-science fields--biological oceanography, chemical oceanography, marine geology/geophysics, and physical oceanography. The report of the study, publication of which is expected early in CY 1979, will document as far as possible the characteristics of the present population of U.S. PhD oceanographers.

## Ocean Science Data Needs

Early in 1978 the Board organized a small group to examine (a) the best ways to handle new kinds of oceanographic data and (b) the best balance in emphasis among national, regional, and "project" data centers. Although a specific study of such problems has not yet been developed, it would be consistent with the conclusions of a recent report issued by the Committee on Data Interchange and Data Centers of the Geophysics Research Board (*Geophysical Data Centers: Impact of Data-Intensive Programs*, NAS, 1976). If a study is organized, it will be carried out in consultation and cooperation with the Geophysics Research Board and other concerned NRC committees.

## Oceanography and Fishery Resources Management Problems

Recent trends in ocean fishery resources management have resulted in unilateral pronouncements by many coastal nations asserting jurisdiction over coastal fisheries in a region extending as far as 200 miles to sea. In the case of the United States, the Fishery Conservation and Management Act of 1976 provides that the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration shall exercise such management responsibilities for U.S. coastal waters. The Act requires that management decisions be reached on the tonnage allocations for U.S. and foreign fisheries in U.S. coastal waters. These decisions must take into consideration economic, political, and ecological parameters and, at this time, can be based on but limited data. Many regard the present fishery management techniques as only useful approximations that are gradually refined as the "art" of fishery management improves step by step. Others believe that the time has come for an in-depth examination of the interdependencies of biological species and of their responses to oceanographic parameters. New theoretical "tools," including methods of handling large quantities of loosely related data, offer the possibility of major advances through research on specific links between the physical and chemical properties of the ocean and the responses of multiple biological species. During 1979, the Board might convene a small group of experts to explore this possibility and to recommend specific kinds of intensive, in-depth research activities.

## Future Ocean Science Needs for Technology

As a result of the Board's review of the *Oceanlab* project and completion of the Post-IDOE Planning study (see preceding discussion), the Board became concerned with the extent to which future ocean-science research might be limited by inadequate facilities and technologies. Several large-scale ocean research activities that will require technological developments are now under way or in the planning stage. These include the *Oceanlab*; long-coring, deep-sea drilling; continental margin studies; and deep-water/sediment interface studies. Using the results of the Post-IDOE Planning study and other related activities, the Board plans to assemble a small group of experts in ocean science and ocean technology. This group would start by identifying the science that needs to be done in the next decade and would then outline the technologies required

to meet the needs of ocean science. These technologies could be either manned or unmanned, either expendable or reusable; they could involve direct or remote sensing. They might require various combinations of these capabilities.

### Other Projects

Besides its various special studies, the Board prepares and distributes a series of directories of marine scientists. The most recent issue was published in 1957. A revised and updated listing is planned for 1978-1979.

Further, the Board has several small *ad hoc* tasks under way that could evolve into studies in the coming year. These include an examination of the ocean-going equipment needs of the oceanographic fleet; consideration of the needs for specialized computers at oceanographic and national ocean facilities; examination of the implications of satellite observations for oceanography, review of priorities among major ocean-science programs; and review of problems related to ocean dumping.

### Membership

#### *Ocean Sciences Board*

Warren S. Wooster (Chairman) (1981)  
Institute for Marine Studies  
University of Washington  
(Physical oceanography)

Vera Alexander (1979)  
Institute of Marine Science  
University of Alaska  
(Biological oceanography)

Gustaf O.S. Arrhenius (1980)  
Scripps Institution of Oceanography  
(Geochemical oceanography)

Willard Bascom (1981)  
Southern California Coastal Water  
Research Project  
(Industrial oceanography)

Rita R. Colwell (1980)  
Department of Microbiology  
University of Maryland  
(Biological oceanography)

Robert M. Garrels (1981)  
Department of Geological Sciences  
Northwestern University  
(Geochemical oceanography)

William W. Hay (1980)  
Rosenstiel School of Marine and  
Atmospheric Science  
University of Miami  
(Micropaleontology)

Dennis Hayes (1981)  
Lamont-Doherty Geological Observatory  
of Columbia University  
(Geology, geophysics)

G. Ross Heath (1979)  
Graduate School of Oceanography  
University of Rhode Island  
(Geological oceanography)

Reuben Lasker (1980)  
Southwest Fisheries Center  
National Marine Fisheries Service  
National Oceanic and Atmospheric  
Administration

Pearn Niler (1979)  
School of Oceanography  
Oregon State University  
(Physical oceanography)

Worth Nowlin (1981)  
Department of Oceanography  
Texas A&M University  
(Physical oceanography)

Derek W. Spencer (1979)  
 Department of Chemistry  
 Woods Hole Oceanographic Institution  
 (Chemical oceanography)

Fred N. Spiess (1980)  
 Scripps Institution of Oceanography  
 (Geophysical oceanography)

John H. Steele (1981)  
 Woods Hole Oceanographic Institution  
 (Biological oceanography)

*Ex Officio*

Edward L. Miles  
 Institute for Marine Studies  
 University of Washington  
 (International organizations)

Executive Secretary, board, committees, and panels: Richard C. Vetter

*Steering Committee for Post-IDOE Planning*

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 Institute for Marine Studies  
 University of Washington

Foster H. Middleton  
 Department of Ocean Engineering  
 University of Rhode Island

John V. Byrne  
 Research Office  
 Oregon State University

Brian J. Rothschild  
 National Marine Fisheries Service  
 National Oceanic and Atmospheric  
 Administration

Reuben Lasker  
 Southwest Fisheries Center  
 National Marine Fisheries Service  
 National Oceanic and Atmospheric  
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Derek W. Spencer  
 Department of Chemistry  
 Woods Hole Oceanographic Institution

Ferris Webster  
 National Oceanic and Atmospheric  
 Administration

*Panel to Investigate the Geological and Geophysical Research Needs and  
 Problems of Continental Margins*

Albert W. Bally (Chairman)  
 Shell Oil Company  
 (Geology)

Thomas A. Clingan, Jr.  
 School of Law  
 University of Miami  
 (Law of the Sea)

William A. Berggren  
 Department of Geology and Geophysics  
 Woods Hole Oceanographic Institution

Joseph R. Curray  
 Scripps Institution of Oceanography  
 (Marine geology)

*Assembly Liaison Representatives*  
 Preston Cloud  
 U.S. Geological Survey  
 Biogeology Clean Laboratory  
 University of California at  
 Santa Barbara

Richard S. Lindzen  
 Department of Applied Physics  
 Harvard University

Carl H. Savit  
 Western Geophysical Company of  
 America

Edgar S. Driver  
Gulf Science and Technology Company  
(Geophysics)

John I. Ewing  
Woods Hole Oceanographic Institution  
(Geophysics)

Donn S. Gorsline  
Department of Geological Sciences  
University of Southern California

Thomas H. Jordan  
Scripps Institution of Oceanography  
(Seismology and marine geophysics)

Charlotte E. Keen  
Atlantic Geoscience Laboratory  
Bedford Institute, Canada  
(Geophysics)

Lavern D. Kulm  
School of Oceanography  
Oregon State University  
(Marine geology)

John D. Milliman  
Department of Geology and Geophysics  
Woods Hole Oceanographic Institution

Walter C. Pitman  
Lamont-Doherty Geological Observatory  
(Marine magnetics)

Joel S. Watkins, Jr.  
Gulf Research and Development Company  
(Geophysics and Seismology)

*Ex Officio*  
Charles L. Drake  
(Former Chairman, Office of Earth  
Sciences)  
Dartmouth College

Jack E. Oliver  
Chairman, Office of Earth Sciences  
Cornell University

*Ocean Sciences Manpower Trends and Curriculum Needs Panel*

Allan R. Robinson (Chairman)  
Center for Earth and Planetary Physics  
Harvard University  
(Physical oceanography)

John V. Byrne  
Research Office  
Oregon State University  
(Physical oceanography)

Robert B. Abel  
Center for Marine Resources  
Texas A&M University  
(Oceanography manpower)

Edward D. Goldberg  
Scripps Institution of Oceanography  
(Geochemical oceanography)

Vera Alexander  
College of Environmental Sciences  
University of Alaska  
(Biological oceanography)

Martha L. Kohler  
Bechtel Corporation  
(Ocean engineering)

*Steering Committee for Study of the Tropospheric Transport of Pollutants to the Ocean (Disbanded April 1978)*

Joseph M. Prospero  
Rosentiel School of Marine  
and Atmospheric Science  
University of Miami  
(Chemical oceanography)

Edwin F. Danielson  
National Center for Atmospheric  
Research  
(Meteorology)



Robert A. Duce  
 Department of Oceanography  
 University of Rhode Island  
 (Atmospheric chemistry)

Edward D. Goldberg  
 Scripps Institution of Oceanography  
 (Geochemical oceanography)

*U.S. National Members of the Scientific Committee on Oceanic Research (of ICSU)*  
 Edward D. Goldberg (1981)  
 Scripps Institution of Oceanography

Warren S. Wooster (1979)  
 Institute for Marine Studies  
 University of Washington

William W. Hay (1983)  
 Rosenstiel School of Marine  
 and Atmospheric Science  
 University of Miami

*U.S. National Committee of the International Association of Biological  
 Oceanography*

John D. Costlow Jr. (Chairman) (1979)  
 Marine Laboratory  
 Duke University

*First GARP Global Experiment Panel (Joint with U.S. Committee for the Global  
 Atmospheric Research Program) (Representatives of the Ocean Sciences Board)*

D. James Baker, Jr. (Vicechairman)  
 Department of Oceanography  
 University of Washington

Dennis W. Moore  
 Oceanographic Laboratory  
 Nova University

Eli J. Katz (1980)  
 Woods Hole Oceanographic Institution

*Liaison Representative*  
 Robert L. Bernstein  
 Scripps Institution of Oceanography

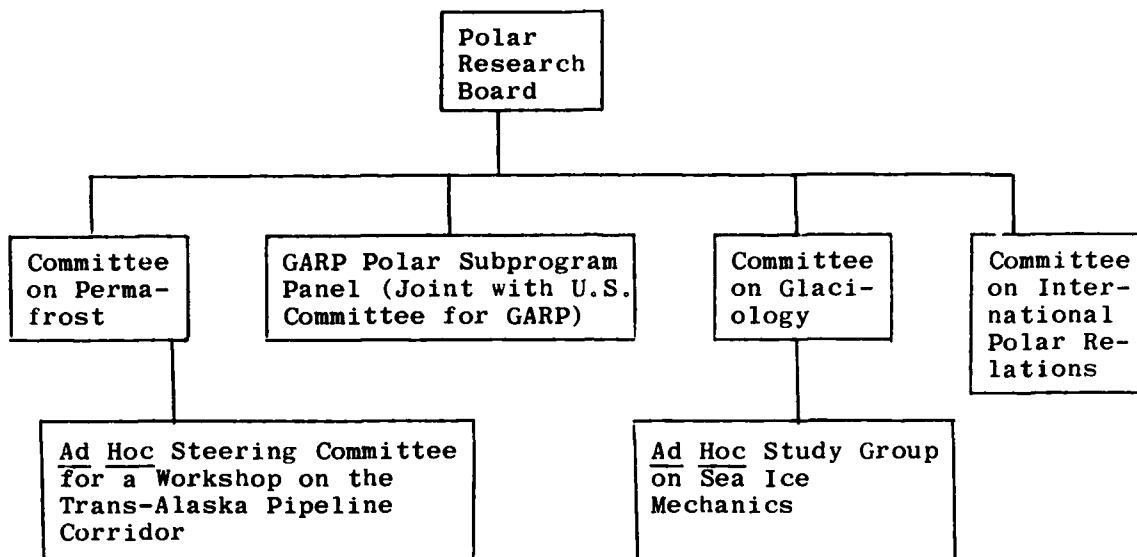
#### POLAR RESEARCH BOARD

The Polar Research Board, established in 1958, advises the U.S. Government on research in the polar regions and adheres to the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions (ICSU) on behalf of the National Academy of Sciences. Its regional orientation and multidisciplinary character involve the Board in a wide range of studies in the physical and life sciences, as well as studies of environmental questions. In the past year, the Board, through SCAR, continued its participation in the development of an international scientific research program to provide information for wise management of the living resources of the Southern Ocean, took part in a study of the possible environmental effects of mineral resource exploration/exploitation in Antarctica, and was host to a symposium to review recent developments in Antarctic geology and geophysics, including mineral resources.

In regard to national concerns, the Board

1. Urged the development of an open dialogue between concerned parties

## POLAR RESEARCH BOARD



to the proposed Alaska Natural Gas Transportation System so that problems associated with the Trans-Alaska oil pipeline need not be repeated;

2. Reaffirmed that the United States should maintain its pivotal position in the support of basic research in the Southern Ocean.

Since July 1977, there were two meetings of the Board, four Committee meetings, and two workshops, in addition to which the Board organized and served as host to an international SCAR Symposium and participated in the XV Plenary Session of SCAR and in six meetings of SCAR Working Groups and three Groups of Specialists' meetings. During the same time interval, the Board issued seven reports, with publication of five more expected by the end of 1978.

According to an internal National Science Foundation (NSF) study, more than 70 percent of the Board's recommendations relative to planning and conduct of research in the Antarctic have been partially or totally implemented, whereas most recommendations with respect to Arctic research remain to be implemented. This difference results largely from the many governmental agencies involved in Arctic research and development, especially in energy-related activities, while the NSF is the sole manager of the U.S. Antarctic Research Program. In an attempt to increase the impact of its recommendations on Arctic research, the Board is seeking to broaden the funding base of its Arctic activities to include support from other government agencies with ongoing Arctic research programs. The Board continues a broad review of current activities in research, education, and manpower that affect the health of polar sciences.

Initiatives being undertaken by the Board include the following:

1. Development of a strategy for polar research in the 1980's through a series of reports focused on research opportunities and problems unique to the polar regions. These reports would identify and assess important polar-unique scientific problems and contain recommendations for consideration by concerned federal agencies. The first study in this series will probably be "The Role of the Polar Regions in World Climate," to be undertaken in collaboration with the Climate Research Board. Other studies under consideration include marine living resources of the polar regions, man in the polar environment, and polar earth sciences.

2. Initiation of an open dialogue among parties concerned with the Alaska Natural Gas Transportation System (ANGTS), with the objective of identifying geotechnical and engineering research problems unique to natural gas pipelines in permafrost environments, particularly as the proposed ANGTS relates to the Trans-Alaska Pipeline Corridor. The Board's Committee on Permafrost called attention to the need for such a dialogue at its workshop in December 1977; as a result, the Department of the Interior requested the Board to assist in developing the dialogue. Participants will include experts from the research and engineering staffs of the Northwest Alaska Pipeline Company and its contractors, appropriate federal regulatory agencies, and the scientific and engineering research communities of the academic, private, and government sectors. The workshop will identify permafrost-related scientific and engineering research problems that should be addressed before construction of the pipeline begins. This task is being closely coordinated with the Commission on Natural Resources and the Commission on Sociotechnical Systems.

Specific projects undertaken by committees, panels, and special study groups of the Board, and by SCAR groups of specialists that include members of the Board, are described in the sections that follow.

#### Committee on Permafrost

This Committee is charged with reviewing the state of permafrost research and its impact on development of polar regions, providing guidelines for permafrost research, and organizing U.S. participation in international permafrost research programs and conferences. The Committee met twice and held a workshop during 1978.

The Committee report "Permafrost Research--A Workshop Survey of Some Recent Activities" was published in *Geotimes*, the *Arctic Bulletin*, and the Norwegian journal *Frost I Jord*. This report emphasizes the need for accelerated research programs on frost heave to increase understanding of this complex phenomenon and to avoid serious problems that are likely to arise in construction and operation of cold gas pipelines.

More than 80 experts from the United States and Canada participated in a workshop that focused on research needs associated with the proposed Alaska Natural Gas Pipeline System (ANGTS) and Arctic offshore developments. Based on the findings of the workshop, the Committee strongly urged early initiation of an open dialogue among all parties concerned with the ANGTS, with the objective of defining problems yet to be resolved, facilitating development of

cost-effective designs, and achieving meaningful regulations and environmentally acceptable construction procedures. In a letter to the Assistant Secretary of the Interior, the NAS alerted the federal government to the Committee's concerns. As a result, the Department of the Interior has requested the Board to assist in the development of such a dialogue.

At the Third International Conference on Permafrost, held in Canada in July 1978, the Committee extended an invitation on behalf of the NAS for the Fourth Conference to be held in the United States, probably at the University of Alaska in Fairbanks in 1983. The Committee also began laying the groundwork for a U.S.-China permafrost exchange and supported, together with Soviet Russia and China, the Canadian proposal that an *ad hoc* secretariat be established to develop an International Permafrost Organization.

### Committee on Glaciology

Established in 1954, this Committee provides advice on U.S. glaciological research programs, maintains cognizance of all aspects of worldwide glaciological research, and recommends glaciology research programs. In the past year the Committee met and held a workshop on current problems and future directions in glaciology. Some 40 individuals from the United States and Canada participated. Based on workshop findings, the Committee called for an examination of the NSF ice-core drilling program, either by the newly established NSF internal Advisory Subcommittee on Glaciology or by an external independent body. This examination should include a review of drilling technology, operational drilling strategy, and contributions such a drilling program could make to the science of glaciology. The Committee also recommended the establishment of an *ad hoc* study group on sea-ice mechanics to be concerned particularly with industrial needs in Arctic offshore development. The study group would assess research needs and priorities in sea-ice mechanics, especially in regard to the interaction of sea ice and offshore structures. The Committee also concluded that glacier ice will probably have to be used as a freshwater source at some time in the future, but it recommended additional research on iceberg distribution, harvest, and deterioration before major expenditures are made on large-scale field tests of towing techniques and protection schemes.

The Committee on Glaciology endorsed a recommendation of the Polar Research Board that the findings of the Committee's *Ad Hoc* Study Group on Snow Research and Control be published in a scientific journal and that the attention of government agencies be called to the Study Group's main conclusion--that greater coordination and focus are needed in snow research. The Study Group was discharged on completion of its study.

### U.S. Organizing Committee for the Third SCAR/IUGS/ICG Symposium on Antarctic Geology and Geophysics

On behalf of the NAS, the Polar Research Board served as host to the SCAR/IUGS/ICG Symposium on Antarctic Geology and Geophysics, and to related field trips and the SCAR Working Group meetings, held in Madison, Wisconsin, in August 1977.

This symposium provided Antarctic geologists and geophysicists an opportunity to review and discuss recent research concerned with Gondwanaland, the East Antarctic Shield, the Scotia Arc, stratigraphy, paleontology, igneous rocks, mineral deposits, structural geology and tectonics, crustal structure, subglacial topography, marine geology, and Cenozoic history. A trend toward more problem-oriented studies, in contrast to the strictly reconnaissance work of the past, was apparent at this meeting. More than 130 papers were presented, and 185 scientists from 15 countries participated in the Symposium. Publication, by the University of Wisconsin Press, of the Symposium volume, containing the complete papers, is expected in 1979. A review of the Symposium in the December 1977 issue of *Geotimes* noted that Antarctic science always has been a model of international cooperation and that this Symposium continued that tradition.

#### Committee on International Polar Relations

To represent the U.S. scientific community more adequately in polar affairs, the Polar Research Board established this Committee in March 1977 and charged it with promoting, on behalf of the NRC, international cooperation with SCAR, providing coordination between SCAR activities and those of concerned U.S. Government agencies and others, and fostering international cooperation and coordination in Arctic sciences. The Committee held its second meeting in March 1978 in preparation for the XVth meeting and Plenary Session of SCAR in May 1978 and considered reports on the recent Antarctic Treaty Special Consultative Meeting on a Conservation Regime for the Southern Ocean, discussed the Antarctic Treaty Nations' response to SCAR reports, and prepared a U.S. position paper for SCAR XV. The Committee endorsed the scientific objectives of the SCAR document, *Biological Investigations of Marine Antarctic Systems and Stocks* (BIOMASS), and concluded that the studies proposed are essential to rational and effective guidance in addressing the problems certain to arise from exploitation of marine living resources of the Southern Ocean. The Committee urged that the United States maintain its pivotal position in the conduct of basic research in the Southern Ocean.

#### SCAR/SCOR Group of Specialists on the Living Resources of the Southern Ocean

Acting on requests from the International Oceanographic Commission and the Antarctic Treaty Consultative Meeting representatives, the Board served as host to the SCAR/SCOR Conference on Living Resources of the Southern Ocean and to a meeting of the Group of Specialists, both of which took place at Woods Hole, Massachusetts, in August 1976. The Group prepared the scientific document titled *Biological Investigations of Marine Antarctic Systems and Stocks* (BIOMASS), which was published in August 1977. The BIOMASS represents the first major international effort to coordinate present and future research for the development and wise management of the living resources of the Southern Ocean. This document has been endorsed by both SCAR and the Scientific Committee for Oceanic Research and more recently was welcomed by the

Intergovernmental Oceanographic Commission International Coordination Group for the Southern Ocean and endorsed by the Ninth Antarctic Treaty Consultative Meeting. Both organizations recommended that the Group continue its activities, including development of programs to implement the BIOMASS Program.

The Group formulated plans for the First BIOMASS Experiment (FIBEX) to be conducted during the 1980-1981 Antarctic field season. Thirteen of the fourteen SCAR nations are expected to participate in FIBEX. The Antarctic Treaty Nations are holding Special Consultative Meetings to draft a definitive conservation scheme for the Southern Ocean. S. Z. El-Sayed of the Board's Committee on International Polar Relations serves as Convenor of the SCAR Group of Specialists, and D. B. Siniff is the other U.S. member.

#### SCAR Group of Specialists on Environmental Impact Assessment of Mineral Resource Exploration and Exploitation in the Antarctic

In response to a request from the Antarctic Treaty Nations, this Group prepared the report "Possible Environmental Effects of Mineral Research Exploration/Exploitation in Antarctica." This report considers the present knowledge of mineral occurrences and resources in Antarctica and the most likely area for onshore and offshore exploration and exploitation, and it evaluates the sensitivity of the Antarctic marine and terrestrial ecosystems to different forms of environmental disturbances.

The Group concluded that at present there are no economical, exploitable on-land mineral or fossil-fuel resources known in Antarctica. If, however, exploration and exploitation should occur, environmental protection measures different from those generally adopted elsewhere will be required. The Group noted that marine living resources of the Antarctic are an important source of additional food for mankind that must be conserved, and it warned against any activity that might unduly affect this resource. SCAR plans to publish the report for widespread public distribution.

As a follow-up to activities initiated by the Group, and on the recommendation of the Ninth Antarctic Treaty Consultative Meeting, the Group will cosponsor a workshop to explore in greater detail the likely location and technical nature of Antarctic mineral exploration and exploitation and their environmental consequences. This workshop will probably be held at the Rockefeller Conference Center, Bellagio, Italy, in March 1979. J. H. Zumberge, Chairman of the Board's Committee on International Polar Relations and the U.S. Delegate to SCAR, convened the SCAR Group, with George A. Llano serving as U.S. member.

#### Polar Subprogram Panel [Joint with the U.S. Committee for the Global Atmospheric Research Program (GARP)]

This Panel provides advice on the GARP Polar Subprogram. Over the past year it did not meet; however, through correspondence it pointed out to the government the need for increased meteorological observations in West Antarctica during the First GARP Global Experiment to be conducted during 1978-1979. As

a result, the NSF agreed to increase meteorological observations in West Antarctica during the Experiment. Administrative support for this Panel is provided by the U.S. Committee for GARP. The Panel has recently been reconstituted and renamed the GARP Polar Subprogram Panel (see section on the U.S. Committee for GARP).

### Membership

#### *Polar Research Board*

- |  |   |
|--|---|
| A. Lincoln Washburn (Chairman) (1981)<br>Quaternary Research Center<br>University of Washington<br>(Quaternary geology, periglacial geomorphology)                   | Robert A. Helliwell (1981)<br>Radioscience Laboratory<br>Stanford University<br>(Whistlers and related ionospheric phenomena)   |
| Wallace S. Broecker (1982)<br>Lamont-Doherty Geological Observatory<br>Columbia University<br>(Chemical oceanography, paleoclimatology)                              | David M. Hickok (1980)<br>Arctic Environmental Information and Data Center<br>University of Alaska<br>(Alaska data management, socio-economics)                       |
| Jerry Brown (1982)<br>Cold Regions Research and Engineering Laboratory<br>(Arctic ecology, soil science)   | Hans O. Jahns (1980)<br>Exxon Production Research Company<br>(Polar petroleum engineering)  |
| Campbell Craddock (1982)<br>Department of Geology and Geophysics<br>University of Wisconsin<br>(Structural geology, antarctic mineral resources)                     | Mary Alice McWhinnie (1979)<br>Department of Biological Sciences<br>DePaul University<br>(Ecosystems and marine living resources)                                     |
| Albert P. Crary (1981)<br>Washington, D.C.<br>(Atmosphere, solid-earth geophysics)   | J. Murray Mitchell, Jr. (1982)<br>Laboratory for Environmental Data Research<br>National Oceanic and Atmospheric Administration<br>(Climatic change and modification) |
| George H. Denton (1980)<br>Department of Geological Sciences<br>University of Maine<br>(Glacial geology, paleoclimatology)   | Clayton A. Paulson (1981)<br>Department of Oceanography<br>Oregon State University<br>(Air-sea interaction, oceanography, and meteorology)                            |
| Joseph O. Fletcher (1979)<br>Environmental Research Laboratories<br>National Oceanic and Atmospheric Administration<br>(Climate dynamics, international cooperation) | Chester M. Pierce (1981)<br>Harvard University<br>(Polar psychophysiology, sleep disturbances)  |

E. Fred Roots (1979)  
 Department of Environment, Canada  
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 resources)

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*Liaison Representatives*

Edward P. Todd  
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Executive Secretary, board, committees, and study group: Louis DeGoes  
 Staff Officer, board, committees, and study group: W. Timothy Hushen

*Committee on Permafrost*

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Roger J. E. Brown (1979)  
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Frederick E. Crory (1980)  
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William D. Harrison (1982)  
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John R. Kiely (1980)  
 Bechtel Corporation  
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Ronald K. McGregor  
 Office of Naval Research

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 General Motors Research Laboratories

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Jack E. Oliver  
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Arthur H. Lachenbruch (1979)  
 Theoretical Geophysics  
 U.S. Geological Survey  
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*Ad Hoc Steering Committee: Workshop on Permafrost-Related Problems  
Associated with the Trans-Alaskan Pipeline Corridor*

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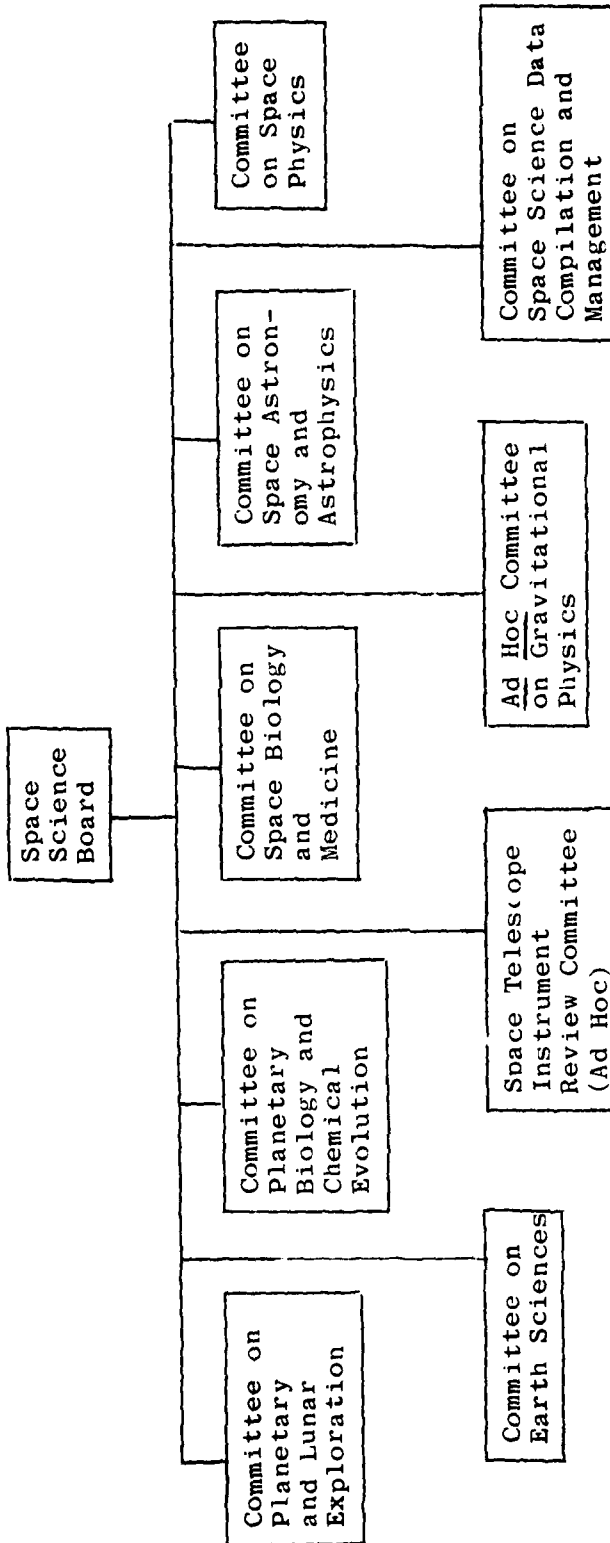
*Liaison Representative*  
E. Fred Roots  
Department of the Environment, Canada

#### SPACE SCIENCE BOARD

The Space Science Board was established in 1958 by the National Academy of Sciences to be "the focus of the interests and responsibilities of the Academy in space science; to establish relationships with civilian science and government scientific activities; and to represent the Academy in its international relationships in this field." The Board acts as the NAS representative to the Committee on Space Research (COSPAR) of the International Council of Scientific Unions.

The Board met three times during fiscal year 1977 and once more in CY 1978. It adopted two major scientific strategy documents: a ten-year strategy for exploring the inner planets of the solar system, which was developed by the Board's Committee on Planetary and Lunar Exploration; and a ten-year strategy for research that was developed by the Board's Committee on Space Astronomy and Astrophysics. The Board also adopted the report of its 1977 summer study on the "Life Sciences in Space," and approved the report of its *ad hoc* Space Telescope Instrument Review Committee, a joint activity of the Board and the European Science Foundation (ESF).

SPACE SCIENCE BOARD



During the coming year the Board will receive strategy documents from its Committees on Space Physics, Earth Sciences, Planetary Biology and Chemical Evolution, and the *ad hoc* Committee on Gravitational Physics. When completed, these reports will constitute a detailed assessment of the goals and objectives of space science for the coming decade, an assessment that can serve the National Aeronautics and Space Administration (NASA) as the basis for the selection of individual missions and the development of necessary instrumentation.

Following the development of these strategies, the Board will direct its attention to additional important questions. For example, it is initiating a three-year study of space-science data computation and management to explore the ways in which data management can enhance the scientific return from space missions.

### COSPAR XXI

The Board is also concerned with the status and activities of international space science. It represents the NAS in COSPAR, a scientific committee of ICSU; a Board member is appointed as the U.S. National Representative to COSPAR. Because the charter allows a nominating privilege to the U.S. and U.S.S.R. Academies, the U.S. representative has also served as one of two vice presidents.

At the 1977 plenary meeting, informal discussions were held on the future of COSPAR. It was decided to study the matter, gather opinions in the interim year, and formally consider a reorganization at the Twenty-First meeting in Innsbruck, Austria, May 29-June 10, 1978. After thorough discussion in Innsbruck, COSPAR decided to restructure its seven discipline-oriented working groups, to allow the working groups to include discussion of technical matters (e.g., instrumentation, future programs), as well as science results, and to allow the convening of special workshops and symposia. It was also agreed that the level of science presented at COSPAR must be raised to maintain the interest of the developed nations. A transition committee was appointed to assure that the new structure will be in place for the Twenty-Second plenary meeting in Bangalore, India, May 29-June 9, 1979.

Five special symposia were held in Innsbruck (x-ray astronomy, gravitational physiology, remote sounding of the atmosphere, planetary surfaces and atmospheres, and scientific uses of balloons and related technical problems), as well as open meetings of the working groups. In addition, the quadrennial symposium on solar-terrestrial physics was also held. The total U.S. attendance was 275, including approximately 70 U.S. papers in the solar-terrestrial physics symposium. In spite of the continuing restriction of travel funds, U.S. attendance in Innsbruck matched the previous high of 278 in Madrid, Spain, in 1972.

### Committee on Planetary and Lunar Exploration

The Committee was established in 1973 to act as the principal source of expertise for the Board in advising NASA on its policies and programs in planetary and lunar exploration. Its broad charge is to monitor the progress and development of NASA programs and to brief the Board periodically on the main issues

in the program. To carry out these responsibilities, the Committee has developed over the past four years a series of ten-year science strategies for exploring the solar system.

The Committee met five times during 1977-1978 and completed the second in its series of science strategies (Strategy for Exploration of the Inner Planets); the report was approved by the Board in May 1978. Following completion of the first task of developing a strategy for outer-planet exploration, the Board had requested the Committee to use a similar approach to extend its considerations to the inner planets. The goals of these tasks were to develop a coherent science strategy that was sensitive to foreseeable budgetary constraints but largely detached from, thus independent of, agency mission strategies; to identify the planetary targets and level of investigation that would lead to major advances in knowledge; and to specify the primary science objectives and critical measurements to be achieved. The Committee recommended that the main exploratory emphasis for 1977-1987 should be on the atmosphere-bearing planets, Mars-earth-Venus. This triad indicates a significant advance in planetary exploration to the point at which comparative planetological study offers the best opportunity to understand the history and evolution of solar system bodies. The report on the outer and inner planets will be used by the Committee to assess the degree to which NASA implements the science strategy recommendation into its mission planning. Publication of the final report on the inner planets is expected by October 1978.

To complete the current series of strategies, NASA requested the Board to develop a strategy for the exploration of comets and asteroids. The Board accepted and designated the Committee on Planetary and Lunar Exploration to carry out the task. This study took place in July 1978, in Snowmass, Colorado. A draft report of the conclusions was prepared for presentation to the Space Science Board at its November meeting. Publication of the final report on the study is expected early in CY 1979.

The Committee will continue to hold periodic meetings to review the status and progress of the planetary program and to assess the science content of proposed new missions.

#### Committee on Planetary Biology and Chemical Evolution

In mid-1978, this Committee published its report on *Recommendations on Quarantine Policy for Mars, Jupiter, Saturn, Uranus, Neptune, and Titan*.

Currently, the Committee is developing a scientific strategy for research in planetary biology and chemical evolution over the coming decade. The strategy will include a diverse range of studies to increase understanding of the chemical evolution required for life to emerge, as well as of the interaction of life with its environment, including modifications to the environment. The major research questions in (a) the interstellar medium, (b) the early history of the solar system, (c) geological and geochemical evidence, and (d) molecular evolution will be identified. The strategy will also include needed studies of the present and past biosphere and the effects of zero gravity on living systems.

### Committee on Space Biology and Medicine

This Committee assisted the Board in the planning and conduct of a summer study in August 1977 to review the NASA life sciences in space program. The study concentrated on six fields: renal and electrolytic function, vestibular function, endocrinology, genetics and developmental biology, cardiovascular research, and ecology. The study group found that zero gravity does provide a unique environment for investigating certain physiologic and biochemical processes but that many of the background experiments should be done on earth. Further, most questions require missions of long duration. Although the biological effects of long-duration missions are uncertain, the study group indicated that the major adverse effects probably can be prevented by creating artificial gravity within the spacecraft. The study also recommended a strong peer review for projected research and closer relations between NASA scientists and the wider scientific community.

### Committee on Space Astronomy and Astrophysics

The Committee assists the Board by providing detailed expertise in the various disciplines of space astronomy: radio, infrared, optical, ultraviolet, x-ray, gamma-ray, and cosmic-ray astronomy, as well as cosmology and theoretical astrophysics. It undertakes studies for the Board and advises the Board on matters concerning the space astronomy activities conducted by NASA. The Committee has just completed a strategy report ("A Strategy for Space Astronomy and Astrophysics for the 1980's") that is expected to be published early in 1979. In 1979, the Committee plans to review the status of the proposed Space Telescope Science Institute. Because the technologies of radio astronomy have advanced to the point at which the potential of space-based instruments could provide significant advances in solving the scientific questions about the radio universe, the Committee believes that a major study to investigate the future of space radio astronomy would be timely and has considered organizing such a study in CY 1979.

### Committee on Space Physics

This Committee, which advises the Board on atmospheric, ionospheric, and magnetospheric physics; solar and solar wind physics; solar-terrestrial interactions; and planetary atmospheres and magnetospheres, recently began the preparation of a ten-year strategy for future NASA research efforts in space plasma physics. It expects to complete its report by spring 1979, with publication following later in the year.

### Committee on Earth Sciences

A new standing committee of the Board, this group was established in 1976 to advise on scientific aspects of NASA's applications programs. The Committee has been investigating the potential of space technology for obtaining scientific results in various earth-science disciplines--oceanography, geology,

hydrology, earth's gravitational and magnetic fields, and earth's cryosphere. A strategy report recommending the direction future earth-science programs in space should take will be completed during the coming year.

#### Ad Hoc Committee on Gravitational Physics

This is a new committee of the Board that was formed to develop a strategy for obtaining experimental and observational evidence bearing directly on the theory of gravitation. The study is in progress, with completion and release of the report expected during the latter half of CY 1979.

#### Space Telescope Instrument Review Committee

The concept of a joint NAS-European Science Foundation committee to review the space telescope instrumentation developed as a result of the Williamsburg, Virginia, meeting in January 1976 between representatives of the NAS and ESF. The Review Committee held its first meeting in March 1978 and considered designs and predicted performance characteristics of the instruments selected by NASA and the European Space Agency. The report resulting from this session (*NAS-ESF Space Telescope Instrument Review Committee, First Report*, issued July 1978) concludes that the instrument complement will meet the scientific objectives of the Space Telescope but that more attention must be paid to adequate testing procedures for noise levels and calibrations.

The Committee will meet once more, in January 1979, to conduct a final review of the instrument designs before NASA begins the hardware procurement phase of the project.

#### Ad Hoc Study Committee on Space Plasma Physics

In response to an April 1976 request from NASA for a review of the scientific content of space plasma physics and recommendations on future directions for productive research in this field, the Board, with assistance from its Committee on Space Physics, organized a special study committee, which met several times during 1976-1977. The Study Committee formed several panels to prepare detailed technical review papers on various aspects of space plasma physics. In the first volume of its report, issued in May 1978 (*Space Plasma Physics: The Study of Solar System Plasmas. Volume I: Reports of the Study Committee and Advocacy Panels*), the Study Committee concluded that space plasma physics is intrinsically an important branch of science, that it has contributed to the development of laboratory plasma physics and astrophysics, that a better understanding of solar-system plasmas could have applications in meteorology and terrestrial communications, and that the theoretical component of space plasma physics should be strengthened.

The technical review papers produced as a part of the study effort will be issued as a companion volume in 1979 (*Space Plasma Physics: The Study of Solar System Plasmas. Volume II: Technical Reports*).



## Membership

*Space Science Board*

A. G. W. Cameron (Chairman) (1979)  
Harvard College Observatory  
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Alexander G. Bearn (1981)  
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Francis S. Johnson (1978)  
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(Theoretical plasma physics)

George C. Reid (1980)  
Aeronomy Laboratory  
National Oceanic and Atmospheric  
Administration  
(Atmospheric physics)

Frederick L. Scarf (1979)  
TRW Systems Group  
(Magnetospheric physics)

Richard A. Wolf (1981)  
Department of Space Physics and  
Astronomy  
Rice University  
(Space physics)

*Liaison Representatives*

Charles R. Chappell  
Marshall Space Flight Center  
National Aeronautics and Space  
Administration

Richard E. Hartle  
Goddard Space Flight Center  
Laboratory of Planetary Atmospheres  
National Aeronautics and Space  
Administration

Staff Officer: Richard C. Hart

*Committee on Earth Sciences*

Peter L. Bender (Chairman) (1980)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado  
(Geophysics)

Shelton S. Alexander (1980)  
Department of Geology and Geophysics  
The Pennsylvania State University  
(Geophysics)

Anthony W. England (1980)  
U.S. Geological Survey National  
Center  
(Geophysics)

Andrew P. Ingersoll (1980)  
Division of Geological and  
Planetary Sciences  
California Institute of Technology  
(Planetary atmospheres)

Staff Officer: Dean P. Kastel

*Committee on Gravitational Physics*

Irwin I. Shapiro (Chairman) (1980)  
Department of Geophysics and Physics  
Massachusetts Institute of  
Technology  
(Physics, astronomy)

Peter L. Bender (1980)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado  
(Physics)

C. G. Faelthammar  
Department of Plasma Physics  
Royal Institute of Technology

Carl I. Wunsch (1980)  
Department of Earth and Planetary  
Sciences  
Massachusetts Institute of  
Technology  
(Oceanography)

*Ex Officio*  
A. G. W. Cameron  
Harvard College Observatory

Ralph Bernstein  
Federal Systems Division  
IBM Corporation

Irwin I. Shapiro  
Department of Geophysics  
and Physics  
Massachusetts Institute of  
Technology

Robert H. Dicke (1980)  
Department of Physics  
Princeton University  
(Astrophysics)

David H. Douglass (1980)  
Department of Physics  
University of Rochester  
(Physics, astrophysics)

C. W. Francis Everitt (1980)  
 High Energy Physics Laboratory  
 Stanford University  
 (Space physics)

Kip Stephen Thorne (1980)  
 Division of Mathematics, Physics  
 and Astronomical Sciences  
 California Institute of Technology  
 (Astrophysics, theoretical physics)

Robert F. C. Vessot (1980)  
 Smithsonian Astrophysical Observatory  
 (Physics)

Staff Officer: Bruce N. Gregory

## COMMITTEES

### ASTRONOMY SURVEY COMMITTEE

In discussions with representatives of the Assembly, the National Aeronautics and Space Administration and the National Science Foundation indicated their willingness to support a survey of astronomy, including both ground- and space-based techniques, to establish priorities for the 1980's in the same way in which the "Greenstein report" (*Astronomy and Astrophysics for the 1970's*, NAS, 1972) established priorities in the 1970's. George B. Field (Center for Astrophysics, Cambridge, Massachusetts) has agreed to serve as chairman of the study, which began its activities at the end of 1978. In addition to the Survey Committee itself, it is planned to have panels concerned with observations in the radio, infrared, optical/ultraviolet, and high-energy wavelength regions, as well as a panel on theoretical astrophysics. Working groups will consider solar studies, planetary studies, facilities, instrumentation and detectors, data reduction, and modeling. Approximately 50 scientists will be involved in the Committee or planning and working groups, with as many as 50 additional consultants. It is proposed that the report of the Committee and its panels be available by summer 1981.

Staff Officer: Bruce N. Gregory

### COMMITTEE ON APPLICATIONS OF MATHEMATICS

This Committee's objective is to advance the use of mathematical sciences in appropriate fields of application. In support of this goal, the Committee is considering holding a conference on mathematical applications to fluid dynamics.

The Department of Energy, as well as various researchers in this field, have indicated an interest in such a conference.

#### Panel on Applied Mathematics Research Alternatives for the Navy

This Panel was established in response to a request from the Office of Naval Research (ONR). Its purposes are to improve communication between the mathematical research and naval science communities, to evaluate the mathematics research programs and policies of the Office of Naval Research, and to identify opportunities in ONR programs for research or applications in computer science and applied mathematics.

The Panel has met three times since its members were appointed in summer 1977. Topics discussed at the meetings included (a) balance among the programs funded by the ONR, (b) the age distribution of ONR contractors, (c) interaction of the mathematics branch with other branches of the ONR, and (d) the role of the naval laboratories.

At its next two or three meetings the Panels plans to examine ONR programs in artificial intelligence and to visit one or two naval laboratories with the objective of examining the role and use of applied mathematics in these laboratories.

#### Membership

##### *Committee on Applications of Mathematics*

James G. Glimm (Chairman) (1980)

Department of Mathematics

Rockefeller University

(Nonlinear differential equations,  
functional analysis, mathematical  
physics)

Ralph S. Phillips (1978)

Department of Mathematics

Stanford University

(Functional analysis, partial  
differential equations,  
mathematical physics)

Herman Chernoff (1979)

Department of Mathematics

Massachusetts Institute of Technology

(Mathematical statistics, statistical  
problems in econometrics)

Hans F. Weinberger (1979)

Department of Mathematics

University of Minnesota

(Approximation of eigenvalues)

Alexandre J. Chorin (1979)

Department of Mathematics

University of California at Berkeley

(Engineering, computer science)

Gerald B. Whitham (1979)

Department of Applied Mathematics

California Institute of Technology

(Fluid dynamics)

Mark Kac (1980)

Rockefeller University

(Theory of probability, mathematical  
statistics, number theory)

*Assembly Liaison Representatives*

Kenneth M. Case  
Rockefeller University

Bradley Efron  
Department of Statistics  
Stanford University

Executive Secretary: Jacob K. Goldhaber

*Panel on Applied Mathematics Research Alternatives for the Navy*

George F. Carrier (Chairman) (1980)  
Division of Engineering  
and Applied Physics  
Harvard University  
(Applied mathematics, hydrodynamics)

Herbert E. Scarf (1979)  
Department of Economics  
Yale University  
(Economics, operations research)

David H. Blackwell (1980)  
Department of Statistics  
University of California at Berkeley  
(Markoff chains, sequential analysis)

Jacob T. Schwartz (1980)  
Courant Institute of Mathematical  
Sciences  
New York University  
(Functional analysis, quantum  
theory, spectral theory of  
operators, computers)

Mark Kac (1980)  
Rockefeller University  
(Theory of probability, mathematical  
statistics, number theory)

Gerald B. Whitham (1978)  
Department of Applied Mathematics  
California Institute of Technology  
(Fluid dynamics)

Victor Klee (1980)  
Department of Mathematics  
University of Washington at Seattle  
(Functional analysis, convex sets,  
point set topology)

Shmuel Winograd (1979)  
Department of Mathematical Sciences  
T. J. Watson Research Center  
IBM Corporation  
(Computer mathematics, reliable  
computations, complexity of  
computations)

Malcolm R. Leadbetter (1979)  
Department of Statistics  
University of North Carolina  
(Mathematical statistics)

Gerald J. Lieberman (1979)  
Stanford University  
(Industrial statistics, quality  
control, reliability, operations  
research)

COMMITTEE ON APPLIED MATHEMATICS TRAINING  
[Ad Hoc]

This Committee, which was authorized in 1976 and established early in 1977, is addressing a variety of problems related to the mathematics training of undergraduates. It is studying and developing recommendations on a transition from mathematics programs that are too narrow in scope to more broadly oriented ones. It is also attempting to determine what curriculum changes are needed,



what obstacles there are to implementation and acceptance of such changes, and how to overcome these obstacles.

There were panel discussions of the Committee's work at the Mathematical Association of America-American Mathematical Society annual meeting in January 1978 in Atlanta, Georgia, at which time position papers developed by task groups of the Committee and dealing with curricula for mathematics majors, new applied mathematics courses, and noncurricular programs for applied mathematics students and faculty were presented. Further discussion took place at the May 1978 meeting of the Society for Industrial and Applied Mathematics in Madison, Wisconsin. At both meetings there was a fruitful interchange of ideas between Committee members and members of the mathematical community concerning methods of enhancing the applied mathematics education of undergraduates.

The Committee has agreed on the structure and outline for its final report and on the recommendations that it will make in this report. The report will be based, at least partially, on numerous position papers by Committee members, which the Committee has discussed during its meetings. The final report will be published early in CY 1979.

#### Membership

##### *Committee on Applied Mathematics Training (Ad Hoc)*

Peter J. Hilton (Chairman)  
Battelle-Seattle Research Center  
(Mathematics, statistics, algebraic  
topology)

Michael C. Reed  
Department of Mathematics  
Duke University  
(Problems in functional analysis  
that arise in mathematical physics,  
partial differential equations)

David J. Benney  
Department of Mathematics  
Massachusetts Institute of  
Technology  
(Mathematics in the physical sciences)

I. Richard Savage  
Department of Statistics  
Yale University  
(Mathematical statistics, nonparametric  
techniques, control theory)

Hans J. Bremermann  
Department of Mathematics  
University of California at  
Berkeley  
(Mathematics, biology, biophysics,  
several complex variables)

Herbert E. Scarf  
Department of Economics  
Yale University  
(Mathematical economics)

Felix E. Browder  
Department of Mathematics  
University of Chicago  
(Partial differential equations  
and nonlinear functional analysis)

Stephen Smale  
Department of Mathematics  
University of California at Berkeley  
(Immersion theory, Poincare con-  
jecture, mathematical economics)

Victor Klee  
Department of Mathematics  
University of Washington  
(Functional analysis, convex sets,  
point set topology)

Elias M. Stein  
Department of Mathematics  
Princeton University  
(Harmonic analysis, differentiability  
properties of functions)

Jean Taylor  
 Department of Mathematics  
 Douglass College  
 Rutgers University  
 (Analysis)

Daniel H. Wagner  
 Daniel H. Wagner Associates  
 (Mathematics, operations research,  
 constrained optimization)

Shmuel Winograd  
 Department of Mathematical Sciences  
 T. J. Watson Research Center  
 IBM Corporation  
 (Computer mathematics, reliable com-  
 putations, complexity of computations)

*Assembly Liaison Representative*  
 Bradley Efron  
 Department of Statistics  
 Stanford University

Executive Secretary: Jacob K. Goldhaber

#### COMMITTEE ON APPLIED AND THEORETICAL STATISTICS

The purpose of this recently organized Committee is to initiate studies in and encourage the effective use of statistics and its applications to the physical and computer sciences. Authorization to create this Committee was received from the Governing Board in spring 1977; the chairman was appointed in fall 1977; and Committee members were selected and appointed in spring 1978.

As a basis for studies that this Committee could undertake, a conference of statisticians and physical scientists was held at Airlie House in February 1978. Among the subjects identified by the conferees for possible study were measurement, state of the art, risk assessment, computation, large data, complex models, and Monte Carlo methods. The conferees outlined, in reasonable detail, the items to be considered in each of the suggested studies.

Currently the Committee is exploring possible sources of funds for these studies, which the Committee or *ad hoc* panels reporting to it would then undertake.

#### Membership

##### *Committee on Applied and Theoretical Statistics*

Ingram Olkin (Chairman) (1980)  
 Department of Statistics  
 Stanford University  
 (Mathematical statistics,  
 multivariate analysis)

Robert Bechhofer (1981)  
 Department of Operations Research  
 Cornell University  
 (Statistics)

Carl A. Bennett (1980)  
 Human Affairs Research Center  
 Battelle-Seattle Research Center  
 (Application of statistical and  
 mathematical techniques to  
 industrial problems)

Ram Gnanadesiken (1981)  
 Department of Statistics  
 Bell Laboratories  
 (Statistical analysis, multivariate  
 analysis)

Donald Guthrie (1979)  
Mental Retardation Research Center  
University of California at Los  
Angeles  
(Statistics, application of statisti-  
cal methods to mental retarda-  
tion research)

Max Halperin (1980)  
Department of Statistics  
George Washington University  
(Mathematical statistics, develop-  
ment of statistical techniques)

J. Stuart Hunter (1979)  
School of Engineering and Applied  
Science  
Princeton University  
(Statistics, experimental design  
in engineering sciences)

Jack C. Kiefer (1980)  
Department of Mathematics  
Cornell University  
(Mathematical statistics, statis-  
tical inference, decision theory)

Gerald J. Lieberman (1981)  
Stanford University  
(Operations research, industrial  
statistics)

Elliott W. Montroll (1979)  
Department of Physics and Astronomy  
University of Rochester  
(Mathematics, physics, statistical  
mechanics, theory of probability)

Ronald Pyke (1980)  
Department of Mathematics  
University of Washington  
(Mathematical statistics, theory of  
distribution-free statistics)

Stephen M. Stigler (1981)  
Department of Statistics  
University of Wisconsin  
(Statistics, order statistics,  
experimental design, history of  
statistics)

John W. Tukey (1980)  
Bell Laboratories  
(Statistics, statistical analysis,  
point set topology)

Marvin Zelen (1979)  
Division of Biostatistics and  
Epidemiology  
Sidney Farber Cancer Institute  
(Probability, mathematical statistics,  
model building in biomedical sciences)

*Ex Officio*

Conrad Taeuber  
Chairman, Committee on National Statis-  
tics  
Assembly of Behavioral and Social  
Sciences

*Liaison Representative*

Edwin D. Goldfield  
Committee on National Statistics  
Assembly of Behavioral and Social  
Sciences

*Assembly Liaison Representatives*

Bradley Efron  
Department of Statistics  
Stanford University

Robert Herman  
Traffic Science Department  
General Motors Research Laboratories

George W. Whitehead  
Department of Mathematics  
Massachusetts Institute of Technology

Executive Secretary: Jacob K. Goldhaber

## COMMITTEE ON ATMOSPHERIC SCIENCES

The Committee on Atmospheric Sciences was initially established in 1956 as the Committee on Meteorology in response to a request from the Department of Commerce. The primary task of the Committee is to review in broad perspective current activities in research and development, education and manpower, and related matters that affect progress in the atmospheric sciences. Through its reviews and special studies, the Committee attempts to encourage the evolution of a balanced national program in atmospheric research. It also stimulates U.S. participation in international atmospheric research programs.

The Committee has two special panels and a steering committee for an atmospheric research review that it has been conducting during the past year. The activities of these groups are described in the following sections.

## STORMFURY Advisory Panel

The STORMFURY Advisory Panel was created in late 1975 at the request of the National Oceanic and Atmospheric Administration (NOAA) to provide scientific guidance on a national hurricane modification program titled Project STORMFURY. Because of a lack of unanimous agreement among the nations bordering on the western Pacific and delays in reaching an agreement with Mexico for experimental plans to conduct the program in the eastern Pacific, the Project has been limited so far to operation in the western Atlantic. In addition, the current budget for the Project permits only limited field work, even when international agreements have already been achieved.

The Panel, which has produced two letter reports on the planning of this Project, is concerned primarily with scientific and technical features of the research program. It has noted that, with recent improved instrumentation of the NOAA research aircraft, meaningful scientific flights can now be made to advance the understanding of the dynamics of hurricanes and to measure changes in physical and thermodynamic parameters that result from artificial modification efforts. The Panel is encouraging NOAA to proceed with such aircraft probes of hurricanes, realizing that a better understanding of the behavior of hurricanes and of variations among them could contribute greatly to the design and procedures of Project STORMFURY.

In addition to its responsibilities to the federal government for review and guidance of scientific and technical program plans for this Project, the STORMFURY Advisory Panel senses that it is also through this Project that the government's attention is directed to broader issues of hurricane research and associated phenomena and public issues. Thus the Panel plans to explore with the government the longer-range plans for Project STORMFURY and for fundamental hurricane and related research efforts.

## Long-Range Weather Forecast Verification Panel

This *ad hoc* Panel was established at the request of NOAA to assist the federal government [that is, NOAA, the Department of Energy (DOE), and the Department

of Agriculture (DOA)] in the development of a practical statistical test that could be used by the government for the conduct of an experimental evaluation of long-range forecasts. The Panel will develop a statistical verification procedure for use in the specific case of forecasts of mean weekly temperatures, which are prepared one month in advance, for alternate weeks at a prescribed series of stations in the United States. It is expected that the federal verification experiment will continue for a period of at least one year.

The Panel will identify the capabilities of the statistical test, its limitations, the basis on which a degree of skill may be indicated by results of the test, and the extent of interpretation that the test allows. *Neither the Panel nor its parent Committee* will participate in the federal evaluation program or in any *post facto* interpretations of the results of the test.

#### Steering Committee for Atmospheric Research Review

Because of recent increased concern among public officials and the general public about a number of environmental issues, the Committee on Atmospheric Sciences concluded that an evaluation of national research priorities in the atmospheric sciences would be timely. This idea was discussed with colleagues at universities and at the National Center for Atmospheric Research (NCAR), as well as at meetings with federal officials. Subsequently, the Committee decided to initiate a broad examination of the objectives and direction of atmospheric research, with the goal of providing improved information and services to the general public, industry, and government.

In 1971, the Committee issued a report, *The Atmospheric Sciences and Man's Needs: Priorities for the Future*, which recommended priorities in research needed to meet important human needs. What is now required is not merely to update the 1971 report but to re-examine the goals of national research efforts in atmospheric sciences as a basis for (a) determining problems and opportunities and (b) defining a set of national objectives for the coming decade that are not only consistent with the present stage of scientific development but that are also directed toward the solution of critical national needs.

For this review, a Steering Committee was established to identify the objectives and to develop a plan and timetable for its conduct. It was decided to approach the examination of the goals and direction of atmospheric research through an analysis of the current status of the interaction of the atmospheric sciences with society--the varieties and potential of predictive regimes and the advertent and inadvertent modification of the atmosphere by human activities. Research opportunities for the coming decade would be evaluated not only in relation to scientific criteria but also in terms of their potential immediate or long-term contribution to this interactive process.

There was consensus among the Steering Committee members that the final report prepared following a one-week workshop in June 1978 should be directed to the nonspecialist--the legislator in Congress, the decision maker in the Executive Branch, the concerned individual in the public sector, and the scientist in another discipline. A chief concern of the Steering Committee is to ensure that the direction it recommends for the future development of atmospheric research is scientifically sound and based on consensus in the broad and diverse atmospheric sciences community.

Twelve *ad hoc* task groups were established under the Steering Committee to consider the atmospheric sciences from the perspectives of 12 different problems and disciplinary research fields. Problems were examined from the viewpoint of the user; disciplinary fields were examined from the viewpoint of the scientific specialist and scholar. In adopting this approach, the Committee recognized that the stimulus for scientific progress can come either from the requirements placed on a discipline by users or from developments in a field that create new challenges to scientific understanding and eventually may lead to new applications.

The primary objective of the workshop was to consider the findings of the task groups, to develop a consensus on opportunities and priorities, and to make the general results of the review and of workshop deliberations available to the government for use in its preparation of the federal budget for FY 1980. Following the workshop and transmission of a preliminary report on the findings to concerned agencies, a final report will be prepared, with publication planned during the winter of 1978-1979.

National goals for atmospheric research in the 1980's that were agreed on by workshop participants, and recommended to the federal government were the following:

1. To improve understanding and prediction of atmospheric precipitation processes;
2. To understand the climate system and its response to various influences;
3. To elucidate the biogeochemical cycles and budgets and their relationship to atmospheric processes.

#### Activities Planned for CY 1979

The Committee on Atmospheric Sciences plans to focus its future work on the priorities identified by the 1978 Workshop. It will consider the physical processes leading to the development of clouds and cloud systems (in cold and warm seasons) and the major problems that are likely to be encountered in research on the genesis and development of precipitation. The barriers to progress in this field will need examination and clarification to provide specific guidance to concerned federal agencies in their efforts to achieve the goal proposed for the next decade.

In regard to biogeochemical cycles, the recent efforts to identify and clarify the roles of trace atmospheric constituents from natural and man-made sources have shown the great complexity of chemical processes occurring in the atmosphere. The Committee plans to review the status of current research in this field; the problems of measurement in both laboratory and field; and related issues of manpower, training, and support to determine whether a detailed study is warranted.

Understanding of the climate system and its response to various influences is a principal concern of the Climate Research Board, thus Committee activity in relation to this goal will probably be limited to encouraging the Board to examine the relatively short-term planetary dynamic processes that contribute to the interannual climatic variability.

In addition, the Committee plans to examine the need for better means of informing the general public about the ways that atmospheric research and development are conducted and supported. The barrage of problems the public learns about through the news services are related primarily to the complex atmospheric pollutant issues, the threat of climatic change, and the uncertainties of severe storms. It is likely that some clarification of what scientists are doing about these matters would not only be of interest to the public but might help to alleviate growing public concern. Thus the Committee will explore ways to improve communication with the public.

### Membership

#### *Committee on Atmospheric Sciences*

|  |  |
|--|--|
| Cecil E. Leith, Jr. (Chairman) (1980)  | Paul J. Crutzen (1981)   |
| Atmospheric Analysis and Predictions<br>Division                             | National Center for Atmospheric<br>Research                                |
| National Center for Atmospheric<br>Research                                  | (Global distribution in photochemistry<br>of long-lived atmospheric gases) |
| (Mathematics, geophysical fluid<br>dynamics)                                 |  |
| Verner E. Suomi (Vice Chairman) (1979)                                       | Charles W. Howe (1980)   |
| Space Science and Engineering Center   | Department of Economics  |
| University of Wisconsin  | University of Colorado   |
| (Meteorological satellites)  | (Economic development, growth and<br>natural resources)                    |
| Richard A. Anthes (1981)   | John E. Kutzbach (1980)  |
| Department of Meteorology  | Center for Climatic Research   |
| Pennsylvania State University  | University of Wisconsin  |
| (Numerical modeling of mesoscale<br>phenomena)                               | (Climate dynamics)   |
| D. James Baker, Jr. (1981)   | Michael B. McElroy (1980)  |
| Pacific Marine Environmental Laboratory                                      | Division of Engineering and Applied<br>Physics                             |
| National Oceanic and Atmospheric<br>Administration                           | Harvard University   |
| (Soft x-ray physics, physical ocean-<br>ography, geophysical fluid dynamics) | (Planetary atmospheres)  |
| Louis J. Battan (1980)   | James H. Newman (1981)   |
| Institute of Atmospheric Physics   | Department of Agronomy   |
| University of Arizona  | Purdue University  |
| (Radar meteorology, cloud physics)   | (Agronomy)   |
| Francis P. Bretherton (1980)   | Joseph Pedlosky (1979)   |
| University Corporation for Atmo-<br>spheric Research                         | Department of Geophysical Sciences   |
| (Geophysical fluid dynamics)   | University of Chicago  |
|  | (Geophysical fluid mechanics)  |
|  | Norman A. Phillips (1980)  |
|  | National Meteorological Center   |
|  | National Oceanic and Atmospheric<br>Administration                         |
|  | (Numerical atmospheric modeling and<br>prediction)                         |

John M. Wallace (1979)  
 Department of Atmospheric Sciences  
 University of Washington  
 (Tropical atmospheric dynamics)

Robert M. White (1981)  
 Climate Research Board  
 Assembly of Mathematical and  
 Physical Sciences  
 (Atmospheric and ocean sciences,  
 environmental sciences)

*Member Emeritus*

Paul E. Klopsteg  
 Laguna Hills, California (Retired)

Executive Secretary: John R. Sievers

*STORMFURY Advisory Panel*

Charles L. Hosler (Chairman) (1981)  
 College of Earth and Mineral Sciences  
 Pennsylvania State University  
 (Cloud and precipitation physics)

Richard A. Anthes (1981)  
 Department of Meteorology  
 Pennsylvania State University  
 (Hurricane modeling)

Roscoe R. Braham (1981)  
 Department of Geophysical Sciences  
 University of Chicago  
 (Precipitation and cloud physics)

Charles L. Jordan (1980)  
 Department of Meteorology  
 Florida State University  
 (Tropical climatology)

Katsuyuki Ooyama (1980)  
 National Center for Atmospheric  
 Research  
 (Hurricane modeling)

*Atmospheric Research Review Steering Committee*

Cecil E. Leith, Jr. (Chairman)  
 Atmospheric Analysis and Predictions  
 Division  
 National Center for Atmospheric  
 Research  
 (Mathematics, geophysical fluid  
 dynamics)

*Liaison Representatives*  
 Walter Telesetsky  
 National Oceanic and Atmospheric  
 Administration

John E. Slaughter  
 National Science Foundation

*Assembly Liaison Representatives*  
 Robert G. Fleagle  
 Department of Atmospheric Sciences  
 University of Washington

Richard S. Lindzen  
 Harvard University

Howard J. Taubenfeld (1980)  
 School of Law  
 Southern Methodist University  
 (Legal implications of weather  
 modification)

*Liaison Representatives*  
 Currie S. Downie  
 National Science Foundation

Ronald L. Lavoie  
 National Oceanic and Atmospheric  
 Administration

Morris Tepper  
 National Aeronautics and Space  
 Administration

Louis J. Battan  
 Institute of Atmospheric Physics  
 University of Arizona  
 (Radar meteorology, cloud physics)



Francis P. Bretherton  
University Corporation for Atmospheric  
Research  
(Geophysical fluid dynamics)

Robert G. Fleagle  
Department of Atmospheric Sciences  
University of Washington  
(Large-scale atmospheric motions,  
physics of air near earth's surface)

John C. Gille  
National Center for Atmospheric  
Research  
(Satellite radiation measurements,  
radiative effects of fluid dynamics)

*Long-Range Weather Forecast Verification Panel*

Cecil E. Leith, Jr. (Chairman)  
Atmospheric Analysis and Predictions  
Division  
National Center for Atmospheric  
Research  
(Mathematics, geophysical fluid dynam-  
ics, statistical hydrodynamics)

Donald R. Johnson  
Space Science and Engineering Center  
University of Wisconsin  
(Dynamic climatology and meteorology,  
secondary and general circulation  
studies)

Richard Jones  
Department of Biometrics  
University of Colorado Medical Center  
(Stochastic processes, time series  
analysis, statistical data analysis)

Charles L. Hosler  
College of Earth and Mineral Sciences  
Pennsylvania State University  
(Cloud and precipitation physics)

Verner E. Suomi  
Space Science and Engineering Center  
University of Wisconsin  
(Meteorological satellites)

John M. Wallace  
Department of Atmospheric Sciences  
University of Washington  
(Tropical atmospheric dynamics)

Frederick Sanders  
Department of Meteorology  
Massachusetts Institute of Technology  
(Application of approach and results  
of theoretical meteorology to  
prediction)

John M. Wallace  
Department of Atmospheric Sciences  
University of Washington  
(Tropical atmospheric dynamics)

COMMITTEE ON ATOMIC AND MOLECULAR SCIENCE

This Committee is concerned with the general field of phenomena at the atomic and molecular level and thus with the disciplines of physics, chemistry, and engineering. Its scope includes fundamental physics as reflected in atomic and molecular phenomena; fundamental properties of atoms and molecules; and interactions of atoms and molecules with electrons, ions, radiation, surfaces, solids, and each other. The Committee's interests include both basic and applied atomic and molecular science. Its principal objectives are to serve

as a focal point for the many small and widely dispersed groups engaged in atomic and molecular science and to act as a spokesman for the field.

Following publication of two reports in 1976, the principal activity of the Committee in 1977 was to reorganize, enlarge its membership, and determine what new projects should be undertaken. As a result of its deliberations, a proposal was drafted for submission to the National Science Foundation. This plan calls for a thorough survey of atomic and molecular science in the United States to determine the current state of the field; to identify active practitioners in industrial as well as the more traditional locations; and to obtain information on present and probable future activities, levels and sources of support, impacts of atomic and molecular science on societal problems and concerns, influx and efflux of personnel (i.e., patterns of mobility), and educational patterns and problems. The survey would require approximately one year, with a report being prepared and published during the year following completion of the survey.

Through the Panel that earlier prepared a report on accelerator-related atomic and molecular physics (issued in 1976), the Committee has continued to study the use and potential of high-energy accelerators in this field.

The Committee also participated in the National Science Foundation's review of its Atomic and Molecular Physics Program.

In addition to these activities, the Committee has two projects under consideration for late 1978 or early 1979: (a) a study of contributions atomic and molecular science could make to federal agency missions and programs and (b) a study of the role of atomic and molecular science in the utilization of resources.

### Membership

#### *Committee on Atomic and Molecular Science*

|   |   |
|---|---|
| Wade L. Fite (Chairman) (1980)<br>Department of Physics<br>University of Pittsburgh<br>(Atomic physics)                     | R. Stephen Berry (1981)<br>Department of Chemistry<br>University of Chicago<br>(Atomic and molecular processes) |
| Bernd Crasemann (Vice Chairman) (1979)<br>Department of Physics<br>University of Oregon<br>(X-ray physics, Auger processes) | Ugo Fano (1980)<br>Department of Physics<br>University of Chicago<br>(Theoretical and atomic physics)           |
| Clarence F. Barnett (Secretary) (1980)<br>Oak Ridge National Laboratory<br>(Controlled fusion)                              | Robert S. Freund (1979)<br>Bell Laboratories<br>(Atomic collisions, atomic physics<br>in communications)        |
| Benjamin Bederson (1979)<br>Department of Physics<br>New York University<br>(Atomic and plasma physics)                     | Frederick Kaufman (1980)<br>Department of Chemistry<br>University of Pittsburgh<br>(Physical chemistry)         |

Joseph Macek (1981)  
Behlen Laboratory of Physics  
University of Nebraska  
(Atomic physics)

Eugen Merzbacher (1980) .  
Department of Physics and Astronomy  
University of North Carolina  
(Theory and high-energy atomic  
physics)

Robert G. Parr (1981)  
Department of Chemistry  
University of North Carolina  
(Molecular vibrations, electronic  
structure of molecules)

Joseph B. Reader (1979)  
Spectroscopy Section  
National Bureau of Standards

Felix T. Smith (1981)  
Molecular Physics Center  
SRI International  
(Atomic collisions, chemical  
reactions)

Stephen J. Smith (1981)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado  
(Electron and atomic physics)

Winthrop W. Smith (1979)  
Department of Physics  
University of Connecticut  
(Atomic and molecular collisions)

Executive Secretary: Charles K. Reed

Benjamin B. Snavely (1981)  
Physics Division  
Eastment Kodak Company Research  
Laboratories  
(Fel compounds, electronic and  
optical properties of thin films)

Ronald F. Stebbings (1979)  
Department of Physics  
Rice University  
(Ionic and atomic physics)

*Ex Officio*  
Neal F. Lane  
Chairman, Division of Electron  
and Atomic Physics, American  
Physical Society

*Liaison Representatives*  
Joseph Martinez  
Department of Energy

Rolf Sinclair  
National Science Foundation

*Assembly Liaison Representatives*  
Richard B. Bernstein  
Department of Chemistry  
Columbia University

Robert Herman  
Traffic Science Department  
General Motors Research Laboratories

*Ad Hoc Panel on Accelerator-Related Atomic Physics Research*

Bernd Crasemann  
Department of Physics  
University of Oregon  
(X-ray physics, Auger processes)

James R. Macdonald  
Department of Physics  
Kansas State University  
(Atomic collisions)

Eugen Merzbacher  
Department of Physics and Astronomy  
University of North Carolina  
(Theory and high-energy atomic  
physics)

Winthrop W. Smith  
Department of Physics  
University of Connecticut  
(Atomic and molecular collisions)

Charles D. Moak  
Oak Ridge National Laboratory  
(Neutron physics)

### COMMITTEE ON CHEMICAL SCIENCES

This Committee was established in May 1977 following discussions in the chemical community and at meetings of the Advisory Board to the Office of Chemistry and Chemical Technology. Its objective is to assist federal agencies that are responsible for funding basic research in the chemical sciences in developing long-range plans, identifying potential problems and promising new fields of chemical research, indicating fields in which interagency cooperation would be productive, and locating gaps in the support of the overall discipline. To accomplish these aims, the Committee, composed of persons broadly knowledgeable in chemical sciences and in the administration of chemical research, organizes studies, workshops, symposia, and conferences, often with the assistance of special panels.

In response to a request from James Kane of the former Energy Research and Development Administration (now the Department of Energy), the Committee undertook a review of the chemical sciences program supported by the Office of Basic Energy Sciences of the Department of Energy. This review includes an examination of present levels of support for various fields of research and development; of facilities and equipment necessary for the advance of research; and of the distribution of support among in-house laboratories, university investigators, nonprofit research institutes, and industry.

An initial report dealing with topics such as analytical chemistry, combustion research, coal science and related chemistry, fuel reprocessing and waste management, and funding and review procedures is scheduled for release in early 1979. The Committee hopes to issue a second follow-on report about a year later (i.e., by the end of CY 1979). In general, the 1978 and 1979 reports would address different topics; however, a subject as broad as coal science and related chemistry could well require discussion in both.

While this requested study is in progress, the Committee is seeking other sources of support to enable it to function as a standing committee responsive to the broad needs of the chemical research community and the agencies funding chemical research. Plans to create two subcommittees, described below, represent a step in this direction.

The Committee met in October and December 1977 and in February, April, June, August, and October 1978. During these meetings, the Committee received briefings from John Deutch, Director of the Office of Energy Research, James Kane, Acting Associate Director for Basic Research Programs, Office of

Energy Research, and the Acting Directors and Staff of the Divisions of Chemical Sciences, Materials Sciences, and Nuclear Science.

#### Subcommittee on Nuclear and Radiochemistry

The nuclear chemistry and radiochemistry communities have expressed the need for a continuing NRC activity to carry on the work of the Subcommittee on Radiochemistry of the recently discharged Committee on Nuclear Science, which was also in this Assembly, and to serve as a focal point for the concerns of this field. Although chemists pioneered the development of particular fields of nuclear science and people with chemical training continue in the forefront, individuals doing these kinds of research are more widely dispersed under various organizational structures than are workers in traditional fields of chemistry. Therefore, the former Subcommittee on Radiochemistry met a real need that is likely to continue.

Following discussions with members of the nuclear science and radiochemistry communities and with staff of the Office of Basic Energy Sciences, Division of Nuclear Science (of the Department of Energy), the Committee on Chemical Sciences agreed to establish a Subcommittee on Nuclear and Radiochemistry. A principal purpose of the Subcommittee would be to maintain awareness of the chemical aspects of nuclear phenomena, to stimulate scientific and technical progress, and to identify opportunities for research. When an established advisory organization exists, as in the case of nuclear science (the Nuclear Sciences Advisory Committee of the National Science Foundation and the Department of Energy), the Subcommittee will channel its advice through the appropriate body.

Among the specific activities that the proposed new Subcommittee would undertake are the following:

1. Alert federal agencies to instructional and research needs in nuclear and radiochemistry, to problems relating to the future supply of adequately trained scientists in these fields, to needs for radiochemical standards, and to needs for low-background materials for construction of instruments.
2. Provide assistance, on request, to federal agencies on problems relating to nuclear and radiochemistry.
3. Continue, as needed, the publication program of the former Subcommittee on Radiochemistry--a series of more than 60 monographs on radiochemistry of the elements and the application of radiochemical procedures in other fields--and facilitate the preparation of related publications.
4. Organize (perhaps jointly with professional societies) workshops, conferences, symposia, and special studies.

The Subcommittee would consist of about eight members knowledgeable in the various areas of research interest and representing institutional units active in the field (universities, industry, and national laboratories). The Subcommittee would meet twice a year, with additional meetings scheduled as needed in connection with any special studies or symposia.

### Subcommittee on Information Storage and Retrieval in Chemistry

In response to a suggestion from the Committee on Chemistry and Federal Policy of the NAS Section of Chemistry, which was endorsed by the Advisory Board of the Office of Chemistry and Chemical Technology, an *ad hoc* Panel on Information Storage and Retrieval in Chemistry was convened at the Academy for two days in October 1977. Ernest L. Eliel and Mary L. Good served as cochairpersons of this panel, which was charged with assessing the need for a study of the problem and, if such a need were apparent, defining the scope of an in-depth study.

Although many disciplines face problems in access to and use of scientific and technical information, the Assembly agreed with the Panel that a pilot study in chemistry could be more easily undertaken than an interdisciplinary one and could provide a useful prototype for like studies in other fields. Further, the secondary services in chemistry (*Chemical Abstracts* and its derivative publications) represent a highly developed system and a pool of experience that should be a useful base for a study of interaction with users.

The *Ad Hoc* Panel recommended (see *Report of the Ad Hoc Panel on Information Storage and Retrieval in Chemistry*, NAS, March 1978) the establishment of a committee, as soon as adequate funding could be obtained, to undertake a one- or two-year in-depth study of information storage and retrieval in chemistry. The proposed committee should consist of about 12 individuals representing the private for-profit (industrial), private nonprofit (academic, scientific society), and government organizations and including persons from the following groups: users (practicing chemists, engineers, and librarians); information scientists (generators and distributors of data bases, both bibliographic and numerical); administrators; and publishers; as well as a lawyer familiar with copyright law, an economist, and a government scientist familiar with data needs for the formulation of regulatory policy.

The study would examine the following:

1. The *economic impact* of future information technology on primary (i.e., journals with original articles), secondary (abstracts, indexes, and derivative products), and tertiary (reviews, monographs, data compilations) publications;
2. The *intellectual impact* of future information technology;
3. *Educational problems* resulting from modern information storage and retrieval methods;
4. Support of *research* in information science;
5. *Problems specific to* the storage and retrieval of *numerical data*.

The Committee on Chemical Sciences, noting that problems resulting from the "information explosion" in chemistry and related sciences were among the kinds of questions that it was originally expected to address, enthusiastically agreed to organize a subcommittee to conduct the recommended study as outlined in the report of the *Ad Hoc* Panel. Funds for the study will be sought from the National Science Foundation, National Institutes of Health, National Bureau of Standards, and American Chemical Society, as well as from other interested organizations.

## Membership

*Committee on Chemical Sciences*

Robert E. Connick (Cochairman) (1980)  
 Department of Chemistry  
 University of California at  
 Berkeley  
 (Physical and inorganic chemistry)

Bryce Crawford, Jr. (Cochairman) (1979)  
 Molecular Spectroscopy Laboratory  
 University of Minnesota  
 (Vibrational spectroscopy and  
 structural chemistry)

Herman S. Bloch (1979)  
 Skokie, Illinois (Retired)  
 (Petroleum chemistry)

Clark H. Ice (1978)  
 Atomic Energy Division  
 Savannah River Laboratory  
 E. I. duPont de Nemours and Company,  
 Inc.  
 (Heavy elements, isotopes)

Rudolph A. Marcus (1978)  
 Noyes Laboratory of Chemical Physics  
 California Institute of Technology  
 (Physical chemistry, kinetics)

Earl L. Muetterties (1979)  
 Department of Chemistry  
 University of California at Berkeley  
 (Inorganic chemistry)

Stanford S. Penner (1979)  
 Energy Center  
 University of California at San Diego  
 (Combustion processes, physical  
 engineering)

Alan Schriesheim (1979)  
 Exxon Research and Engineering Company  
 (Organic chemistry)

Executive Secretary: William Spindel

Arthur M. Squires (1978)  
 Department of Chemical Engineering  
 Virginia Polytechnic Institute and  
 State University  
 (Physical chemistry, fossil fuels,  
 coal conversion)

Ellison H. Taylor (1978)  
 Oak Ridge National Laboratory  
 (Physical chemistry, atomic and  
 molecular science)

Anthony L. Turkevich (1979)  
 Enrico Fermi Institute and  
 Chemical Institute  
 University of Chicago  
 (Nuclear chemistry, space chemistry)

Alfred P. Wolf (1979)  
 Chemistry Department  
 Brookhaven National Laboratory  
 (Nuclear medicine, organic and  
 physical chemistry)

Wayne L. Worrell (1978)  
 Department of Metallurgy and Materials  
 Science  
 University of Pennsylvania  
 (High-temperature chemistry)

*Assembly Liaison Representatives*  
 Richard B. Bernstein  
 Department of Chemistry  
 Columbia University

William G. Dauben  
 Department of Chemistry  
 University of California at Berkeley

Robert G. Sachs  
 University of Chicago

## COMMITTEE ON GEODESY

The rapid evolution of geodetic techniques in recent decades and the development of new applications of geodesy, particularly in ocean dynamics and solid-earth geophysics encouraged the relevant federal agencies to seek the assistance of the National Research Council in the examination of the health of this science and development of recommendations on its future. The initial charge was to review the following topics, identify any problems related to them, and offer recommendations for their solution:

1. Scientific and technological advances in modern geodesy and related fields;
2. Planning for spaceborne instrumentation pertinent to geodesy during the 1980's;
3. Geodetic control for the oceans;
4. Educational opportunities in geodesy and surveying;
5. Current work in plane surveying and mapping;
6. Current work on traditional geodesy.

The charge also included development of a Senior Scientist Grants in Geodesy Program.

In response to this request, the Assembly formed the Committee on Geodesy late in 1975 to undertake these studies. The Committee's conclusions and recommendations were published in August 1978 in a report titled *Geodesy--Trends and Prospects* (which is available from the Director [C18], National Geodetic Information Center, 11400 Rockville Pike, Rockville, Maryland 20852). The report recommends an increase in the transmission of procedures and technology of this field from the public sector to the private sector; the improvement of geodetic methods for application to geophysics, including crustal motion and earthquake hazard studies; a greater effort in the development of instrumentation; and a greater awareness on the part of government of the educational and organizational needs of the science.

The Committee also concluded that there were several questions on which more useful recommendations could be made after more detailed technical study. Therefore, it recommended that the following problems be examined by *ad hoc* panels:

1. What geodetic instrumentation and observing programs are required for geodynamic purposes, in particular, to improve understanding of tectonic motions and to enhance earthquake prediction capability?
2. How should the Department of Defense Global Positioning System be used for geodesy and surveying?
3. What should be the role of federal geodetic and mapping agencies in working with states to establish a multipurpose cadastre?
4. What are the applications of the gravity field and what observations are required to satisfy these applications?
5. What are the applications of the satellite altimetry data, and what should be done to ensure that these data are effectively applied?
6. How can present and planned geodetic technology be most effectively transferred to users?



7. What is the economic benefit of geodesy?
8. What is the present status of the 1973 Report of the Federal Mapping Task Force on Mapping, Charting, Geodesy, and Surveying, and what further actions might be taken to improve the health and vitality of geodesy and related sciences?

The Committee determined that the most immediate problems to consider were those dealing with the Global Positioning System, geodynamics, a national cadastre, and the Federal Mapping Task Force Report, including technology transfer. Thus it convened a group of experts in Boulder, Colorado, in July 1978 to consider specific tasks that might be undertaken by a Special Panel on the Global Positioning System, and a second group in Reston, Virginia, in August 1978 to outline specific tasks for Special Panels on the Federal Mapping Task Force report. In addition, the Committee is working with the Committee on Seismology on the planning of a joint panel to examine the geodetic instrumentation and observing programs required for geodynamic purposes.

In its report, the Committee had discussed problems that could be resolved by accurately determined, short-wavelength earth gravity components. Specifically, the Committee recommended a dedicated gravity satellite, maintained at as low an altitude as possible, with satellite-to-satellite tracking, subject to further analysis of accuracy requirements and feasibilities. In direct response to the Committee's recommendation and its concern about the specifications and requirements for a dedicated gravity satellite, the National Aeronautics and Space Administration requested more-detailed guidance. Consequently, the Committee organized a five-day workshop to prepare a follow-up report on (a) anticipated accuracies from satellite systems for determining short-wavelength (100- to 300-km) components of earth's gravity field and (b) scientific and technical applications requirements of the anticipated data. The workshop agenda included briefings on various space systems and their accuracies, followed by deliberations and draft reports of special panels on solid-earth, oceanographic, geodetic, and orbital applications. A final report, based on these inputs, will be published early in 1979.

In addition to these projects, the National Oceanic and Atmospheric Administration has invited the Committee on Geodesy to review the research and development programs in geodesy and related fields of its National Ocean Survey. This assessment should include the quality of the research and development program in relation to the state of the art, the strengths and weaknesses of each program area, the adequacy of the research and development effort in relation to agency goals, and interaction between NOAA scientists and engineers and those in related activities in nongovernment organizations. The Committee plans to establish a panel early in 1979 to undertake this review and prepare a report on its findings. The NOAA request for such a review was responsive to a recommendation made in a 1977 report of the Ocean Sciences Board on the quality of NOAA's Ocean Research and Development Program.

During the period from early 1976 to 1978, five Senior Scientist Grants were approved. Their research was supported by the National Oceanic and Atmospheric Administration. Research topics included: (a) Multiquadric Functions and Stochastic Processes (Rolland L. Hardy, Iowa State University); (b) Differential-Geometric Foundations for Time-Dependent Geodesy (Nathaniel Grossman, University of California at Los Angeles); (c) *A Priori* Estimation

of Rounding Errors during the Solution of Superlarge Systems of Geodetic Normal Equations (Peter Meissl, Institut für Mathematische und Numerische Geodäsie); (d) Observational Equations in Three-Dimensional and Four-Dimensional Geodesy (Erik W. Grafarend, Lehrstuhl für Astronomische und Physikalische Geodäsie); and (e) Time Variations in Geodetic Positions (Petr Vaníček, University of New Brunswick). The Committee on Geodesy plans to continue to provide a Senior Scientist Grants in Geodesy Program.

*Committee on Geodesy*

Ivan I. Mueller (Chairman) (1981)  
Department of Geodetic Science  
Ohio State University  
(Geodesy)

Peter L. Bender (1979)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado  
(Physics)

Duane C. Brown (1981)  
Geodetic Services Inc.  
(Photogrammetry)

Daniel B. DeBra (1981)  
Department of Aeronautics and  
Astronautics  
Stanford University  
(Inertial guidance)

Edward M. Gaposchkin (1981)  
Smithsonian Astrophysical  
Observatory  
(Geophysics)

John C. Harrison (1981)  
Cooperative Institute for Research  
in Environmental Sciences  
University of Colorado  
(Geophysics)

George E. Jones (1981)  
Survey Engineering  
Chevron Oil Company  
(Surveying)

William M. Kaula (1981)  
Institute of Geophysics and Space  
Physics  
University of California at Los Angeles  
(Geophysics)

Byron D. Tapley (1981)  
College of Engineering  
University of Texas at Austin  
(Aerospace engineering, engineering  
mechanics)

John A. Whitehead, Jr. (1979)  
Woods Hole Oceanographic Institution  
(Fluid dynamics)

Charles A. Whitten (1981)  
Silver Spring, Maryland (retired)  
(Geodesy)

*Liaison Representatives*

William J. Best  
Air Force Office of Scientific Research

John D. Bossler  
National Geodetic Survey

Frederick J. Doyle  
U.S. Geological Survey

Leonard Johnson  
National Science Foundation

Thomas T. Pyle  
Office of Naval Research

Carl F. Romney  
Advanced Research Projects Agency

James C. Savage  
U.S. Geological Survey

Pitt G. Thome  
National Aeronautics and Space  
Administration

Owen W. Williams  
Defense Mapping Agency

*Assembly Liaison Representatives*  
Robert B. Leighton  
George W. Downs Laboratory of  
Physics  
California Institute of Technology

Executive Secretary: Hyman Orlin

*Panel on Crustal Movement Measurement*  
Adam Dziewonski (Chairman) (1981)  
Department of Geological Sciences  
Harvard University  
(Seismology)

Peter L. Bender (1981)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado  
(Physics)

John C. Harrison (1981)  
Cooperative Institute for Research in  
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University of Colorado  
(Geophysics)

William M. Kaula (1981)  
Institute of Geophysics and Space  
Physics  
University of California at Los  
Angeles  
(Geophysics)

*Panel on Global Positioning System*  
Daniel B. DeBra (Chairman) (1981)  
Department of Aeronautics and  
Astronautics  
Stanford University  
(Inertial guidance)

Duane C. Brown (1981)  
Geodetic Services Inc.  
(Photogrammetry)

Edward M. Gaposchkin (1981)  
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Jack E. Oliver  
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*Ex Officio*  
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James Savage  
U.S. Geological Survey

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in Environmental Sciences  
University of Colorado  
(Geophysics)

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Chevron Oil Company  
(Surveying)

Judah Levine (1981)  
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Astrophysics  
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(Physics)

Bradford Parkinson (1981)  
Department of Mechanical Engineering  
Colorado State University  
(Astronautical engineering)

Byron D. Tapley (1981)  
College of Engineering  
University of Texas at Austin  
(Aerospace engineering, engineering  
mechanics)

Dennis C. Wright (1981)  
Aircraft Owners and Pilots Association  
(Aviation management)

*Ex Officio*

Ivan I. Mueller  
Department of Geodetic Science  
Ohio State University

*Panel on Gravity Field and Sea Level*

John C. Harrison (Chairman) (1981)  
Cooperative Institute for Research in  
Environmental Sciences  
University of Colorado  
(Geophysics)

D. James Baker, Jr. (1981)  
Pacific Marine Environmental  
Laboratory  
(Physical Oceanography)

Peter L. Bender (1979)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado  
(Physics)

Daniel B. DeBra (1981)  
Department of Aeronautics and  
Astronautics  
Stanford University  
(Inertial guidance)

Edward M. Gaposchkin (1981)  
Smithsonian Astrophysical Observatory  
(Geophysics)

William M. Kaula (1981)  
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Physics  
University of California at Los Angeles  
(Geophysics)

*Liaison Representatives*  
William Chapman  
U.S. Geological Survey

Clyde Goad  
National Geodetic Survey

Charles Martin  
Defense Mapping Agency

Thomas Fischetti  
National Aeronautics and Space  
Administration

Richard Rapp (1981)  
Department of Geodetic Science  
Ohio State University  
(Geodesy)

Byron D. Tapley (1981)  
College of Engineering  
University of Texas at Austin  
(Aerospace Engineering, engineering  
mechanics)

Anthony Watts (1981)  
Lamont-Doherty Geological Observatory  
(Gravity field, tectonics)

John A. Whitehead, Jr. (1979)  
Woods Hole Oceanographic Institution  
(Fluid dynamics)

Carl Wunsch (1981)  
Department of Earth and Planetary  
Sciences  
Massachusetts Institute of Technology  
(Oceanography)

*Ex Officio*

Ivan I. Mueller  
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*Liaison Representatives*  
Bernard Chovitz  
National Geodetic Survey

James Murphy  
National Aeronautics and Space  
Administration

Kenneth I. Dougherty  
Defense Mapping Agency

James C. Savage  
U.S. Geological Survey

#### COMMITTEE ON GEOLOGICAL AND MATERIALS SCIENCES (AD HOC)

The Advisory Board to the Office of Earth Sciences recommended convening an *ad hoc* committee to determine whether there was need for increased interaction between geological and materials sciences. Using Program Initiation and Development Funds, the Committee met in April 1978. There was consensus that greater interaction between these sets of disciplines would facilitate the exchange of science, technology, and concepts and that such interchanges would contribute to the solution of national problems, as well as stimulating both fields. The Committee identified several pressing problems, such as the enhanced recovery of fuels and underground facility construction, in which increased interaction would be especially helpful.

In its report, distributed to the Assembly at its September 1978 meeting, the Committee recommended six tasks for additional study and proposed the organization of an *ad hoc* committee of the Assembly to undertake these tasks, which are as follows:

1. To identify and help to reduce impediments to effective interdisciplinary interaction between these fields in universities, industry, and government;
2. To examine the means by which basic interdisciplinary research is or could be incorporated into long-range planning for large geoscience projects;
3. To consider the need for regional or national centers to provide special facilities for interdisciplinary research;
4. To foster interaction between geoscientists and materials scientists through conferences, symposia, and the like;
5. To bring together more members of the research communities of these fields, who do not have or recognize a pre-existing common interest, through lecture series, workshops, and the like;
6. To stimulate the publication of state-of-the-art reviews, with special emphasis on interdisciplinary research opportunities.

In response to this report, the Assembly authorized, with subsequent Governing Board approval, the creation of an *ad hoc* Committee on Geological and Materials Sciences to operate for a two-year period beginning late in CY 1978.

## Membership\*

*Ad Hoc Committee on Geological and Materials Sciences*

|                                      |                                      |
|--------------------------------------|--------------------------------------|
| Hugh C. Heard (Chairman)             | Amiya K. Mukherjee                   |
| Lawrence Livermore Laboratory        | Department of Mechanical Engineering |
| University of California             | University of California at Davis    |
| (Rock mechanics)                     | (Engineering and material sciences)  |
| <br>                                 |                                      |
| Thomas J. Ahrens                     | James R. Rice                        |
| California Institute of Technology   | Division of Engineering              |
| (Geophysics, internal constitution   | Brown University                     |
| of the earth)                        | (Engineering and material sciences)  |
| <br>                                 |                                      |
| John C. Frye                         | Rustum Roy                           |
| Geological Society of America        | Materials Research Laboratory        |
| (General geology and economic        | Pennsylvania State University        |
| resources)                           | (Geochemistry and material sciences) |
| <br>                                 |                                      |
| John W. Handin                       | Thomas J. Shankland                  |
| Center for Tectonophysics            | Los Alamos Scientific Laboratory     |
| Texas A & M University               | (Geophysics)                         |
| (Rock mechanics)                     |                                      |
| <br>                                 |                                      |
| Robert E. Hughes                     | Jack H. Wernick                      |
| Department of Chemistry              | Bell Laboratories                    |
| Cornell University                   | (Geochemistry and material sciences) |
| (Chemistry and material sciences)    |                                      |
| <br>                                 |                                      |
| William C. Kelly                     | <i>Agency Representatives</i>        |
| Department of Geology and Mineralogy | John F. Lance                        |
| University of Michigan               | National Science Foundation          |
| (Minerals and ore deposits)          |                                      |
| <br>                                 |                                      |
|                                      | Gary Olhoeft                         |
|                                      | U.S. Geological Survey               |

Executive Secretary: Joseph W. Berg, Jr.

## COMMITTEE ON HAZARDOUS SUBSTANCES IN THE LABORATORY

In December 1975, an *ad hoc* planning group was convened by the Assembly at the suggestion of Jerome A. Berson and Richard N. Zare of the Advisory Board to the Office of Chemistry and Chemical Technology. This group considered the need for an NRC study of procedures for the safe handling and disposal of toxic substances in the laboratory. If the group decided that such a study would be desirable, it was to define the scope of the study and develop a plan

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\*These are members who participated in the April 1978 planning effort. The membership of the new Assembly Committee on Geological and Materials Sciences has not yet been appointed. Some of the above will probably serve on it.

of action. Subsequently, the *ad hoc* group recommended organization of a study to appraise the character and magnitude of laboratory hazards and to identify procedures that would minimize risk without crippling laboratory operations. The proposed study was to result in a report that could assist laboratory scientists and administrators in ensuring that laboratory operations did not adversely affect the health and safety of personnel or of the neighboring community.

Difficulties in obtaining support for such a study delayed its inception. Meanwhile, concern grew in the chemical community about the need for better data and guidelines as a basis for proposed regulatory measures. In fall 1978, the proposal for a two-year study was revised and submitted not only to a number of federal agencies but to the American Chemical Society, the Manufacturing Chemists Association, and the Sloan Foundation. These three organizations reacted favorably to the study plans, and the American Chemical Society has already provided support for it; like action by the Sloan Foundation and the Manufacturing Chemists Association is hoped for by the end of the year. The revised proposal has also been submitted to a number of federal agencies.

A chairman for the study has been appointed: Herbert O. House, School of Chemistry, Georgia Institute of Technology; it is expected that the study will be under way by the beginning of CY 1979.

*Assembly Liaison Representatives*

William G. Dauben  
Department of Chemistry  
University of California at  
Berkeley

Richard B. Bernstein  
Department of Chemistry  
Columbia University

Executive Secretary: William Spindel

COMMITTEE ON HIGH TEMPERATURE  
SCIENCE AND TECHNOLOGY

The Committee fosters and coordinates research and data-compilation efforts on high-temperature phenomena and related aspects of chemical and materials sciences. It supplies the U.S. representative to the Commission on High Temperatures and Refractory Materials (G. Rosenblatt) of the International Union of Pure and Applied Chemistry (IUPAC). In cooperation with appropriate IUPAC committees, it continues efforts to establish unambiguous nomenclature for thermodynamic functions important in high-temperature science. Through overlapping membership and liaison, the Committee coordinates with and contributes to the efforts of related NRC committees; for example, the Committee on Chemical Sciences, the former Committee on Data Analysis and Needs of the Numerical Data Advisory Board, and the Solid State Sciences Committee.

The Committee prepared a proposal concerning nomenclature for high-temperature thermodynamic functions, which was presented at the IUPAC meetings held in August 1977 in Ronneby and Warsaw. A major portion of the Committee's

recommendations were approved and appear as part of an 18-month trial document, "Manual of Symbols and Terminology for Physicochemical Quantities and Units-- Appendix IV." Clarification and implementation of the recommendations within the scientific community is a continuing Committee activity.

The Committee helped to plan and coordinate three major symposia concerned with high-temperature science and technology: (a) a five-day symposium on "High Temperature Metal Halide Chemistry (D. L. Hildenbrand and D. D. Cubicciotti, chairmen) held as part of the Electrochemical Society meeting in Atlanta, in October 1977; (b) the Gordon Research Conference on High Temperature Chemistry (E. D. Cater, chairman) in August 1978; and (c) a National Bureau of Standards symposium on "Characterization of High Temperature Vapors and Gases" (J. Hastie, chairman) held in September 1978 in Gaithersburg, Maryland. In addition, the Committee contributed expertise to the High Temperature Sciences Workshop of the Solar Thermal Test Facilities Users Association in Albuquerque in November 1977.

For a number of years the Committee has been concerned with publication outlets for papers in the high-temperature field and has cooperated with J. Margrave's successful efforts to publish *High Temperature Science* independently. At the same time, it fostered establishment of divisional editors to deal with high-temperature manuscripts for *The Journal of the Electrochemical Society*.

During the past year, the Committee initiated a study, funded by the National Science Foundation, to identify (and thereby stimulate research in) fields of high-temperature science in which special progress in basic understanding is anticipated in the next decade or two as a result of advances in experimental and theoretical techniques or of research advances in other fields. This study, which will be closely coordinated with other relevant NRC efforts, will bring together, at a three- or four-day workshop in April 1979, members of the Committee and about 15 other basic scientists knowledgeable in the various research topics and tools related to high-temperature science (such as thermochemistry, EMF studies, vaporization studies, mass spectrometry, electronic spectroscopy, matrix isolation spectroscopy, high-temperature Raman spectroscopy, chemiluminescence, electron diffraction, interaction of lasers with solids, molecular beams, reactivity of high-temperature vapors with cold or hot substrates, electron microscopy, *ab initio* quantum-mechanical calculations, and computer simulation of complex systems). In advance of the workshop, written suggestions will be solicited from a considerably larger group of colleagues for consideration at the workshop.

The workshop report will be circulated for comment to those scientists who provided input and to others prior to final revision. Publication is planned by late 1979. The report should serve as an information resource for both the high-temperature research community and government science administrators. As an ancillary benefit, it could be useful as a starting point for a subsequent study that would attempt to identify fields in which progress in high-temperature science is required to solve applied problems.

The Committee does much of its work by correspondence and telephone. It held two general meetings during the past two years, one in October 1977 at the meeting of the Electrochemical Society, and one in August 1978 at the Gordon Research Conference. Discussion focused on the full range of the Committee activities and on liaison responsibilities, particularly those to IUPAC groups.



## Membership

*Committee on High Temperature Science and Technology*

- |   |   |
|---|---|
| Gerd M. Rosenblatt (Chairman) (1979)<br>Department of Chemistry<br>Pennsylvania State University<br>(Physical chemistry)  | John W. Hastie (1980)<br>National Bureau of Standards<br>(Combustion chemistry)                                     |
| Joan B. Berkowitz (1980)<br>Arthur D. Little, Inc.<br>(Physical chemistry)  | Marshall Lapp (1981)<br>Corporate Research and Development<br>General Electric Company<br>(Engineering physics)     |
| H. Kent Bowen (1979)<br>Department of Materials Science<br>and Engineering<br>Massachusetts Institute of Technology<br>(Ceramics science)   | Thomas A. Milne (1981)<br>Solar Energy Research Institute<br>(Mass spectroscopy)                                    |
| Leo Brewer (1981)<br>Department of Chemistry<br>University of California at<br>Berkeley<br>(Thermodynamics)   | William Weltner, Jr. (1980)<br>Department of Chemistry<br>University of Florida at<br>Gainesville<br>(Spectroscopy) |
| Harry G. Drickamer (1979)<br>Department of Chemical Engineering<br>and Physical Chemistry<br>University of Illinois at Urbana<br>(Physics, physical chemistry,<br>chemical engineering) | <i>Assembly Liaison Representative</i><br>Charles P. Bean<br>General Electric Research and<br>Development Center    |

Executive Secretary: William Spindel

## COMMITTEE ON IMPACTS OF STRATOSPHERIC CHANGE

The Committee on Impacts of Stratospheric Change was established in 1972 under the name Climatic Impact Committee in response to a request from the Department of Transportation. Its first assignment involved an assessment of the effects of the operation of high-altitude vehicles, including subsonic and supersonic aircraft and NASA's projected Space Shuttle, on the atmosphere, in particular, the stratospheric portion thereof. The Committee's findings were published in April 1975 in the report *Environmental Impact of Stratospheric Flight*.

Next, the Committee turned its attention to an assessment of the climatic and biological impacts of chlorofluoromethanes, which are released into the atmosphere from a number of sources. These relatively inert compounds drift upward to the stratosphere where they are dissociated by ultraviolet light

from the sun, thus releasing free chlorine, which acts as a catalyst destroying ozone. It is the depletion of the ozone layer that is of concern. The Committee's Panel on Atmospheric Chemistry presented its findings in the report *Halocarbons: Effects on Stratospheric Ozone*. On the basis of this report, the Committee then evaluated the impacts on climate and health in its report *Halocarbons: Effects of Chlorofluoromethane Release*. These reports were published in 1976.

The Clean Air Act, as amended, requires the Administrator of the Environmental Protection Agency (EPA) "...to contract with the National Academy of Sciences to study the state of knowledge and the adequacy of research efforts to understand (A) the effects of all substances, practices, processes, and activities which may affect the stratosphere, especially ozone in the stratosphere; (B) the health and welfare effects of modifications of the stratosphere, especially ozone in the stratosphere; and (C) methods of control of such substances, practices, and activities, including alternatives, feasibility, and timing." The legislation also stipulated that the NAS should submit an interim report by January 1, 1978. During the latter part of CY 1977, therefore, the Committee prepared the requested interim report--*Response to the Ozone Protection Sections of the Clean Air Act Amendments of 1977: An Interim Report* (January 1978)--in which several *ad hoc* panels of the Committee re-evaluated (1) the stratospheric chemistry and transport, (2) the effect of stratospheric changes on climate, (3) the biological effects, and (4) the effects on human health.

In 1978, in further response to the Clean Air Act, the EPA requested the Academy to prepare a comprehensive report that would address parts (A), (B), and (C) of section 153 (d) of the Act (see preceding paragraph); specifically, the NAS was asked to provide the best possible information base for reaching decisions regarding regulation of human causes of stratospheric ozone depletion. The Committee on Impacts of Stratospheric Change has undertaken this work in cooperation with a parallel Committee on Alternatives for Reduction of CFM Emissions, which was established by the Commission on Sociotechnical Systems to assess the economic and social impacts of various regulatory strategies. The Panel on Stratospheric Chemistry and Transport (of the Committee on Impacts of Stratospheric Change) is updating and revising its 1976 report as a part of this new study. The two Committees (on Impacts of Stratospheric Change and on Reduction of CFM Emissions) expect to publish a single joint report during the latter half of CY 1979.

#### Membership

##### *Committee on Impacts of Stratospheric Change*

John W. Tukey (Chairman) (1979)  
Bell Laboratories  
(Statistics)

Martyn M. Caldwell (1979)  
Ecology Center  
Utah State University

Thomas B. Fitzpatrick (1979)  
Harvard Medical School and  
Massachusetts General Hospital  
(Dermatology)

James P. Friend (1979)  
Department of Chemistry  
Drexel University

Maureen Henderson (1979)  
Health Sciences Center  
University of Washington  
(Epidemiology)

Francis S. Johnson (1979)  
University of Texas at Dallas  
(Atmospheric physics)

Frederick Kaufman (1979)  
Department of Chemistry  
University of Pittsburgh

Allen Latham, Jr. (1979)  
Haemonetics Corporation  
(Low-temperature phenomena)

J. Murray Mitchell, Jr. (1979)  
Environmental Data Service  
National Oceanic and Atmospheric  
Administration  
(Climatology)

Hans A. Panofsky (1979)  
Department of Meteorology  
Pennsylvania State University

C. Stan Rupert (1979)  
School of Natural Sciences and  
Mathematics  
University of Texas at Dallas  
(Photochemistry radiation biology)

Harold I. Schiff (1979)  
York University  
Ontario, Canada  
(Chemical kinetics)

*Assembly Liaison Representatives*  
Richard B. Bernstein  
Department of Chemistry  
Columbia University

Kenneth M. Case  
Rockefeller University

Executive Secretary, committee and panels: Milton W. Rosen

*Panel on Stratospheric Chemistry and Transport*

Harold I. Schiff (Chairman) (1979)  
York University  
Ontario, Canada  
(Chemical kinetics)

Eldon E. Ferguson (1981)  
Environmental Research Laboratories  
National Oceanic and Atmospheric  
Administration

Julius Chang (1979)  
National Center for Atmospheric  
Research  
(Modeling)

James P. Friend (1979)  
Department of Chemistry  
Drexel University

Edwin F. Danielsen (1981)  
Air Resources Center  
Oregon State University  
(Meteorology)

David M. Golden (1981)  
Stanford Research Institute  
(Chemical kinetics)

Robert Dickinson (1979)  
National Center for Atmospheric  
Research

Frederick Kaufman (1979)  
Department of Chemistry  
University of Pittsburgh

Dieter H. Ehhalt (1979)  
Institute for Chemistry  
Julich, West Germany

Brian A. Thrush (1979)  
Department of Physical Chemistry  
University of Cambridge

John W. Tukey (1979)  
Bell Laboratories  
(Statistics)

Cheves Walling (1979)  
Department of Chemistry  
University of Utah

Geoffrey Watson (1979)  
Department of Statistics  
Princeton University

*Panel on Effects on Human Health*

Thomas B. Fitzpatrick (Chairman) (1979)  
Harvard Medical School and  
Massachusetts General Hospital  
(Dermatology)

Farrington Daniels, Jr. (1981)  
Medical College  
Cornell University  
(Dermatology)

Maureen Henderson (1979)  
Health Sciences Center  
University of Washington  
(Epidemiology)

*Panel on Effects on Climate*

Hans A. Panofsky (Chairman) (1979)  
Department of Meteorology  
Pennsylvania State University

Robert G. Fleagle (1980)  
Department of Atmospheric Sciences  
University of Washington  
(Atmospheric motions)

J. Murray Mitchell, Jr. (1979)  
Environmental Data Service  
National Oceanic and Atmospheric  
Administration  
(Climatology)

*Consultants*

Dixon Butler and  
Richard M. Stolarski  
Goddard Space Flight Center  
National Aeronautics and Space  
Administration

John A. H. Lee (1980)  
Department of Epidemiology and  
International Health  
University of Washington

Raymond R. Suskind (1981)  
College of Medicine  
University of Cincinnati  
(Environmental medicine)

V. Ramanathan (1980)  
National Center for Atmospheric  
Research  
(Meteorology)

*Consultant*

J. D. Mahlman  
Geophysical Fluid Dynamics Laboratory  
National Oceanic and Atmospheric  
Administration

COMMITTEE ON KINETICS OF CHEMICAL REACTIONS

This Committee organizes and sponsors activities in support of research in chemical kinetics. During the past year it organized a symposium on "Experiments and Trajectories in Kinetics" in cooperation with the Division of Physical Chemistry of the American Chemical Society (ACS). The symposium took place at the March 1978 ACS meeting in Anaheim, California, as a tribute to the late Donald L. Bunker, an outstanding kineticist. Twelve friends,

co-workers, and former students of Professor Bunker were invited to present papers. In addition, the symposium attracted 35 contributed papers, and the overall program was regarded as highly successful. Most of the papers will be published in a single issue of the *Journal of Physical Chemistry*.

The Committee also sponsored with the National Bureau of Standards a three-day international symposium titled "Current Status of Kinetics of Elementary Gas Reactions: Predictive Power of Theory and Accuracy of Measurement." The meeting, chaired by Frederick Kaufman of the Chemistry Department, University of Pittsburgh, was held at the National Bureau of Standards, Gaithersburg, Maryland, in June 1978. Among the questions considered were: How well are rate constants of elementary thermal gas reactions being measured? How and where are their values compiled? How well do we understand them, and how well can they be predicted? The meeting was attended by 113 scientists from 10 countries. From some 60 abstracts submitted, the Program Committee selected 34 for presentation because of their close relationship to the questions that served as the theme of the symposium. The final session consisted of a panel discussion and summary. Symposium papers, together with an introduction and a summary of the discussion, will be published in a single issue of the *Journal of Physical Chemistry*.

The National Bureau of Standards, as cosponsor, provided services for planning and administration, as well as staff support for the meeting. The Committee, with funds from the ACS-Petroleum Research Fund, the Department of Energy, and the National Science Foundation, provided partial travel support for key participants from abroad and for selected outstanding younger scientists in the United States.

### Membership

#### *Committee on Kinetics of Chemical Reactions*

Frederick Kaufman (Chairman) (1979)  
Department of Chemistry  
University of Pittsburgh  
(Physical chemistry)

Myron L. Bender (1979)  
Department of Chemistry  
Northwestern University  
(Chemistry)

Michael J. Berry (1981)  
Photon Chemistry Department  
Allied Chemical Corporation  
(Physical chemistry)

Kenneth B. Eisenthal (1979)  
Department of Chemistry  
Columbia University  
(Physical chemistry)

David M. Golden (1981)  
Stanford Research Institute  
(Chemical kinetics)

Hiromi Niki (1981)  
Scientific Laboratories  
Ford Motor Company  
(Physical chemistry and kinetics)

Richard M. Noyes (1980)  
Department of Chemistry  
University of Oregon  
(Physical chemistry)

Robert H. Schuler (1980)  
Department of Chemistry  
University of Notre Dame  
(Physical chemistry)

Donald G. Truhlar (1980)  
Department of Chemistry  
University of Minnesota  
(Physical chemistry, molecular  
physics)

*Assembly Liaison Representative*  
Richard B. Bernstein  
Department of Chemistry  
Columbia University

Executive Secretary: William Spindel

#### COMMITTEE ON LINE SPECTRA OF THE ELEMENTS

The Committee on Line Spectra of the Elements is the oldest committee in continuous service in the Assembly of Mathematical and Physical Sciences. It has a long history of service to the scientific community. Broadly speaking, the Committee is concerned with the long-term health of atomic spectroscopy in the United States. Today this field represents a wide range of research, including the spectra and structure of atoms and ions; wavelength standards; laser spectroscopy; beam-foil spectroscopy; and applications of spectra to astrophysics, the diagnosis of fusion plasmas, and laser-isotope separation. It was under the guidance of this Committee that the Atomic Energy Levels compilations program was set up at the National Bureau of Standards, and members of the Committee continue to serve as consultants to this active program. The Committee also sponsors a continuing series of international symposia on atomic spectroscopy that are well attended and well regarded. Some special studies that the Committee has conducted are *Research in Optical Spectroscopy* (1968) and *Atomic Spectroscopy Survey* (1974). Other aspects of its operation relate to spectroscopic terminology, guidance to spectroscopists, and coordination of spectroscopic activities. The Committee pays a unique, unifying role in U.S. spectroscopy.

Activities of the Committee during the past year are as follows:

1. Spectral Tables for the *Handbook of Chemistry and Physics* (HCP): The Committee's 1974 Survey showed that the spectral tables most widely in use by scientists were those found in old editions of the HCP. These extensive tables were regarded as out of date and were dropped by HCP about ten years ago. As a result of the Survey, the editors of HCP expressed interest in including an updated spectral table in future editions. The Committee then developed a plan for such a table, which was accepted by the HCP. During the past year, members of the Committee and several additional scientists completed work on the first phase of these tables, which will be published in the 1978-1979 edition of the HCP. The tables consist of two separate sections. The first, "Line Spectra of the Elements," contains tables of spectra for all neutral and singly ionized atoms for which spectra are known, 98 elements in all. There are also tables for the spectra of many doubly, triply, and quadruply ionized atoms. The present table, which will occupy about 85 pages in the HCP, contains data for some 42,000 spectral lines. Each table contains references to the original literature. There are over 400 references. The second section, "Atomic Transition Probabilities," contains transition probabilities together with estimated uncertainties for about 400 spectral lines of atoms in various stages of ionization. This section will occupy about 15 pages in the HCP.

2. Atomic Spectroscopy Symposia: Interest in the several conferences sponsored by the Committee in recent years has steadily increased. At a 1961 meeting at the Argonne National Laboratory, attendance was 88; in 1967, 150 attended the meeting held at the National Bureau of Standards; and in 1975, again at the Bureau, more than 220, some representing foreign countries, were present. In 1976 the Committee concluded that these conferences should be held on a regular four-year cycle, thus the next is scheduled for September 1979 at the University of Arizona in Tucson. The program will focus on developments in spectroscopy relating to new energy sources, new types of lasers, high Rydberg states, astrophysics, and a wide range of other topics. Planning for this conference, which will be titled "Symposium on Atomic Spectroscopy--1979," has occupied much of the Committee's time and attention this past year.

3. Liaison with European Spectroscopists: For the past several years the Committee has discussed the desirability of establishing some regular lines of communication with the European Group for Atomic Spectroscopy (EGAS). Evidence of progress toward this goal during the past year was the agreement by the governing board of EGAS to make copies of the abstracts of papers presented at its annual meeting available to U.S. scientists through the Committee.

4. Other: The Committee continues to collect information on compilations of spectroscopic data and to make this information available to scientists. It also considers and makes recommendations on the usage of spectroscopic terminology in the literature.

In the coming year the Committee expects to complete the spectral tables for the HCP. Plans for updating the final table on a continuing basis and for a possible separate, expanded version of the table will then be discussed. On completion of this project and of arrangements for the 1979 symposium, the Committee will consider what new directions its work might take.

### Membership

#### *Committee on Line Spectra of the Elements*

|                                      |                                      |
|--------------------------------------|--------------------------------------|
| Joseph B. Reader (Chairman) (1980)   | Charles R. Cowley (1981)             |
| Atomic and Plasma Radiation Division | Department of Astronomy              |
| National Bureau of Standards         | University of Michigan               |
| (Atomic spectroscopy)                | (Astronomy)                          |
| John G. Conway (1979)                | George A. Doschek (1980)             |
| Lawrence Berkeley Laboratory         | E. O. Hulbert Center for Space       |
| University of California at          | Research                             |
| Berkeley                             | Naval Research Laboratory            |
| (Atomic spectroscopy)                | (Solar physics, atomic spectroscopy) |
| Robert D. Cowan (1980)               | Wade L. Fite (1980)                  |
| Los Alamos Scientific Laboratory     | Physics and Astronomy Department     |
| (Atomic physics)                     | University of Pittsburgh             |
|                                      | (Atomic physics)                     |

Georgia A. Martin (1981)  
Atomic and Plasma Radiation Division  
National Bureau of Standards  
(Atomic spectroscopy)

Leon J. Radziemski (1981)  
Los Alamos Scientific Laboratory  
(Atomic spectroscopy)

John O. Stoner, Jr. (1981)  
Department of Physics  
University of Arizona  
(Atomic spectroscopy)

H. Henry Stroke (1979)  
Department of Physics  
New York University  
(Atomic spectroscopy)

Staff Officer: George W. Wood

Earl F. Worden, Jr. (1980)  
Lawrence Livermore Laboratory  
University of California  
(Physical chemistry)

James J. Wynne (1981)  
Thomas J. Watson Research Center  
IBM Corporation  
(Laser spectroscopy)

*Assembly Liaison Representatives*  
Charles P. Bean  
Research and Development Center  
General Electric Company

Ralph O. Simmons  
Department of Physics  
University of Illinois

#### COMMITTEE ON NUCLEAR SCIENCE

The Committee on Nuclear Science, which was established in 1938 under the name Committee on Radioactivity Standards, was discharged on March 31, 1978. During its 40 years of existence, its scope broadened and, through a series of *ad hoc* panel and subcommittee studies, it worked effectively to stimulate research in the various subfields of nuclear science and to foster the application of the knowledge and methodology of this field to problems in related fields, for example, medical diagnosis and therapy, environmental monitoring, and energy production. A sample of reports produced over the past few years gives an indication of the scope of its work:

*Use of Accelerators to Study Irradiation Effects*  
*Users Guides for Radioactivity Standards*  
*Neutron Activation Techniques for Measurement of Trace Metals*  
*in Environmental Samples*  
*Nuclear Science: A Survey of Funding, Facilities, and Manpower*  
*Assessment of the Current Status of the Nuclear Data Compilation*  
*Effort. A Letter Report*  
*Radiochemistry of Iodine* (most recent in a monograph series of  
more than 60 volumes on radiochemistry of elements and applica-  
tions of radiochemical techniques)  
*Future of Nuclear Science*

Early in 1977 an agreement was reached between the Department of Energy and the National Science Foundation on plans for an in-house advisory committee on nuclear science. Initially, it appeared that the scope of this



proposed committee would be basic research into nuclear structure and interactions, thus the NRC Committee might still have a useful function through studies of the interactions between nuclear research and other fundamental disciplines and fields of application. An interim Steering Committee, chaired by T. A. Tombrello, was established to plan the future direction and work of the Committee. However, when the agencies announced the organization of the new Nuclear Science Advisory Committee, indicating that it would be concerned with basic research into nuclear structure and applications, related research conducted with nuclear facilities, and interactions between nuclear research and other disciplines or applications, it was clear that there was no longer a need to continue the NRC activity.

It is likely that two subunits of the former Committee will continue their current projects under other boards and committees within this Assembly; the *ad hoc* Panel on Basic Nuclear Data Compilations will become an activity of the Numerical Data Advisory Board, and the transfer of the Subcommittee on Radiochemistry to the Committee on Chemical Sciences is planned.

### Membership

#### *Committee on Nuclear Science Interim Steering Group*

|                                       |   |
|---------------------------------------|---|
| Thomas A. Tombrello (Chairman) (1978) | Joseph Weneser (1978)                   |
| Kellogg Radiation Laboratory          | Department of Chemistry                 |
| California Institute of Technology    | Brookhaven National Laboratory          |
| (Nuclear physics)                     | (Nuclear physics and nuclear chemistry) |

Lowell M. Bollinger (1978)  
Argonne National Laboratory  
(Nuclear physics)

*Liaison Representatives*  
Gregory R. Choppin  
Division of Nuclear Chemistry and  
Technology  
American Chemical Society

John Huizenga (1978)  
Nuclear Structure Research  
Laboratory  
University of Rochester  
(Nuclear chemistry)

Stanley Hanna  
Division of Nuclear Physics  
American Physical Society

G. Davis O'Kelley (1978)  
Oak Ridge National Laboratory  
(Radiochemistry)

*Assembly Liaison Representative*  
Robert G. Sachs  
Argonne National Laboratory

Henry N. Wagner, Jr. (1978)  
Medicine, Radiology, and Environ-  
mental Health  
Johns Hopkins Medical Institutions  
(Nuclear medicine)

Executive Secretary: Charles K. Reed

## COMMITTEE ON RADIO FREQUENCIES

The principal functions of the Committee are to assist the U.S. scientific and engineering communities in determining radio-frequency requirements for research, to work actively with the U.S. Government in securing these frequencies, and to work with the Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science (IUCAF) of the International Council of Scientific Unions and other relevant international organizations. The Committee serves as a focal point to secure and represent the interests of the scientific nongovernment activities, a role that is increasingly important as the demand for frequencies grows.

The Committee has two standing subcommittees, on radio astronomy and on space science. The first is concerned with protection of radio-astronomy research bands from possible interference from transmission from satellites and other space and airborne stations. The Subcommittee on Space Science is concerned with allocations of frequencies for space research.

At a meeting in Washington, D.C., in March 1978, the Committee reviewed its activities and those of its two subcommittees in preparation for participation in the 1979 World Administrative Radio Conference (WARC). The Subcommittee on Space Science met on the day prior to the meeting of the parent Committee and received a briefing from a representative of the SETI (Search for Extraterrestrial Intelligence) group at NASA's Ames Research Center on the status of this NASA program. The Subcommittee also reviewed the U.S. and IUCAF requirements for space-research frequencies as given in preliminary planning documents. The Subcommittee on Radio Astronomy met in Charlottesville, Virginia, in May 1978, its meeting also being concerned with plans for the 1979 WARC.

The Committee and its subcommittees are working closely with the Federal Communications Commission (FCC) and other federal agencies to prepare for the 1979 WARC. The Committee reviewed the FCC Fourth, Fifth, and Eighth Notices of Inquiry on the WARC-79 during the past year and prepared comments on the proposed allocations of frequencies for scientific research. These were submitted to the FCC by the Academy. In addition, radio astronomers recommended by the Committee are serving on the FCC Radio Astronomy Service Working Group, which is assisting in preparations for the 1979 WARC. This Working Group maintains communication with the Committee and its subcommittees as it develops and documents the requirements for the Radio Astronomy Service for use of the radio spectrum over the next approximately 20 years.

The Committee and its subcommittees have also worked closely with the NSF Radio Spectrum Coordinator in providing information and recommendations regarding frequency requirements for scientific research needed in connection with matters under consideration by the Interdepartment Radio Advisory Committee.

A continuing concern of the Subcommittee on Radio Astronomy is possible interference by satellites in the 1660-1670 MHz and 2690-2700 MHz bands. Members of the Subcommittee maintain close liaison with representatives of interested government agencies (the National Telecommunications and Information Administration, FCC, Department of Health, Education, and Welfare, and NASA) in regard to experiments in these bands from the ATS-6 and SMS satellites, and

they arranged for tests to determine the effect of transmissions from these satellites on several radio-astronomy observatories.

One member of the Subcommittee on Radio Astronomy serves as a representative of the radio-astronomy community on an *ad hoc* Working Party on Radio Astronomy vs. Adjacent Band Operations. This Working Party operates under a Technical Subcommittee of the Interdepartment Radio Advisory Committee and is studying the technical feasibility of affording the Radio Astronomy Service protection in the exclusive radio astronomy bands from downlink transmission of both space and airborne stations.

Several members of the Subcommittee on Radio Astronomy also serve on a subgroup of U.S. Study Group 2 (of the U.S. National Committee for the International Radio Consultative Committee) to advise on technical problems pertaining to radio astronomy. They have reviewed, updated, and corrected several U.S. Study Group 2 documents on radio astronomy in preparation for future meetings of this Group.

The Committee on Radio Frequencies establishes *ad hoc* subcommittees to study particular problems in the use of radio frequencies for scientific research. Currently, it is planning to organize a subcommittee to prepare a report on what oceanographers view as their critical scientific requirements for radio frequencies.

The Committee staff maintains a current list of U.S. Radio Astronomy Observatories and assists the radio-astronomy observatories in registering their radio frequencies with the International Frequency Registration Board through the FCC. A new *List of Radio and Radar Astronomy Observatories* is being compiled for distribution to radio astronomers and radio-astronomy observatories. The list has been extremely helpful in justifying the needs of the Radio Astronomy Service for frequencies, and it is used by Radio Frequency Managers in making assignments of frequencies to other services so that interference to the observatories is minimized.

### Membership

#### *Committee on Radio Frequencies*

Bernard F. Burke (Chairman) (1979)  
Department of Physics  
Massachusetts Institute of Technology  
(Physics)

Alan H. Barrett (1979)  
Research Laboratory of Electronics  
Massachusetts Institute of Technology  
(Radio astronomy)

Otis Brown (1981)  
School of Marine and Atmospheric  
Sciences  
University of Miami  
(Oceanography)

Andrea K. Dupree (1980)  
Center for Astrophysics  
(Astrophysics)

William C. Erickson (1979)  
Department of Physics and Astronomy  
University of Maryland  
(Radio astronomy)

John P. Hagen (1979)  
Whitmore Laboratory, Department of  
Astronomy  
Pennsylvania State University  
(Radio astronomy)

David C. Hogg (1980)  
Environmental Radiometry  
Department of Commerce  
(Radio astronomy)

Hein Hvatum (1979)  
National Radio Astronomy Observatory  
(Electronics)

Frank J. Kerr (1979)  
Department of Physics and Astronomy  
University of Maryland  
(Radio astronomy)

Nancy G. Roman (1980)  
Astronomy/Relativity  
National Aeronautics and Space  
Administration  
(Radio astronomy)

John R. Tester (1979)  
Department of Ecology and Behavioral  
Biology  
University of Minnesota  
(Ecology)

*Ex Officio*  
George S. Benton (1979)  
Chairman, Committee on Atmospheric  
Sciences

A. G. W. Cameron (1979)  
Chairman, Space Science Board

Rita Colwell (1979)  
Chairman, U.S. National Committee  
for the International Union of  
Biochemistry

John V. Evans (1978)  
Chairman, U.S. National Committee for  
the International Union of Radio  
Science

*Subcommittee on Radio Astronomy*  
William C. Erickson (Chairman) (1979)  
Department of Physics and Astronomy  
University of Maryland  
(Radio astronomy)

Alan H. Barrett (1979)  
Research Laboratory of Electronics  
Massachusetts Institute of Technology  
(Radio astronomy)

John W. Findlay, John P. Hagen, and  
Gart Westerhout  
Inter-Union Commission for Frequency  
Allocations for Radio Astronomy  
and Space Science

Arthur E. Maxwell (1979)  
Chairman, U.S. National Committee for  
the International Union of Geodesy  
and Geophysics

Elske v. P. Smith (1980)  
Chairman, U.S. National Committee for  
the International Astronomical Union

Verner E. Suomi (1979)  
Chairman, U.S. Committee for the  
Global Atmospheric Research Program

Warren S. Wooster (1980)  
Chairman, Ocean Sciences Board

*Liaison Representatives*  
Robert L. Cutts  
Federal Communications Commission

Harold G. Kimball  
National Aeronautics and Space  
Administration

Wilfred K. Klemperer  
National Science Foundation

James E. Ogle  
Department of Commerce

Allen M. Peterson  
Joint Technical Advisory Council

S. E. Probst  
National Telecommunications and  
Information Administration

Andrea K. Dupree (1980)  
Center for Astrophysics  
(Astrophysics)

*Subcommittee on Space Science*

John P. Hagen (Chairman) (1979)  
Whitmore Laboratory, Department  
of Astronomy  
Pennsylvania State University  
(Radio astronomy)

John J. Kelleher (1979)  
National Scientific Laboratories, Inc.  
(Radio communications)

John W. Kiebler (1980)  
Goddard Space Flight Center  
National Aeronautics and Space  
Administration  
(Electronics)

Jules Lehmann (1980)  
Earth Observations Programs  
National Aeronautics and Space  
Administration  
(Optical engineering)

Secretary: Richard Y. Dow

Nancy G. Roman (1980)  
Astronomy/Relativity  
National Aeronautics and Space  
Administration  
(Radio astronomy)

Stanley D. Shawhan (1980)  
Department of Physics and Astronomy  
University of Iowa  
(Physics)

David H. Staelin (1979)  
Department of Electrical Engineering  
and Computer Science  
Massachusetts Institute of Technology  
(Radio astronomy)

COMMITTEE ON RECOMMENDATIONS FOR  
U.S. ARMY BASIC SCIENTIFIC RESEARCH

In 1951, at the request of the U.S. Army's Office of Ordnance Research, the National Academy of Sciences established an eight-member committee to assist in the evaluation of the scientific merit of proposals for basic research. Since that time, the Army Research Office (ARO) has replaced the Office of Ordnance Research and the Committee has increased to 81 members as a consequence of the expanding Army research program, but its mission, to provide peer evaluations of unsolicited research proposals, remains unchanged. In addition to this Assembly, the Assemblies of Engineering and Life Sciences nominate members to serve on the Committee.

The proposals that the Committee evaluates represent the following fields: biological sciences, chemistry, electronics, engineering, geosciences, mathematics, metallurgy and materials science, and physics. A majority of the proposals are from scientists in the academic community.

The Committee's evaluation program is continuous. From January 1, 1977, through December 31, 1977, 421 proposals were evaluated, of which 97 were in chemistry, 64 in electronics, 40 in engineering, 24 in geosciences, 18 in life sciences, 34 in metallurgy and materials science, 94 in mathematics, and 50 in physics. Each proposal received a peer review by referees selected by the Committee member to whose discipline it was related. The referees' reports

served as a basis for the Committee member's appraisal comments and recommendation. Copies of all reports were provided the ARO. In the evaluation of these 421 proposals during CY 1977, Committee members requested the opinions and assessments of over 1900 referees.

Late in CY 1977, the Committee established a smaller steering group, whose objective is described below.

### Steering Committee

In October 1977, a Steering Committee was organized to serve as liaison between the ARO and the Committee on Recommendations for U.S. Army Basic Scientific Research. The Steering Committee meets once or twice a year with the ARO scientific personnel to gain greater familiarity with the objectives and requirements of the Army research program and the constraints under which it operates. Information that would assist the larger parent Committee in its work is then distributed by the Steering Committee.

The Chairman of the parent Committee also chairs the Steering Committee, which is composed of 12 members representing the disciplines of concern to the Committee. All members of the Steering Committee are either current or former members of the larger parent Committee.

The first meeting of the Steering Committee took place in September 1977, and a second one was held in Fall 1978.

### Membership

#### *Steering Committee*

|   |   |
|---|---|
| Gerhart Friedlander (Chairman) (1980)<br>Chemistry Department<br>Brookhaven National Laboratory                     | Daniel G. Dow (1981)<br>Applied Physics Laboratory<br>University of Washington<br>(Electrical engineering)  |
| Rachel M. Barker (1980)<br>U.S. Geological Survey, Reston<br>(Geology)  | Ernest L. Eliel (1979)<br>Department of Chemistry<br>University of North Carolina<br>(Organic chemistry)  |
| Joseph E. Burke (1981)<br>Research and Development Center<br>General Electric Company<br>(Metallurgy, ceramics)     | Donald E. Hudson (1979)<br>Division of Engineering and Applied<br>Science<br>California Institute of Technology<br>(Mechanical engineering, applied<br>mechanics) |
| Alison P. Casarett (1979)<br>Graduate School<br>Cornell University<br>(Radiation biology)                           | Paul L. Kelley (1981)<br>Lincoln Laboratory<br>Massachusetts Institute of Technology<br>(Solid-state physics)   |
| Richard C. DiPrima (1979)<br>Department of Mathematics<br>Rensselaer Polytechnic Institute<br>(Applied mathematics) |   |

Alan G. MacDiarmid (1980)  
 Department of Chemistry  
 University of Pennsylvania  
 (Inorganic chemistry)

Terry A. Miller (1980)  
 Bell Laboratories  
 (Chemical physics)

*Chemistry*

Simon H. Bauer (1981)  
 Department of Chemistry  
 Cornell University

Michel Boudart (1980)  
 Department of Chemical Engineering  
 Stanford University

Marjorie C. Caserio (1981)  
 Department of Chemistry  
 University of California at Irvine

James Economy (1980)  
 IBM Corporation  
 (Organic chemistry)

John O. Edwards (1979)  
 Department of Chemistry  
 University of Rochester

Alan G. MacDiarmid (1981)  
 Department of Chemistry  
 University of Pennsylvania

*Engineering*

Hsien K. Cheng (1981)  
 Department of Aerospace Engineering  
 University of Southern California  
 (Fluid mechanics, applied mathematics)

Julian D. Cole (1980)  
 Department of Mechanics and  
 Structures  
 University of California at Los  
 Angeles

Jacques W. Duffy (1981)  
 Department of Engineering  
 Brown University  
 (Mechanical engineering)

Chang L. Tien (1980)  
 Department of Mechanical Engineering  
 University of California at Berkeley  
 (Mechanical engineering)

Geoffrey S. Watson (1981)  
 Department of Statistics  
 Princeton University  
 (Mathematical statistics)

Kenneth M. Maloney (1979)  
 Xerox Corporation  
 (Chemical kinetics)

Harry S. Mosher (1981)  
 Department of Chemistry  
 Stanford University

Royce W. Murray (1981)  
 Department of Chemistry  
 University of North Carolina

S. Elaine Petrie (1980)  
 Eastman Kodak Company  
 (Physical chemistry)

Richard R. Schrock (1981)  
 Department of Chemistry  
 Massachusetts Institute of Technology

Ralph E. Weston, Jr. (1981)  
 Department of Chemistry  
 Brookhaven National Laboratory

Irvin Glassman (1980)  
 Guggenheim Laboratories  
 Princeton University

Donald E. Hudson (1979)  
 Division of Engineering and Applied  
 Science  
 California Institute of Technology

E. Erwin Klaus (1980)  
 Department of Chemical Engineering  
 Pennsylvania State University

Jerome Klosner (1979)  
 Department of Aerospace Engineering and  
 Applied Mechanics  
 Polytechnic Institute of New York

Joseph A. Schetz (1981)  
Department of Aerospace Engineering  
Virginia Polytechnic Institute  
and State University

Patarasp R. Sethna (1981)  
Department of Aeronautics and  
Engineering Mechanics  
University of Minnesota

Shan F. Shen (1979)  
School of Mechanics and Aerospace  
Engineering  
Cornell University

*Electronics*

Edward S. Davidson (1981)  
Coordinated Science Laboratory  
University of Illinois  
(Electrical engineering)

Daniel G. Dow (1981)  
Applied Physics Laboratory  
University of Washington  
(Electrical engineering)

Michael Fischer (1981)  
Department of Computer Science  
University of Washington

Solomon W. Golomb (1981)  
Department of Mathematics and  
Electrical Engineering  
University of Southern California

Susan L. Graham (1981)  
Department of Electrical Engineering  
and Computer Science  
University of California at  
Berkeley

*Geosciences*

Rachel M. Barker (1979)  
U.S. Geological Survey, Reston  
(Geology)

Arthur D. Belmont (1979)  
Meteorological Research  
Control Data Corporation  
(Meteorology)

Richard T. Shield (1981)  
Department of Theoretical and Applied  
Mechanics  
University of Illinois

Chang L. Tien (1980)  
Department of Mechanical Engineering  
University of California at Berkeley

William H. Warner (1981)  
Department of Aerospace Engineering  
and Mechanics  
University of Minnesota

Carl W. Helstrom (1979)  
Department of Applied Physics  
and Information Science  
University of California at San Diego

David C. Hogg (1979)  
National Oceanographic and Atmospheric  
Administration  
Boulder, Colorado  
(Radio physics)

Akira A. Ishimaru (1979)  
Department of Electrical Engineering  
University of Washington

Herbert Kroemer (1981)  
Department of Electrical Engineering  
and Computer Science  
University of California at Santa  
Barbara

Gerald L. Pearson (1981)  
Solid-Electronics Laboratories  
Stanford University  
(Physics)

Wallace G. Ernst (1979)  
Department of Geology  
University of California at Los  
Angeles

Paul L. Smith (1979)  
Institute of Atmospheric Sciences  
South Dakota School of Mines



George V. Keller (1980)  
Department of Geophysics  
Colorado School of Mines

Cecil E. Leith, Jr. (1980)  
National Center for Atmospheric  
Research  
Boulder, Colorado  
(Mathematical physics)

*Life Sciences*

Domingo M. Aviado (1979)  
Biomedical Research  
Allied Chemical Corporation  
(Pharmacology, physiology)

Seymour S. Block (1979)  
Department of Chemical Engineering  
University of Florida  
(Industrial microbiology)

Alison P. Casarett (1979)  
Graduate School  
Cornell University  
(Radiation biology)

Bruce F. Eldridge (1980)  
Department of Entomology  
Oregon State University

*Mathematics*

Egon Balas (1980)  
Graduate School of Industrial  
Administration  
Carnegie-Mellon University  
(Economics)

Richard W. Cottle (1980)  
Department of Operations Research  
Stanford University

Florence N. David (1980)  
Department of Statistics  
University of California at  
Berkeley

Richard C. DiPrima (1979)  
Department of Mathematics  
Rensselaer Polytechnic Institute

Richard K. Moore (1980)  
Space Technology Laboratories  
University of Kansas  
(Electrical engineering)

Anthony F. Gaudy, Jr. (1979)  
Bioenvironmental Laboratories  
Oklahoma State University  
(Bioengineering, civil engineering)

Lavell M. Henderson (1980)  
Department of Biochemistry  
University of Minnesota

Robert H. Wasserman (1981)  
Department of Physical Biology  
Cornell University  
(Physiology, biochemistry)

Herbert B. Keller (1981)  
Department of Applied Mathematics  
California Institute of Technology

James M. Ortega (1979)  
Department of Mathematics  
North Carolina State University

Lawrence E. Payne (1979)  
Department of Mathematics  
Cornell University

Ronald Pyke (1980)  
Department of Mathematics  
University of Washington

George R. Sell (1979)  
Mathematics Science Division  
National Science Foundation

Ivar Stakgold (1980)  
Department of Mathematics  
University of Delaware

*Metallurgy and Materials Science*  
Franz R. Brotzen (1981)  
Department of Mechanical and Aero-  
space Engineering and Materials  
Science  
Rice University  
(Physical metallurgy)

Lawrence J. Broutman (1979)  
Department of Metallurgical and  
Materials Engineering  
Illinois Institute of Technology  
(Materials engineering)

Leslie E. Cross (1980)  
Materials Research Laboratory  
Pennsylvania State University  
(Physics)

Gordon H. Geiger (1981)  
Department of Metallurgical  
Engineering  
University of Arizona  
(Materials science)

George T. Hahn (1980)  
Metal Science Group  
Battelle Memorial Institute  
(Metallurgy)

*Physics*

John Clarke (1979)  
Department of Physics  
University of California at  
Berkeley

Morrel H. Cohen (1981)  
James Franck Institute  
University of Chicago  
(Theoretical physics)

Hellmut Fritzsche (1979)  
James Franck Institute  
University of Chicago

Geoffrey S. Watson (1979)  
Department of Statistics  
Princeton University

Jerome Kruger (1979)  
Corrosion Section  
National Bureau of Standards  
(Physical chemistry)

John C. Shyne (1981)  
Department of Materials Science  
and Engineering  
Stanford University  
(Metallurgy)

Richard E. Tressler (1981)  
Department of Materials Science  
Pennsylvania State University  
(Ceramics, materials science)

Charles A. Wert (1980)  
Department of Metallurgy and Mining  
Engineering  
University of Illinois  
(Physics)

Sheldon M. Wiederhorn (1980)  
Physical Properties Section  
National Bureau of Standards  
(Chemical engineering)

Frank L. Galeener (1979)  
Xerox Corporation  
Palo Alto Research Center  
(Solid-state physics)

John L. Hall (1979)  
Joint Institute for Laboratory  
Astrophysics  
University of Colorado

Paul L. Kelley (1979)  
Lincoln Laboratory  
Massachusetts Institute of Technology  
(Solid-state physics)

Michael S. Lubell (1980)  
Physical Department  
Yale University

G. Lorimer Miller (1981)  
Bell Laboratories

Terry A. Miller (1979)  
Bell Laboratories  
(Chemical physics)

Alan S. Pine (1980)  
Lincoln Laboratory  
Massachusetts Institute of Technology  
(Solid-state and molecular  
spectroscopy)

Staff Officer: Lester W. Barber

Robert W. Zwanzig (1979)  
Institute for Physical Science  
and Technology  
University of Maryland  
(Chemical physics)

*Assembly Liaison Representative*  
Charles P. Bean  
General Electric Research  
and Development Center

#### COMMITTEE ON SEISMOLOGY

In 1960, the President of the NAS appointed a Committee on Seismological Stations to advise the Advanced Research Projects Agency on the establishment of a Worldwide Network of Standardized Seismographs. The Committee was renamed the Committee on Seismology in July 1964, and in the latter part of 1966 and early 1967 its membership and scope were enlarged, partly in response to requests from seismological groups within and outside the federal government.

The fundamental mission of the Committee is

1. To maintain active surveillance of major trends in seismology and developments related to seismology in allied scientific and technical fields;
2. To provide special studies for government agencies on appropriate subjects and problems;
3. To maintain liaison with international seismological activities;
4. To provide advice to government agencies on the operation of government-supported seismograph networks and data-dissemination facilities.

The Committee has two *ad hoc* panels--on Earthquake Problems Related to the Siting of Critical Facilities and on National, Regional, and Local Seismograph Networks--which have been engaged in studies during the past year.

The Panel on Earthquake Problems Related to the Siting of Critical Facilities met twice during CY 1978, including a workshop held in June. The charge to this Panel is to determine the seismological and geological information that is required to make decisions on the siting and construction of critical facilities such as dams, reactors, reprocessing plants, enrichment plants, offshore platforms, liquid natural gas plants, and others. The Panel

expects to publish its report in CY 1979 in which it will make recommendations to public officials and others concerned with the location of critical facilities on the long-term research needed to provide a basis for sound decision making.

The Panel on National, Regional, and Local Seismograph Networks, appointed late in 1977, is preparing a report that deals with current operation of such networks, the needs they meet, and their design and implementation. The Panel met twice during the past year and is preparing an initial draft of its report and recommendations on the future development of national, regional, and local seismograph networks.

In addition to these special studies, the Committee will continue to be concerned with and to study problems pertaining to the collection, storage, and accessibility of data, ocean-bottom seismographs, and the need for complete complements of equipment in seismological observatories to permit the collection of baseline data. The Committee is also planning to form a new panel to study and make recommendations on seismological investigations of the continental crust.

#### Membership

##### *Committee on Seismology*

Kei-iti Aki (Chairman) (1980)  
Department of Earth and Planetary  
Sciences

Massachusetts Institute of Technology  
(Seismology)

John C. Crowell (1981)  
Department of Geological Sciences  
University of California at  
Santa Barbara  
(Geology)

William J. Hall (1979)  
Department of Civil Engineering  
University of Illinois  
(Earthquake engineering)

Donald V. Helmberger (1980)  
Seismological Laboratory  
California Institute of Technology  
(Strong-motion seismology)

Bryan L. Isacks (1981)  
Department of Geological Sciences  
Cornell University  
(Global seismology)

David D. Jackson (1979)  
Department of Geophysics and  
Space Physics  
University of California at Los  
Angeles  
(Seismology)

Thomas V. McEvilly (1981)  
Department of Geology and Geophysics  
University of California at Berkeley  
(Seismology)

Otto W. Nuttli (1979)  
Department of Earth and Atmospheric  
Sciences  
St. Louis University  
(Seismology)

Christopher H. Scholz (1979)  
Lamont-Doherty Geological Observatory  
(Rock mechanics)

Sven Treitel (1980)  
Amoco Production Company  
(Exploration seismology)

*Liaison Members*

William J. Best  
Air Force Office of Scientific  
Research

Edward A. Flinn and Joseph W. Siry  
National Aeronautics and Space  
Administration

William W. Hakala and Roy E. Hanson  
National Science Foundation

Robert L. Wesson and Robert E.  
Wallace  
U.S. Geological Survey

Jerry Harbour  
U.S. Nuclear Regulatory Commission

George A. Kolstad  
Department of Energy

James F. Lander  
National Oceanic and Atmospheric  
Administration

Carl F. Romeny  
Advanced Research Projects  
Agency

*Ex Officio*

J. Freeman Gilbert (1979)  
Institute of Geophysics and  
Planetary Physics  
University of California at San  
Diego

*Assembly Liaison Representatives*  
George W. Housner  
Division of Engineering and  
Applied Science  
California Institute of Technology

Jack E. Oliver  
Department of Geological Sciences  
Cornell University

Carl H. Savit  
Western Geophysical Company of  
America

Executive Secretary, committee and panels: Joseph W. Berg, Jr.

*Panel on Earthquake Problems Related to the Siting of Critical Facilities*

William J. Hall (Chairman)  
Department of Civil Engineering  
University of Illinois at  
Urbana-Champaign  
(Earthquake engineering)

Clarence R. Allen  
Seismological Laboratory  
California Institute of Technology  
(Geology)

Robert G. Bea  
Woodward-Clyde Consultants  
(Engineering)

Raymond L. Blum  
Pacific Gas and Electric Company  
(Engineering)

Ray W. Clough  
Department of Civil Engineering  
University of California at Berkeley  
(Earthquake engineering)

Lloyd S. Cluff  
Woodward-Clyde Consultants  
(Geological engineering)

John C. Crowell  
Department of Geological Sciences  
University of California at  
Santa Barbara  
(Geology)

John E. Lyons  
Exxon Research and Engineering Company  
(Engineering)

Thomas V. McEvelly  
Department of Geology and Geophysics  
University of California at Berkeley  
(Seismology)

Christopher H. Scholz  
Lamont-Doherty Geological Observatory  
(Rock mechanics)

William F. Swiger  
Stone and Webster Engineering  
Corporation  
(Engineering)

David D. Tillson  
Washington Public Power Supply  
System  
(Engineering)

*Liaison Members*  
James F. Devine  
U.S. Geological Survey

Norman A. Dixon  
U.S. Army Corps of Engineers

Kent L. Goering  
Defense Nuclear Agency

William W. Hakala, Roy E. Hanson,  
and John F. Lance  
National Science Foundation

*Panel on National, Regional, and Local Seismograph Networks*  
Bruce A. Bolt (Chairman)  
Seismographic Station  
University of California at Berkeley  
(Seismic-wave propagation)

Edward F. Chiburis  
Weston Observatory  
(Seismic network and array  
analyses)

Robert S. Crosson  
Graduate Program in Geophysics  
University of Washington  
(Physical properties and structure  
of earth's crust)

Robert B. Herrmann  
Department of Earth and Atmospheric  
Science  
St. Louis University  
(Seismic network analyses)

Hiroo Kanamori  
Seismological Laboratory  
California Institute of Technology  
(General earthquake seismology)

Jerry Harbour and J. Carl Stepp  
U.S. Nuclear Regulatory Commission

George L. Sherwood  
Department of Energy

J. Lawrence Von Thun  
Bureau of Reclamation

*Liaison Representatives*  
John O. Berga  
Energy Engineering Board

Robert L. Bangert  
U.S. National Committee for  
Rock Mechanics

Jack W. Boller  
Marine Board

John H. Pomeroy  
Committee on Radioactive Waste  
Management

Paul W. Pomeroy  
Lamont-Doherty Geological Observatory  
(Refraction seismology)

David W. Simpson  
Lamont-Doherty Geological Observatory  
(Refraction seismology)

Robert B. Smith  
Department of Geology and Geophysics  
University of Utah  
(General earthquake seismology)

Don Tocher  
Woodward-Clyde Consultants  
(Earth dynamics)

Mihailo D. Trifunac  
Department of Civil Engineering  
University of Southern California  
(Engineering seismology)

*Liaison Members*  
Rutlage J. Brazee and John A. Kelleher  
U.S. Nuclear Regulatory Commission

E. Robert Engdahl and Robert A.  
Page  
U.S. Geological Survey

James F. Lander  
National Oceanic and Atmospheric  
Administration

Frederick F. Followill  
Lawrence Livermore Laboratory

Ralph W. Alewine III  
Advanced Research Projects  
Agency

William W. Hakala and Roy E.  
Hanson  
National Science Foundation

#### COMMITTEE ON US-USSR COOPERATION IN PHYSICS

Cooperation in physics between the United States and the Soviet Union under the bilateral science and technology agreement originally signed in 1972 greatly accelerated during the past year. As a consequence, to discharge the responsibility accepted for guiding the program in physics, the Academy, through the National Research Council, felt it necessary to seek additional funds from the National Science Foundation and to formalize its procedures for ensuring proper participation by the physics community. Under the new arrangements, David Pines, who was largely responsible for the U.S. initiative over the past eight to ten years of relative inactivity, agreed to chair a small committee of this Assembly (see list that follows). This Committee's primary role is (a) to facilitate participation of the U.S. scientific community in the choice of topics for cooperative projects and the selection of those to take part in the resulting activities and (b) to facilitate communication with the Academy of Sciences of the U.S.S.R. and access to its institutions through conferences, symposia, seminars, and individual visits for discussion and research in fields of mutual interest. The Commission on International Relations provides administrative support for this Committee; the Assembly is responsible for the substantive content of the program and the choice of participants in it.

Overall guidance of the program of activities under the US-USSR Agreement for Cooperation in Fields of Science and Technology is provided by a Joint US-USSR Commission, the U.S. cochairman of which is Frank Press. The NRC Committee serves as the U.S. component of a working group of this Joint US-USSR Commission. Recently, a Soviet Commission on Cooperation in Physics was formed and functions as the U.S.S.R. component of this working group.

The Committee held its first meeting in February 1978, at which time a program for 1978 was approved. Fields selected for cooperative projects were relativistic astrophysics, condensed matter, laser interactions with matter, and theoretical particle physics. A second meeting took place in November, and the Committee met with its Soviet counterpart in Moscow in December.

During the CY 1978 Program Year, the following activities took place under the auspices of this program: (a) a one-month visit in the United

States by a delegation of six Soviet astrophysicists in July and August 1978; (b) a Joint Workshop on Absorption and Transport Phenomena in Laser-Produced Plasmas in the Soviet Union in August-September 1978, with 15 U.S. scientists taking part; (c) a three-week visit in the Soviet Union in May 1978 by U.S. Working Group Cochairman David Pines to discuss projects for future cooperation under the Working Group; and (d) individual visits to the Soviet Union by three U.S. scientists for exploration of possible new fields of cooperation and research in mathematical physics and biomolecular physics and individual visits of Soviet scientists to the United States to conduct research in the previously established fields of cooperation of theoretical astrophysics and condensed matter theory.

Activities planned for the CY 1979 Program Year include (a) a Joint Research Group Meeting in Condensed Matter Theory, to be held in the Soviet Union during the summer of 1979 for from four to six weeks, with 10 or 15 participants from each country; (b) a Joint Research Group Meeting on Dynamics of Non-Abelian Gauge Fields, to be held in the United States in July and August 1979 for eight weeks, with approximately 12 participants from each country; (c) a Joint Workshop on Absorption and Transport Phenomena in Laser-Produced Plasmas, to be held in the United States in September 1979 for two weeks, with about 15 scientists from each country taking part; (d) a Joint Symposium on Mathematical Physics, to be held in the Soviet Union in summer 1979 for two weeks, with 10 or 15 participants from each country; (e) a Workshop on Quantum Dynamics and Reactivity of Large Molecules, to be held in the United States for three weeks in August 1979, with from four to six Soviet and eight to ten U.S. participants; and (f) four or five visits by individual U.S. and Soviet scientists to one another's countries for research and exploration. There might also be a second Joint Working Group meeting in the United States in fall 1979 to plan for the following year.

#### Membership

David Pines (Chairman) (1979)  
Department of Physics  
University of Illinois  
(Theoretical astrophysics;  
theoretical physics)

Peter A. Carruthers (1981)  
Los Alamos Scientific Laboratory  
(Theoretical physics)

William A. Fowler (1980)  
Kellogg Radiation Laboratory  
California Institute of Technology  
(Physics)

Francis E. Low (1980)  
Department of Physics  
Massachusetts Institute of Technology  
(Theoretical physics)

Marshall N. Rosenbluth (1981)  
Institute for Advanced Study  
(Theoretical physics)

J. Robert Schrieffer (1980)  
Department of Physics  
University of Pennsylvania  
(Physics)

Kip S. Thorne (1980)  
California Institute of Technology  
(Astrophysics; theoretical physics)

*Liaison Representatives*  
Dwight M. Cramer  
Department of State

Richard A. Isaacson and Arthur  
E. Pardee  
National Science Foundation



*Assembly Liaison Representatives*

Kenneth M. Case  
The Rockefeller University

Robert G. Sachs  
Argonne National Laboratory

Staff Officers: George W. Wood, Gerson S. Sher (Commission on International Relations)

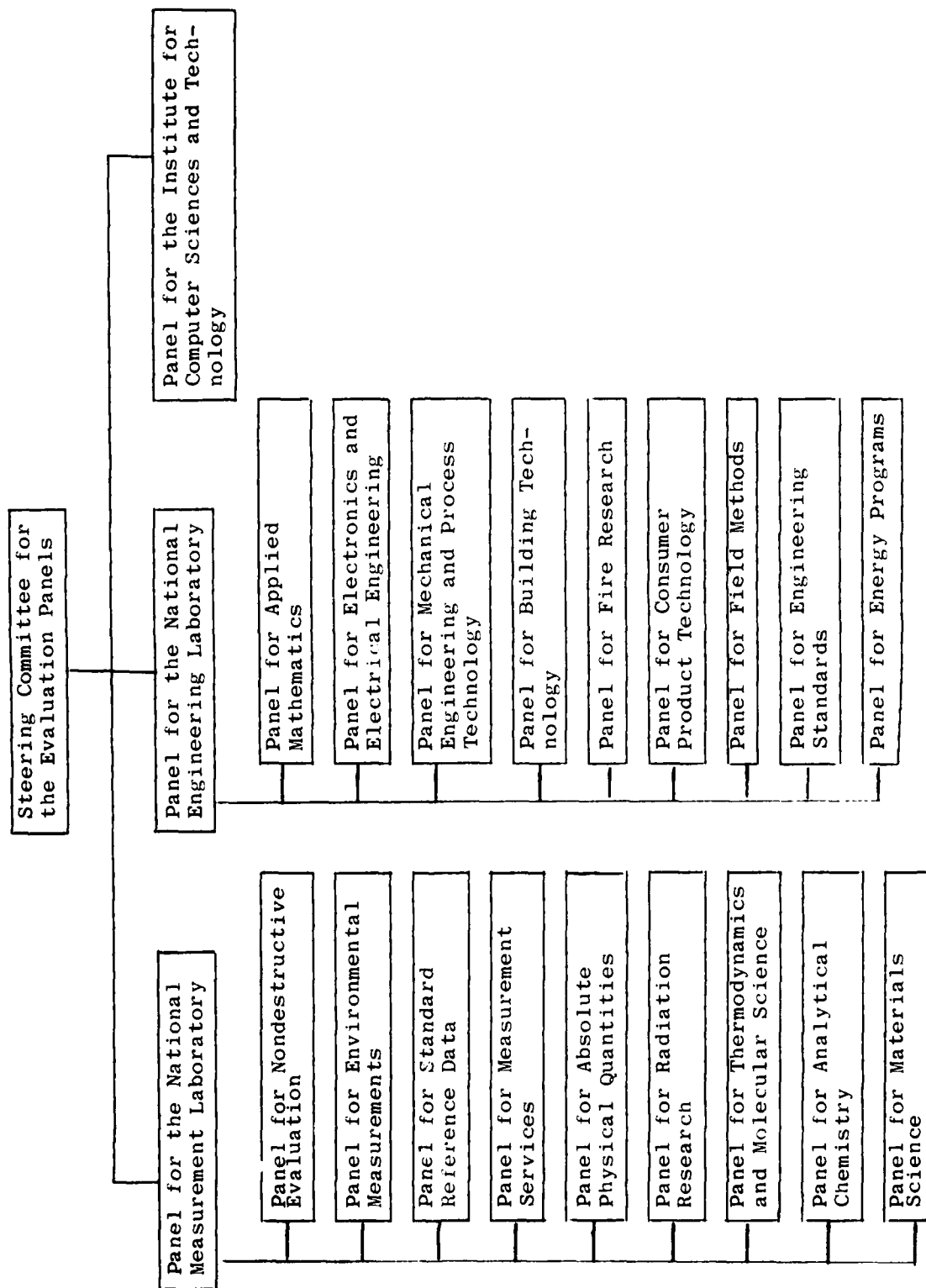
## EVALUATION PANELS FOR THE NATIONAL BUREAU OF STANDARDS

In response to a request from the Director of the National Bureau of Standards (NBS) in 1959, the NRC has annually reviewed and evaluated the technical functions and operations of the Bureau, which is an agency of the Department of Commerce. Responsibility for this annual review rests with the Evaluation Panels, of which there have been some 30. Each would review the work of an institute or office or of a division, center, laboratory, or special program under an institute. In particular, the panels considered priorities among projects, quality of staff, equipment needs, distribution of support, and relationship of a project or group of projects to the mission of the Bureau. Equally important, the panels fostered interaction between the NBS staff and scientists and engineers in academic and industrial organizations.

A Steering Committee guided the work of the panels, extracted from their reports problems common to several organizational units of NBS, and brought such problems to the attention of the Director of the Bureau and the Statutory Visiting Committee, which reports to the Secretary of Commerce.

During the past year the NBS has been reorganizing, thus the Evaluation Panels have been in a state of transition to the new structure. New panels have been formed to match new NBS units, and some panels have been merged with others or disbanded. The year has been productive, however, with six reports completed and published, including an evaluation of the Institute for Computer Science and Technology for FY 1976, and a letter report on the operation of this Institute up to the time of reorganization; a report on the Experimental Technology Incentives Program for FY 1977; a report on the Institute for Materials Research for FY 1977; a report on the Institute for Applied Technology for FY 1977; and a report on the Institute for Basic Standards for FY 1977. Four other reports were nearing completion at the close of CY 1978.

EVALUATION PANELS FOR THE NATIONAL BUREAU OF STANDARDS



## Membership\*

*Steering Committee of the Evaluation Panels**Members-at-Large*

Mildred S. Dresselhaus (Chairman)  
(1981)  
Center for Materials Science and  
Engineering  
Massachusetts Institute of Technology  
(Physics)

G. King Walters (1980)  
Department of Physics  
Rice University  
(Physics)

*Ex Officio*

Lawrence Goldmuntz (1980)  
Economics and Science Planning  
(Science research and public policy)

Lester Kilpatrick (1980)  
Kilpatrick Management Company  
(Computer science)

Charles J. Meechan (1979)  
Energy Systems Group  
Rockwell International  
(Solid-state physics)

*Assembly Liaison Representatives*

Charles P. Bean  
General Electric Company

Robert Herman  
Traffic Science Department  
General Motors Research Laboratories

Director: Gary E. Clark

*Evaluation Panel for the National Measurement Laboratory (500)**Members-at-Large*

Charles J. Meechan (Chairman) (1979)  
Energy Systems Group  
Rockwell International  
(Solid-state physics)

Neil Bartlett (1980)  
Department of Chemistry  
University of California  
(Inorganic chemistry)

Morris Cohen (1979)  
Department of Materials Science  
and Engineering  
Massachusetts Institute of Technology  
(Physical metallurgy, materials  
science)

Frank E. Jamerson (1980)  
General Motors Research Laboratories  
(Research management)

William P. Slichter (1981)  
Research, Materials Science and  
Engineering Division  
Bell Laboratories  
(Physical chemistry)

*Ex Officio*

Sydney D. Andrews (1981)  
Department of Agriculture and  
Consumer Services  
State of Florida  
(Weights and measures)

Joseph E. Burke (1981)  
General Electric Corporate  
Research and Development Center  
(Materials for nuclear reactors)

Alan Eschenroeder (1980)  
Arthur D. Little, Inc.  
(Mechanical engineering, aerodynamics)

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\* Panels are being reorganized to coincide with new structure of the National Bureau of Standards. Therefore, the membership of some Panels is not yet complete.

Herman Feshbach (1980)  
 Department of Physics  
 Massachusetts Institute of Technology  
 (Theoretical physics)

Donald L. Hammond (1980)  
 Physical Electronics Laboratory  
 Hewlett-Packard Laboratories  
 (Physical electronics)

Joseph Kestin (1980)  
 Brown University  
 (Mechanical engineering, thermo-  
 dynamics)

*Evaluation Panel for Nondestructive Evaluation (501)*

Max Yeater (Chairman) (1981)  
 Nuclear Engineering  
 Rensselaer Polytechnic Institute  
 (Nuclear engineering)

John F. Ewing (1981)  
 Naval Nuclear Fuel Division  
 Babcock and Wilcox  
 (Heavy industry)

William J. Harris, Jr. (1981)  
 Association of American Railroads  
 (Transportation industry)

*Evaluation Panel for Environmental Measurements (505)*

Alan Eschenroeder (Chairman) (1980)  
 Arthur D. Little, Inc.  
 (Mechanical engineering, aero-  
 dynamics)

Kyle D. Bayes (1979)  
 Department of Chemistry  
 University of California at Los  
 Angeles  
 (Physical chemistry)

Geraldine V. Cox (1980)  
 Medicine and Biological Sciences  
 Department  
 American Petroleum Institute  
 (Water pollution control)

William O. Fitzgibbons (1979)  
 Standard Oil Company  
 (Environmental biology)

Irving L. Mador (1980)  
 Chemical Research Center  
 Allied Chemical Corporation  
 (Physical chemistry)

E. P. Przybylowicz (1981)  
 Research Laboratories  
 Eastman Kodak Company  
 (Physical and analytical chemistry)

Max Yeater (1981)  
 Nuclear Engineering  
 Rensselaer Polytechnic Institute  
 (Nuclear engineering)

Milton Levenson (1981)  
 Nuclear Power Division  
 Electrical Power Research Institute  
 (Electric utilities)

Robert C. McMaster (1981)  
 Consulting Engineer  
 (Nondestructive testing)

J. Carrell Morris (1980)  
 Division of Applied Sciences  
 Harvard University  
 (Waste-water treatment)

Jimmie S. Payne (1980)  
 Laboratory Division  
 Texas Air Control Board  
 (Organic and analytical chemistry)

Bernard Weinstock (1980)  
 Chemistry Department  
 Ford Motor Company  
 (Inorganic chemistry)

F. T. Weiss (1979)  
 Research  
 Shell Development Company  
 (Analytical and organic chemistry)

Jerome J. Wesolowski (1979)  
Air and Industrial Hygiene Laboratory  
Section  
State of California Department of  
Health Services  
(Environmental physics)

*Liaison Representatives*

Robert L. Booth and George Morgan  
Environmental Protection Agency

*Evaluation Panel for Standard Reference Data (504)*

Joseph Kestin (Chairman) (1980)  
Brown University  
(Mechanical engineering, thermo-  
dynamics)

Herbert T. Corten (1980)  
Theoretical and Applied Mechanics  
University of Illinois  
(Fracture mechanics)

Edwin D. Becker (1979)  
Laboratory of Chemical Physics  
National Institutes of Health  
(Physical chemistry)

Daniel R. Miller (1979)  
Office of Energy Research  
Department of Energy  
(Chemistry)

A. Arnold Bondi (1979)  
Consulting Research Engineer  
Shell Development Company  
(Chemical engineering)

*Evaluation Panel for Measurement Services (510)*

Sydney D. Andrews (Chairman) (1981)  
Department of Agriculture and  
Consumer Services  
State of Florida  
(Weights and measures)

Kenneth F. Hammer (1981)  
Fairbanks Weighing Division  
Colt Industries  
(Mechanical engineering)

Bruce Barrow (1981)  
Defense Communications Engineering  
Center  
(IEEE standards)

Jerry L. Hayes (1980)  
Metrology Engineering Center  
Naval Plant Representative Office  
(Meteorology)

*Evaluation Panel for Absolute Physical Quantities (520)*

Donald L. Hammond (Chairman) (1980)  
Physical Electronics Laboratory  
Hewlett-Packard Laboratories  
(Physical electronics)

Benjamin Bederson (1980)  
Department of Physics  
New York University  
(Atomic and molecular physics)

Roy E. Anderson (1979)  
General Electric Company  
(Communications)

H. Richard Crane (1979)  
Physics Department  
University of Michigan  
(Physics)

Laques M. Beckers (1980)  
Carmelito Peak Observatory  
(Astronomy)

L. S. Cutler (1979)  
Physical Research Laboratory  
Hewlett-Packard Company  
(Atomic-beam tubes and quantum  
electronics)

William E. Keller (1980)  
Los Alamos Scientific Laboratory  
University of California  
(Physical chemistry)

William Klemperer (1979)  
Department of Chemistry  
Harvard University  
(Physical chemistry)

William F. Krupke (1980)  
Lawrence Livermore Laboratory  
(Plasma physics)

P. Kusch (1979)  
Physics Department  
University of Texas at Dallas  
(Physics)

Lawrence G. Rubin (1979)  
National Magnet Laboratory  
Massachusetts Institute of Technology  
(Electronics)

*Evaluation Panel for Radiation Research (530)*

Herman Feshbach (Chairman) (1980)  
Department of Physics  
Massachusetts Institute of Technology  
(Theoretical physics)

Peter Axel (1980)  
Department of Physics  
University of Illinois  
(Nuclear physics)

J. Calvin Brantley (1981)  
Administration  
New England Nuclear Corporation  
(Inorganic chemistry)

H. Richard Crane (1979)  
Physics Department  
University of Michigan  
(Physics)

Peter Demos (1980)  
Department of Physics  
Massachusetts Institute of Technology  
(Experimental nuclear physics,  
management of research)

Clayton A. Swenson (1980)  
Department of Physics  
Iowa State University  
(Cryogenic temperature scales)

Hardy Trolander (1980)  
Yellow Springs Instrument Company  
(Fluid-flow measurements)

Arthur B. C. Walker, Jr. (1979)  
Institute of Plasma Research and  
Department of Applied Physics  
Stanford University  
(Space physics, astronomy)

Gernot M. R. Winkler (1980)  
Time Service Division  
U.S. Naval Observatory  
(Astronomy)

Ivan G. Easton (1981)  
IEEE Standards Office  
(Electronic instrumentation)

John E. Eby (1981)  
GTE Sylvania, Inc.  
(Solid-state physics, optics)

Ugo Fano (1979)  
Department of Physics  
University of Chicago  
(Physics)

Theodor W. Hansch (1980)  
Department of Physics  
Stanford University  
(Laser spectroscopy)

William W. Havens, Jr. (1980)  
Columbia University  
(Neutron standards)

Einar Hinnov (1981)  
Plasma Physics Laboratory  
Princeton University  
(Physics)

Edward A. Knapp (1981)  
Los Alamos Scientific Laboratory  
(Linear accelerators)

John S. Laughlin (1980)  
Division of Biophysics  
Memorial Sloan-Kettering Cancer  
Center  
(Medical physics, radiation  
dosimetry)

William N. McElroy (1979)  
Hanford Engineering Development  
Laboratory  
Westinghouse Hanford Company  
(Reactor dosimetry)

*Evaluation Panel for Thermodynamics and Molecular Science (540)*

Irving L. Mador (Chairman) (1980)  
Corporate Research Center  
Allied Chemical Corporation  
(Physical chemistry)

Simon H. Bauer (1981)  
Department of Chemistry  
Cornell University  
(Molecular spectra)

Robert Floyd Curl, Jr. (1981)  
Department of Chemistry  
Rice University  
(Microwave and laser spectroscopy)

Anna J. Harrison (1979)  
Chemistry Department  
Mt. Holyoke College  
(Physical chemistry)

Clyde A. Hutchison (1980)  
Department of Chemistry  
University of Chicago  
(Physical chemistry)

*Evaluation Panel for Analytical Chemistry (550)*

E. P. Przybylowicz (Chairman) (1981)  
Research Laboratories  
Eastman Kodak Company  
(Physical and analytical chemistry)

Roger Schneider (1980)  
Division of Electronic Products  
Food and Drug Administration  
(Radiological health, government  
regulations)

John J. Taylor (1981)  
Water Reactor Divisions  
Westinghouse Electric Corporation  
(Nuclear-reactor development)

Jack V. Walker (1979)  
Advanced Reactor Research  
Sandia Laboratories  
(Nuclear measurements for weapons)

K. Keith Innes (1981)  
Department of Chemistry  
State University of New York at  
Binghamton  
(Molecular spectroscopy)

Eric Kay (1979)  
Surface, Thin Film and Plasma Science  
Thomas J. Watson Research Center  
IBM Corporation  
(Inorganic and physical chemistry)

Aneesur Rahman (1981)  
Argonne National Laboratory  
(Theory of liquids)

Peter M. Rentzepis (1979)  
Physical and Inorganic Chemistry  
Research Department  
Bell Laboratories  
(Chemical physics)

J. Charles Tracy (1980)  
Physics Department  
General Motors Research Laboratories  
(Surface physics)

George N. Bowers, Jr. (1979)  
Clinical Chemistry  
Hartford Hospital  
(Analytical chemistry)

Donald E. Campbell (1980)  
European Research Center  
Corning  
(Physical and analytical chemistry)

Franklin R. Elevitch (1981)  
Mt. Zion Hospital  
(Clinical chemistry)

Catherine Clarke Fenselau (1981)  
Department of Pharmacology  
John Hopkins University  
School of Medicine  
(Biomedical application of mass spectrometry)

Jeanette G. Grasselli (1980)  
Molecular Spectroscopy Section  
Standard Oil Company  
(Molecular spectroscopy)

James H. Kanzelmeyer (1980)  
Smelting Division  
St. Joe Zinc Company  
(Analytical chemistry)

Lynn L. Lewis (1981)  
Analytical Chemistry Department  
General Motors Research Laboratories  
(Gases in metals)

*Evaluation Panel for Materials Science (560)*

Joseph E. Burke (1981)  
Special Projects  
General Electric Corporate  
Research and Development Center  
(Materials for nuclear reactors)

S. L. Aggarwal (1980)  
Research Division  
The General Tire and Rubber Company  
(Mechanical properties of polymers and composites)

William John Bailey (1980)  
Department of Chemistry  
University of Maryland  
(Organic synthesis of polymers)

Khalil H. Mancy (1979)  
Department of Environmental and  
Industrial Health  
University of Michigan  
(Environmental chemistry)

Allen L. Mossman (1981)  
Matheson Gas Products  
(Gas analysis)

Richard W. Perkins (1979)  
Physical Sciences Department  
Battelle Memorial Institute  
(Atmospheric chemistry)

Charles N. Reilley (1981)  
Department of Chemistry  
University of North Carolina  
(Analytical chemistry)

Wilhad Reuter (1981)  
Thomas J. Watson Research Center  
IBM Corporation  
(Analytical chemistry)

Morton K. Schwartz (1979)  
Department of Biochemistry  
Memorial Hospital for Cancer and  
Allied Diseases  
(Biochemistry)

J. H. Bechtold (1979)  
Materials Sciences  
Westinghouse Research Laboratories  
(Theoretical metallurgy)

Frank Bovey (1980)  
Polymer Chemistry Research Department  
Bell Laboratories  
(Polymer chemistry research)

Walter L. Brown (1979)  
Radiation Physics Research Department  
Bell Laboratories  
(Physics)

K. Lawrence DeVries (1979)  
Department of Mechanical Engineering  
University of Utah  
(Mechanical and materials engineering, physics)



Alan N. Gent (1979)  
 Graduate Studies and Research  
 University of Akron  
 (Polymer physics)

Martin E. Glicksman (1979)  
 Materials Engineering Department  
 Rensselaer Polytechnic Institute  
 (Physical metallurgy)

Franklin P. Huddle (1979)  
 Congressional Research Service  
 Library of Congress  
 (National materials policy)

John C. Jamieson (1980)  
 Department of Geophysical Sciences  
 University of Chicago  
 (Crystallography)

John Gilbert Kaufman (1980)  
 Technical Development  
 Aluminum Company of America  
 (Materials science)

Gerald Lucovsky (1980)  
 Xerox Palo Alto Research Center  
 (Solid-state materials)

Alan G. MacDiarmid (1979)  
 Chemistry Department  
 University of Pennsylvania  
 (Inorganic chemistry)

Richard L. Myerson (1979)  
 Dental Research and Product Develop-  
 ment  
 Howmedica, Inc.  
 (Porcelain and plastic artificial  
 teeth)

S. Elaine B. Petrie (1979)  
 Chemistry Division  
 Eastman Kodak Company  
 (Physical chemistry)

Riley Schaeffer (1979)  
 Department of Chemistry  
 University of Wyoming  
 (Inorganic chemistry)

Marion Semchyshen (1979)  
 Research  
 Climax Molybdenum Company of Michigan  
 (Metallurgy)

Robert D. Shannon (1980)  
 E. I. duPont de Nemours and Company,  
 Inc.  
 Experimental Station  
 (Solid-state chemistry)

David P. Shoemaker (1980)  
 Department of Chemistry  
 Oregon State University  
 (Crystallography)

Michael K. Wilkinson (1979)  
 Solid State Division  
 Oak Ridge National Laboratory  
 (Physics)

*Evaluation Panel for the Institute for Computer Sciences and Technology (600)*  
 Lester Kilpatrick (Chairman) (1980)  
 Kilpatrick Management Company  
 (Computer science)

Anne W. Branscomb (1980)  
 Kalba Bowen Associates, Inc.  
 (Economics and public policy)

Gene M. Amdahl (1981)  
 Amdahl Corporation  
 (Computer science)

George Bugliarello (1980)  
 Polytechnic Institute of New York  
 (Automation in engineering)

Walter F. Bauer (1980)  
 Informatics Inc.  
 (Data handling, systems design)

Lawrence Goldmuntz (1979)  
 Economics and Science Planning  
 (Science research and public policy)

William F. May (1980)  
American Can Company  
(Manufacturing)

William C. Norris (1980)  
Control Data Corporation  
(Computer science)

*Evaluation Panel for the National Engineering Laboratory (700)*  
*Members-at-Large*

Lawrence Goldmuntz (Chairman) (1980)  
Economics and Science Planning  
(Science research and public policy)

Ernest S. Kuh (1981)  
College of Engineering  
University of California at Berkeley  
(Electrical engineering)

Eric Wolman (1980)  
Operations Research Techniques and  
Software Systems Research  
Department  
Bell Laboratories  
(Applied mathematics)

*Ex Officio*  
Richard Bender (1979)  
College of Environmental Design  
University of California at Berkeley  
(Architectural engineering)

Richard E. Bland (1979)  
Applied Research Laboratory  
Pennsylvania State University  
(Engineering physics)

*Evaluation Panel for Applied Mathematics (710)*

J. Stuart Hunter (Chairman) (1980)  
School of Engineering and Applied  
Science  
Princeton University  
(Experimental statistics)

James C. Browne (1981)  
Department of Computer Sciences  
University of Texas  
(Atomic and molecular physics,  
scientific computing)

Douglas T. Ross (1980)  
SofTech, Inc.  
(Computer software engineering)

Robert W. Dunlap (1979)  
Environmental Research and Technology,  
Inc.  
(Metallurgical engineering)

Richard Goodemote (1980)  
Sears, Roebuck and Company  
(Product standards)

J. Stuart Hunter (1980)  
School of Engineering and Applied  
Science  
Princeton University  
(Experimental statistics)

P. A. McKeown (1979)  
Cranfield Unit for Precision  
Engineering  
Cranfield Institute of Technology  
(Mechanical engineering)

Herbert A. Shepard (1979)  
Consultant  
(Economics, management)

R. Creighton Buck (1980)  
Mathematics Research Center  
University of Wisconsin  
(Mathematics)

George F. Carrier (1980)  
Division of Applied Sciences  
Harvard University  
(Applied mathematics)

Gene H. Golub (1981)  
Computer Science Department  
Stanford University  
(Numerical analysis)

William H. Lawton (1980)  
Corporate Commercial Services  
Eastman Kodak Company  
(Statistics)

James M. Ortega (1979)  
Department of Mathematics  
North Carolina State University  
(Mathematics)

William F. Lucas (1979)  
Operations Research and Applied  
Mathematics  
Cornell University  
(Operations research)

*Evaluation Panel for Electronics and Electrical Engineering (720)*  
To be appointed

*Evaluation Panel for Mechanical Engineering and Process Technology (730)*

P. A. McKeown (Chairman) (1979)  
Cranfield Unit for Precision  
Engineering  
Cranfield Institute of Technology  
(Mechanical engineering)

Edward A. Myers (1981)  
Southern California Edison Company  
(Thermophysical processes)

Frederick Henry Abernathy (1979)  
Harvard University  
(Fluid mechanics, nuclear  
engineering)

James H. Parker, Jr.  
Superconductivity and Cryogenics  
Westinghouse Research and Develop-  
ment Center  
(Solid-state physics)

John F. Elliott (1981)  
Metallurgy  
Massachusetts Institute of Technology  
(Physical chemistry of metals)

Charles A. Rosen (1981)  
Artificial Intelligence Center  
SRI International  
(Industrial automation)

Edward F. Hammel, Jr. (1981)  
Los Alamos Scientific Laboratory  
(Thermophysical properties)

Peter K. Stein (1979)  
Stein Engineering Services, Inc.  
(Measurement engineering)

Paul L. Hathaway (1979)  
Northwest Natural Gas Company  
(Mechanical engineering)

Nam P. Suh (1980)  
Mechanical Engineering Department  
Massachusetts Institute of Technology  
(Automated engineering)

K. H. Hemsath (1981)  
Technical Center  
Midland Ross Corporation  
(Physical chemistry)

E. Loy Upp (1981)  
Systems Engineering Division  
Daniel Industries, Inc.  
(Liquid and gas flow measurements)

*Evaluation Panel for Building Technology (740)*

Richard Bender (Chairman) (1979)  
College of Environmental Design  
University of California at Berkeley  
(Architectural engineering)

Jack B. Chaddock (1979)  
Department of Mechanical Engineering  
and Materials Science  
Duke University  
(Mechanical engineering)

Richard Davis (1981)  
College of Engineering and Physical  
Sciences  
University of New Hampshire  
(Metallurgical engineering)

Steven J. Fenves (1979)  
Civil Engineering Department  
Carnegie-Mellon University  
(Civil engineering)

George D. Hudelson (1980)  
Engineering and Research  
Carrier Corporation  
(Mechanical engineering)

Rudard A. Jones (1979)  
Small Homes Council-Building  
Research Council  
University of Illinois  
(Architectural research)

*Evaluation Panel for Fire Research (750)*

Richard E. Bland (Chairman) (1979)  
Applied Research Laboratory  
Pennsylvania State University  
(Engineering physics)

Robert H. Barker (1979)  
Clemson University  
(Organic chemistry)

Jack Bono (1980)  
Underwriters Laboratories, Inc.  
(Fire safety)

A. Fred Kerst (1979)  
Velsicol Chemical Corporation  
(Fire research)

*Evaluation Panel for Consumer Product Technology (760)*

Richard Goodemote (Chairman) (1980)  
Sears, Roebuck and Company  
(Product standards)

Valentine A. Lehr (1980)  
Lehr Associates  
(Consulting engineer)

William M. Pena (1981)  
Caudill Rowlett Scott  
(Architecture, building design)

Harold M. Proshansky (1981)  
The Graduate School and University Center  
The City University of New York  
(Environmental psychology)

Wilbur R. Thompson (1979)  
Phoenix, Arizona  
(Economics)

John I. Yellott (1981)  
John Yellott Engineering Associates  
(Solar energy, energy conservation)

Eugene Zwoyer (1980)  
American Society of Civil Engineers  
(Resistant structures design)

John E. Lee (1979)  
Fire Department  
Charlotte, North Carolina  
(Fire fighting)

Anne W. Phillips (1980)  
National Smoke, Fire and Burn  
Institute, Inc.  
(Treatment of fire injuries)

Charles Reinhardt (1980)  
Laboratory for Toxicology and  
Industrial Medicine  
E. I. duPont de Nemours and Company, Inc.  
(Toxicology and industrial medicine)

Arthur Spiegelman (1979)  
American Insurance Association  
(Insurance)

Donald S. Beilman (1980)  
Applied Research and Engineering  
Division  
General Electric Company  
(Appliance manufacture and use)

- S. David Hoffman (1981)  
Standards and Legal  
Underwriters Laboratories Inc.  
(Product safety)
- Glen D. King (1981)  
International Association of Chiefs  
of Police  
(Law enforcement standards)
- Mary E. Powers (1979)  
Consumer Affairs  
Good Housekeeping Magazine  
(Consumer information and relations)
- Peter N. Renzi (1979)  
Utility and Industrial Operations  
Rockwell International  
(Product labeling)
- Rose Steidl (1980)  
New York State College of Human  
Ecology  
Cornell University  
(Human factors research)
- Evaluation Panel for Field Methods (770)*
- Herbert A. Shepard (Chairman) (1979)  
Consultant  
(Economics, management)
- Daniel Berg (1979)  
Mellon Institute of Science  
Carnegie-Mellon University  
(Physical chemistry)
- William M. Capron (1979)  
Department of Economics  
Boston University  
(Economics)
- Herbert I. Fusfeld (1979)  
Research  
Kennecott Copper Corporation  
(Research management)
- Milton Harris (1979)  
Consultant  
(Chemistry)
- David A. Swankin (1981)  
Swankin and Turner  
(Consumer advocate)
- Hans B. Thorelli (1979)  
Graduate School of Business  
Indiana University  
(Product labeling)
- Julian A. Waller (1979)  
Department of Epidemiology and  
Environmental Health  
University of Vermont  
(Behavioral research, product safety)
- Alvin S. Weinstein (1981)  
Mechanical Engineering and Public  
Policy  
Carnegie-Mellon University  
(Product liability)
- Foster C. Wilson (1979)  
Building Research Laboratory  
Owens-Corning Fiberglas Corporation  
(Consumer standards)
- Walter R. Hibbard, Jr. (1979)  
College of Engineering  
Virginia Polytechnic Institute  
(Metallurgy)
- Almarin Phillips (1980)  
Department of Economics  
University of Pennsylvania  
(Economics)
- Louis T. Rader (1979)  
The Darden Graduate School of Business  
University of Virginia  
(Electrical engineering)
- Charles E. Reed (1979)  
General Electric Company  
(Chemistry, chemical engineering)
- Donald A. Schon (1980)  
Urban Studies and Education  
Massachusetts Institute of Technology  
(Technological innovation)

*Evaluation Panel for Engineering Standards (780)*

To be appointed

*Evaluation Panel for Energy Programs (790)*

|  |   |
|--|---|
| Robert W. Dunlap (Chairman) (1979)             | John E. Haaland (1980)                      |
| Environmental Research and Technology,<br>Inc. | Pillsbury Company                           |
| (Metallurgical engineering)                    | (Industrial energy conservation)            |
| James B. Comly (1980)                          | Jack B. Howard (1981)                       |
| Energy Sciences Branch                         | Chemical Engineering                        |
| General Electric Company                       | Massachusetts Institute of Technology       |
| (Applied physics)                              | (Combustion research)                       |
| Paul P. Craig (1980)                           | Lester Massey (1981)                        |
| Council on Energy and Resources                | Process Development                         |
| University of California at Davis              | Consolidated Natural Gas Service<br>Company |
| (Energy conservation)                          | (Chemical engineering)                      |
| John H. Gibbons (1979)                         | Walter A. Meisen (1980)                     |
| Environment Center                             | Daniel, Mann, Johnson and Mendenhall        |
| University of Tennessee                        | (Architecture)                              |
| (Environmental research)                       |   |
| Paul C. Greiner (1980)                         | Harold W. Paxton (1981)                     |
| Edison Electric Institute                      | Research                                    |
| (Energy applications)                          | U.S. Steel Corporation                      |
|  | (Chemical engineering)                      |

## SOLID STATE SCIENCES COMMITTEE

The Solid State Sciences Committee is an interdisciplinary body, with members drawn from universities, industry, government, and national laboratories. Members represent solid-state physics; solid-state chemistry; and basic materials science aspects of ceramics, electronic materials, metallurgy, and polymers. Formed in the late 1940's as an Advisory Solid State Sciences Panel of the Office of Naval Research, sponsorship later expanded to include the then Atomic Energy Commission, National Science Foundation, Air Force Office of Scientific Research, Army Research Office, and Advanced Research Projects Agency. In 1962 this Solid State Sciences Panel became affiliated with the NRC, and in 1971 it was reorganized into a Solid State Sciences Committee consisting of 12 members. Committee members are appointed by the Chairman of the Assembly, with the approval of the Chairman of the NRC; an informal advisory panel to the Committee is invited by the Committee Chairman to participate in the semi-annual symposia and workshops of the Committee and to assist in the planning of special studies.

The Committee has two general objectives: (a) to ascertain and make recommendations on the needs of the solid-state sciences community, particularly

in regard to research opportunities and support, and (b) to provide guidance to federal agencies regarding their materials-science research programs. To achieve these objectives, the Committee organizes and conducts special studies of matters of concern to the materials-science community and the federal agencies, such as the health of the various disciplines that compose materials science or the need for major national facilities. It also organizes semi-annual symposia and workshops that are attended by key members of the materials-science community, representatives of federal agencies, and members of the informal advisory panel to the Committee. Through *ad hoc* subcommittees, the Committee arranges for the preparation of resource papers on timely topics; these papers often serve as the nucleus of a proposal for a special study. It also meets from time to time at key centers of materials-science research. The Committee's informal advisory panel provides a broadly representative group for the discussion of issues that affect the progress and vitality of materials science.

The Committee's semiannual workshops or symposia are traditional parts of its annual program, usually taking place in early summer and in December. The topic of the two-day session in December 1977 was "Recent Advances in Materials Science Equipment and Techniques." The objective was to explore equipment needs in the intermediate cost range, as well as new developments in equipment and the science that could result from their availability. Papers dealt with high-pressure (diamond anvil) equipment, developments in magnetic measurements, nuclear magnetic resonance in polymers, molecular-beam epitaxy, field desorption mass spectroscopy, low-energy electron loss, scanning Auger microscopy, and patterns of equipment management.

In June 1978, the Committee and its informal panel visited the Oak Ridge National Laboratory, where they reviewed the Materials Research Program. This session was followed by a symposium on "Ion Beam Applications in the Materials Sciences" in which papers were presented by key scientists from various laboratories on "Use of Ion Beams for Materials Analysis," "Materials Alterations by Ion Beam Techniques," "Implantation Metallurgy," "New Advances in Semiconductor Implantation," and "Microfocused Ion Beams."

Planned for December 1978 was a workshop in solid-state chemistry that addressed the concerns of the solid-state synthesis chemists and the status of the synthesis and characterization of advanced materials. A working group of the Committee, chaired by Murray Robbins of Bell Laboratories, was in charge of planning and organizing this meeting.

Subjects tentatively selected for workshops in 1979 are "Polymer Science," which, like the December session on solid-state chemistry would assess the status of polymer science in the United States, and "High Pressure Research and Facilities in the United States." If funds become available, the Committee will also cooperate with the Committee on Chemical Sciences in a study of the educational problems and research needs in polymer science.

Several studies conducted by *ad hoc* panels of the Committee have been completed during the past year or are in progress. As a result of a request from the National Science Foundation and Department of Energy for information about scientific opportunities in neutron research on condensed matter and needs for neutron source facilities, the Panel on Research Facilities and Scientific Opportunities in the Use of Low-Energy Neutrons was established early in 1977 and completed its report by the end of the year. The Panel

recommended continued support of the highest-flux steady-state reactors, with particular attention to enhancing the instrumentation at these facilities so that they could continue to compete at the forefront of science. It also noted the importance of medium-flux reactors and the probability that, ultimately, new types of steady-state reactors would be needed. The Panel recommended an immediate commitment for procuring a high-flux pulsed neutron source of about  $10^{16}$  thermal neutrons per square centimeter per second peak, a peak flux that is about a factor of 10 greater than the highest steady-state flux currently available in the United States. It also emphasized the importance of implementing an instrument development phase in parallel with facility development and urged that instrumentation at neutron facilities be augmented and modernized to permit wider use by the scientific and technical community.

In April 1976, Allen E. Puckett, Chairman of the Space Applications Board of the Assembly of Engineering, invited the Committee to assist in an assessment of the National Aeronautics and Space Administration Materials Processing in Space Program. As a result, the Committee formed an *ad hoc* Panel, chaired by William P. Slichter of Bell Laboratories, which was charged with (a) reviewing the philosophy and goals of the NASA Program, (b) assessing the scientific value and technological importance of these goals, (c) assessing the scientific and technological significance of what has been accomplished under this Program, and (d) making recommendations on the future nature and scope of the Program. A parallel panel established by the Space Applications Board evaluated commercial, industrial, and policy aspects of the Program. The report on these studies was issued by the Space Applications Board in June 1978. The main conclusion of the Panel on Scientific and Technological Aspects of Processing Materials in Space was that the Space Shuttle, because of the low-gravity environment that it will provide in earth orbit for long periods of time, offers some new opportunities for research and development in processing materials in space; however, it emphasized that any experiments proposed for this space environment should have "a sound base in terrestrial research." In some instances there was not enough "earth-bound" research to determine whether additional effort and improvements in it would yield results similar to or surpassing those achieved in space. The Panel identified a number of specific fields in which experimentation in space might contribute meaningfully to the understanding of the properties and processing of materials; however, it did not find any examples "of economically justifiable processes for *producing* materials in space."

As an outgrowth of the presentations and discussions at the December 1976 symposium of the Committee, the Air Force Office of Scientific Research suggested that a study of the role of small university-based research programs in the overall national materials-sciences research effort might be useful. The Office of Naval Research also expressed interest in such a project, and as a result, a panel was established in September 1977 under the chairmanship of Allan D. Franklin (National Bureau of Standards) to undertake this study. This Panel attempted to ascertain the factors that lead to viable small research programs, specifically those factors that can be influenced by universities and funding organizations to create a more productive atmosphere for small research programs and to determine the types of funding (hierarchy, portfolio, or individual) that would be most helpful in a small research



setting. Because funding modes have a strong impact on research efforts in small programs, it is important to identify those that would be most effective and would permit small research programs to continue their productive role in the national effort in this field. Publication of the Panel's report is expected early in 1979.

In response to a request from the Division of Materials Research of the NSF, the Committee established a panel, chaired by Seymour P. Keller (IBM Corporation) in May 1978 to conduct a six-month study of high-magnetic-field research and facilities. The Panel considered both the science and the technological opportunities these fields offer. The study included also an assessment of facilities and needs for upgrading or for advanced new facilities. The Panel's report includes sections on (a) scientific opportunities, (b) technological opportunities, (c) facilities and users, and (d) magnetic design and materials. Publication of the report is expected by March 1979.

Another new study initiated in summer 1978 deals with national needs in thin-film microstructure science and technology. The study grew out of concern that there was an insufficient level of basic research underlying microstructure fabrication in the United States, especially in academic settings. A Panel chaired by Norman G. Einspruch (University of Miami) held its first meeting in July 1978. Major emphasis in the study will be to identify national needs and opportunities in microstructure science and technology that are especially relevant to the university community. Topics being considered in the study include (a) materials, phenomena, fabrication, and characterization (lithography, materials science and processes, instrumentation, sub-micrometer engineering, problems of theory at small-scale limits); (b) integrated circuit engineering and technology (new chip and circuit design methodologies, fabrication methods and processes, fabrication facilities, new device approaches, new packaging methods, etc.); and (c) organizational and educational considerations. A report is expected by February 1979.

#### Membership

##### *Solid State Sciences Committee*

Dean E. Eastman (Chairman) (1980)  
Thomas J. Watson Research Center  
IBM Corporation  
(Surface science, photoemission)

Robb M. Thomson (Secretary) (1979)  
Center for Materials Science  
National Bureau of Standards

Elias Burstein (1980)  
Department of Physics  
University of Pennsylvania  
(Solid-state physics)

Martin Blume (1981)  
Department of Physics  
Brookhaven National Laboratory  
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Morris Cohen (1981)  
Department of Materials Science  
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Massachusetts Institute of Technology  
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Mildred S. Dresselhaus (1980)  
Center for Materials Science and  
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Massachusetts Institute of Technology

Hugo F. Franzen (1981)  
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Lawrence L. Hench (1980)  
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 University of Florida

Walter Kohn (1980)  
 Department of Physics  
 University of California at San  
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Carolyn M. Preece (1979)  
 Bell Laboratories  
 (Physical metallurgy)

Stuart A. Rice (1980)  
 James Franck Institute  
 University of Chicago  
 (Physical chemistry)

William A. Sibley (1980)  
 Department of Physics  
 Oklahoma State University  
 (Crystal structure)

John Silcox (1981)  
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 (Electron-optical physics)

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 Air Force Office of Scientific Research

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 Office of Technology Assessment

Ted Berlincourt and Edward I.  
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NATIONAL RESEARCH COUNCIL WASHINGTON DC ASSEMBLY OF --ETC F/G 5/1  
ANNUAL REPORT OF THE ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIE--ETC(U)  
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*Ad Hoc Panel on Thin Film Microstructure Science and Technology*

Norman G. Einspruch (Chairman)  
 School of Engineering and Architecture  
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 Cornell University  
 (Solid-state physics)

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 (Low-temperature and semiconductor  
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 Intel Corporation  
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Larry R. Cooper and David Nelson  
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Executive Secretary: Charles K. Reed  
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*Ad Hoc Panel on High Magnetic Field Research and Facilities*

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 Westinghouse Electric Corporation  
 (Superconductivity)

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 Development Center  
 (Magnetism)

Executive Secretary: Charles K. Reed  
 Staff Consultant: Wesley N. Mathews, Jr.

*Ad Hoc Panel on Small University-Based Research Projects in Materials Science*

Alan D. Franklin (Chairman)  
 Physical Property Section  
 National Bureau of Standards  
 (Theoretical and applied solid-  
 state sciences)

W. J. Levedahl  
 David Taylor Naval Research  
 and Development Center

Bruce McCombe  
 Semiconductors Branch  
 Naval Research Laboratory

D. Bruce Montgomery  
 National Magnet Laboratory  
 Massachusetts Institute of Technology  
 (High field magnet design)

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*Liaison*

Elias Burstein and William A. Sibley  
 Solid State Sciences Committee

Howard Etzel  
 National Science Foundation

Alan Rosenstein  
 Air Force Office of Scientific  
 Research

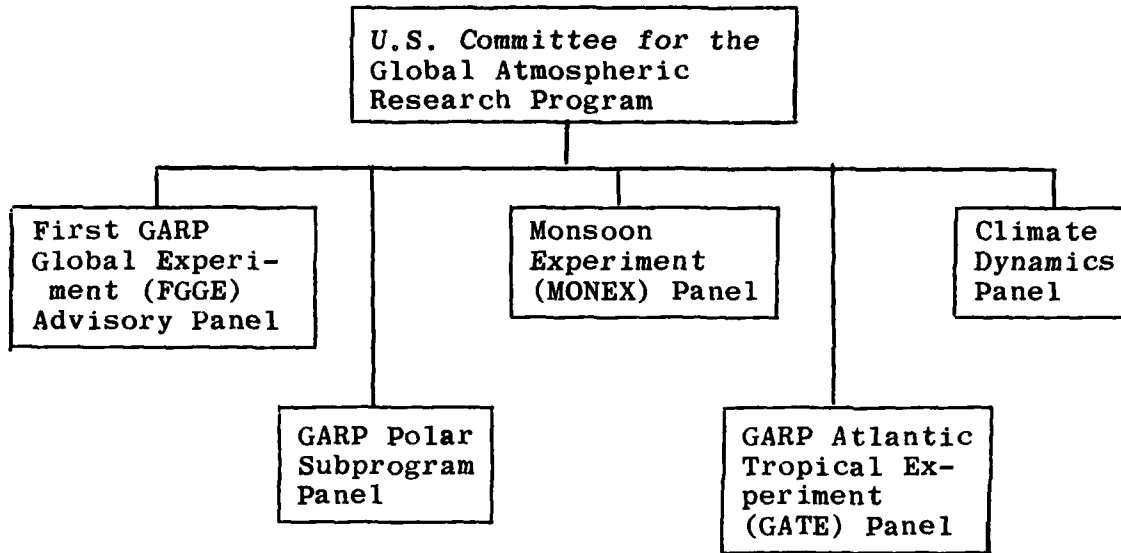
Donald Stevens  
 Department of Energy

David Nelson  
 Office of Naval Research

U.S. COMMITTEE FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM

The Global Atmospheric Research Program (GARP) is an international undertaking organized jointly by the International Council of Scientific Unions (ICSU) and the World Meteorological Organization (WMO). Its objectives are to study the physical processes governing the transient behavior of the atmosphere and the statistical properties of the general circulation. Understanding of the former would lead to improved weather forecasting, perhaps ten days to two weeks in advance, while the latter knowledge would lead to an understanding of climate and perhaps the ability to predict its fluctuations.

U.S. COMMITTEE FOR THE  
GLOBAL ATMOSPHERIC RESEARCH PROGRAM



Established by the NRC in March 1968, the U.S. Committee for GARP is one of several national committees that guide the participation of individual countries in this international undertaking. Specifically, the U.S. Committee develops scientific objectives, specifies observational requirements, serves as a means of communication between the scientific community and the government, reviews and advises on project design and planning, and represents the United States in international scientific planning activities.

During the past year the U.S. Committee has concentrated on two important activities of GARP--the Global Weather Experiment (FGGE, First GARP Global Experiment, now named the Global Weather Experiment) and the National Climate Program. The U.S. Committee has reviewed the overall functions of these activities, while assigning specific details to its panels--the FGGE Advisory Panel and the Climate Dynamics Panel (described below).

In fall 1977, the U.S. Committee took under consideration a serious problem in the Global Weather Experiment brought about by changes in Soviet plans to operate a geostationary satellite over the Indian Ocean. Through extensive correspondence by the Chairman, a triagency arrangement of the U.S. Government was worked out to provide funds to move a third U.S. satellite to the Indian Ocean. This satellite will fill the gap in that area for global coverage and will provide indispensable data for the Monsoon Experiment (MONEX).

The U.S. Committee was local host for the Joint Organizing Study Conference on Climate Models, held at the National Academy of Sciences on April 3-7, 1978. The conference reviewed and intercompared the climate models being used by research workers throughout the world and the climate sensitivity and prediction studies being conducted with these models.

During March 9-17, 1978, the Chairman of the U.S. Committee attended international meetings in Germany and Paris concerned with processing of satellite data for FGGE.

#### First GARP Global Experiment (FGGE) Advisory Panel

The FGGE Advisory Panel was established jointly by the U.S. Committee for GARP and the Ocean Sciences Board in 1974 at the request of the National Aeronautics and Space Administration (NASA). The Panel advises the Committee on U.S. participation in the Global Weather Experiment, which is scheduled to cover a period beginning late in 1978 and extending through 1979. The Panel is concerned with (a) specification of the observational and measurement requirements for FGGE; (b) the adequate technical development, evaluation, and testing of FGGE scientific platforms; (c) the project design, logistical planning, and field work developed by the several federal agencies; and (d) the scientific problems, research planning, and scientific community participation in the experiment.

The Panel has continued to play an active part in the formulation of the U.S. contribution to the FGGE observational program. Under consideration at several meetings was the national and international quality control of satellite temperature data and wind data produced through cloud motions. In response to recommendations of the Panel, the United States will undertake a special research effort to provide better resolution and increased editing of the data. The improved data will be available to computer centers producing analyses for global circulation modeling research.

Now that the observational system for the Global Weather Experiment has essentially been completed, the Panel is concentrating on the research activities that will result from using the global data sets. A document is being developed to outline U.S. participation in the Global Weather Experiment, the observational system, the anticipated data resulting from the operation, and suggested research that could be developed using the global data sets. Publication of this report is expected in the last quarter of 1978.

The Panel Chairman participated in international meetings of the Intergovernmental Panel for FGGE and provided scientific advice concerning the detailed planning for the Global Weather Experiment.

#### Monsoon Experiment (MONEX) Panel

The MONEX Panel was established during 1976 at the request of the National Science Foundation (NSF) to organize U.S. planning and participation in this regional program and to develop a planning document for the use and guidance of the federal program planners. The document, *Plan for U.S. Participation in the Monsoon Experiment (MONEX)*, was published in 1977. The Panel has played a significant role in the formulation of national and international management mechanisms for this experiment. The Panel was represented at the Fourth International MONEX Planning Meeting in Kuala Lumpur, Malaysia, in February 1978, and held several meetings in the United States at which detailed recommendations were made concerning scientific and observational



requirements. Based on the Panel's recommendation, a U.S. MONEX Project Office has been established and close liaison is maintained between the Panel and the Project Office staff.

#### Climate Dynamics Panel

Established by the U.S. Committee for GARP in mid-1975, the Climate Dynamics Panel evolved from the increased worldwide interest in the problems of climate variation. In examining the role of the United States in the GARP Climate Dynamics Subprogram, the Panel developed a document setting forth a scientific strategy for development of a climate research program. This document, *Elements of the Research Strategy for the United States Climate Program*, was published in summer 1978. The report emphasized the need for a better understanding of the annual cycle of climate as a first step in a continuing comprehensive program. Members of the Panel and the parent Committee have been active in other groups concerned with climate, for example, the Climate Research Board recently established in this Assembly and the NASA Climate Scientific Working Group. The staff of the U.S. Committee for GARP attends the Climate Research Board's Coordination Group meetings and the regular meetings of the Board. The Panel plans to respond to requests from the Climate Research Board to evaluate the scientific aspects of the U.S. Climate Program, and the Panel was represented at the Workshop on Assessment of U.S. Climate Program Planning, which was organized by the Climate Research Board and held in July 1978 (see description under Climate Research Board).

#### GARP Polar Subprogram Panel

The GARP Polar Subprogram Panel, a joint effort with the Polar Research Board, was reconstituted in 1977 from the previous Polar Experiment (POLEX) Panel, becoming a smaller standing panel. A major problem--a data gap in the West Antarctic during the Global Weather Experiment--was presented to the U.S. Committee for GARP by the international Joint Organizing Committee of GARP. The Panel and the Polar Research Board reviewed this problem and made recommendations concerning priorities for observational stations. The recommendations were considered carefully by the government, and measures were taken to fill the data gap. The Panel will continue to respond to problems in the polar regions as they arise in the GARP.

#### GARP Atlantic Tropical Experiment (GATE) Panel

Following the conduct in 1974 of the GARP Atlantic Tropical Experiment (GATE), the first major GARP field program, the focus of this Panel's activities shifted to U.S. GATE data management plans and the ensuing research. To stimulate research based on the GATE data sets, the Panel assisted in a major GATE workshop, which took place in summer 1977 at the National Center for Atmospheric Research. A report of the workshop provided a current survey of the research being accomplished using the GATE data. The Panel has been encouraged by the U.S. Committee for GARP to continue to advise the government

as the GATE research proceeds in order to ensure effective management of research funds. The Panel plans to sponsor a seminar in summer 1979 to review the impact of GATE data on large-scale numerical modeling. The results of such a seminar will be especially important to the scientists who plan to perform research using the Global Weather Experiment data sets.

#### Other Activities and Responsibilities of U.S. Committee Staff

The U.S. Committee's Executive Scientist, John S. Perry, returned in January 1978 from nearly two years on seconded duty with the WMO/ICSU Joint Planning Staff for GARP at the WMO Headquarters in Geneva, Switzerland. During that period, Dr. Perry provided staff support for the planning of a number of GARP subprograms, particularly the Global Weather Experiment and the Climate Dynamics Subprogram. At the request of the Director of the GARP Joint Planning Staff, he also provided staff support for the first meeting of the Joint Organizing Committee Working Group on Land Surface Processes, held in Dublin in May 1978. At the request of the National Oceanic and Atmospheric Administration (NOAA) and the Department of State, he served as a member of the U.S. delegation to the seventh session of the WMO Commission on Atmospheric Sciences, which took place in Manila, Philippines, in March 1978.

Dr. Perry has also been appointed Executive Secretary of the Climate Research Board on a part-time basis. In April 1978, in this capacity, he assisted in the Board's International Workshop on Climate Issues at the International Institute for Applied Systems Analysis, Laxenburg, Austria (see description under Climate Research Board). He will continue to support Climate Research Board activities on a part-time basis during 1979 and will contribute as needed to Climate Board-GARP international activities.

Since fall 1977, Thomas H. R. O'Neill performed the functions of Executive Secretary to the U.S. Committee for GARP as a part-time consultant; on October 1, 1978, Mr. O'Neill was appointed to this position.

#### Membership

##### *U.S. Committee for the Global Atmospheric Research Program*

|  |   |
|--|---|
| Verner E. Suomi (Chairman) (1981)  | D. James Baker, Jr. (1980)  |
| Space Science and Engineering Center<br>University of Wisconsin<br>(Meteorological satellites)               | Pacific Marine Environmental<br>Laboratory<br>National Oceanic and Atmospheric<br>Administration<br>(Physical oceanography) |
| Francis P. Bretherton (Vice Chairman)<br>(1980)  | Tiruvalam N. Krishnamurti (1980)  |
| National Center for Atmospheric<br>Research<br>(Geophysical fluid dynamics)                                  | Department of Meteorology<br>Florida State University<br>(Tropical meteorology)   |
| Richard A. Anthes (1981)   | John E. Kutzbach (1981)   |
| Department of Meteorology<br>Pennsylvania State University<br>(Numerical modeling of mesoscale<br>phenomena) | Center for Climatic Research<br>University of Wisconsin<br>(Climate dynamics)   |

Richard S. Lindzen (1981)  
 Division of Engineering and Applied  
 Physics  
 Harvard University  
 (Dynamic meteorology)

Syukuro Manabe (1980)  
 Geophysical Fluid Dynamics  
 Laboratory  
 National Oceanic and Atmospheric  
 Administration  
 (Numerical modeling)

Norman A. Phillips (1980)  
 National Meteorological Center  
 National Oceanic and Atmospheric  
 Administration  
 (Numerical modeling and prediction)

Richard J. Reed (1980)  
 Department of Atmospheric Sciences  
 University of Washington  
 (Stratospheric meteorology)

Peter B. Rhines (1981)  
 Woods Hole Oceanographic Institution  
 (Fluid dynamics)

Executive Scientist: John S. Perry  
 Executive Secretary: Thomas O'Neill

*Climate Dynamics Panel*  
 John E. Kutzbach (Chairman)  
 Center for Climatic Research  
 University of Wisconsin  
 (Climate dynamics)

Allan R. Robinson (Vice Chairman)  
 Division of Engineering and Applied  
 Physics  
 Harvard University  
 (Oceanography, theoretical geo-  
 physical fluid dynamics)

D. James Baker, Jr.  
 Pacific Marine Environmental  
 Laboratory  
 National Oceanic and Atmospheric  
 Administration  
 (Physical oceanography)

John M. Wallace (1981)  
 Department of Atmospheric Sciences  
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 (Tropical atmospheric dynamics)

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 National Science Foundation

Elbert Friday  
 Department of Defense

Douglas H. Sargeant  
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 Administration

Robert A. Schiffer  
 National Aeronautics and Space  
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Jeremiah P. Ostriker  
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William R. Holland  
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National Oceanic and Atmospheric  
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John E. Masterson  
National Center for Atmospheric  
Research

*GARP Atlantic Tropical Experiment (GATE) Panel (All terms end in 1980)*

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University of Washington  
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Stephen K. Cox  
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Colorado State University  
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National Oceanic and Atmospheric  
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(Oceanography)

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Colorado State University  
(Dynamic and tropical meteorology)

*GARP Polar Subprogram Panel* (Joint with Polar Research Board)  
(All terms end in 1980)

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National Oceanic and Atmospheric  
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Department of Environmental Sciences  
University of Virginia  
(Atmospheric convection)

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University of Wisconsin  
(Arctic strata)

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Cold Regions Research and Engineering  
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University of Wisconsin  
(Dynamic meteorology)

## U.S. NATIONAL COMMITTEES

### U.S.A. NATIONAL COMMITTEE FOR CRYSTALLOGRAPHY

The U.S.A. National Committee for Crystallography promotes the advancement of crystallography in the United States and throughout the world and effects U.S. participation in the International Union of Crystallography. It nominates, informs, and instructs U.S. delegates to the triennial congresses of the International Union; assists in the planning, sponsorship, and support of meetings related to crystallography, particularly international meetings held in the United States; and undertakes other activities directed toward the benefit and progress of the discipline.

The Committee generally meets twice annually in conjunction with meetings of the American Crystallographic Association. During the past year it assisted with planning the program of the Congress of the International Union, held in Warsaw in July 1978, nominated candidates for a U.S. delegation to the General Assembly, held simultaneously with the Congress, explored potential sources of travel support for all U.S. delegates, and discussed visa formalities, ways to facilitate and minimize costs of travel, and accommodations for delegates and other U.S. crystallographers participating in the Assembly and Congress in Poland.

The Committee plans to assist with program planning and to provide financial assistance for travel grants to selected participants at an international meeting on Modulated Structures to be held in Hawaii in March 1979, under the auspices of the American Crystallographic Association and in conjunction with its spring meeting.

#### Membership

##### *U.S.A. National Committee for Crystallography*

|  |                                      |
|--|--------------------------------------|
| Melvin H. Mueller (Chairman) (1978)    | Joan R. Clark (1979)                 |
| Materials Science Division             | U.S. Geological Survey               |
| Argonne National Laboratory            | (Crystallography)                    |
| (Chemistry, metallurgy)                |                                      |
|  | Jerome B. Cohen (1980)               |
| Robert F. Bryan (Vice Chairman) (1980) | Department of Materials Science      |
| Chemistry Department                   | and Engineering                      |
| University of Virginia                 | The Technological Institute          |
| (Crystallography)                      | Northwestern University              |
|  | (Materials science, crystallography) |
| Jenny P. Glusker (Secretary-Treasurer) |                                      |
| (1979)                                 | John M. Cowley (1978)                |
| The Institute for Cancer Research      | Department of Physics                |
| (Physical chemistry)                   | Arizona State University             |
|  | (Physics)                            |
| Sidney C. Abrahams (1980)              |                                      |
| Bell Laboratories                      | Quintin C. Johnson (1979)            |
| (Crystallography)                      | Chemistry and Materials Science      |
|  | Department                           |
|  | Lawrence Livermore Laboratory        |
|  | (Physical chemistry)                 |

Jerome Karle (1980)  
 Laboratory for the Structure of  
 Matter  
 U.S. Naval Research Laboratory  
 (Physics)

Richard E. Marsh (1979)  
 A.A. Noyes Laboratory of Chemical  
 Physics  
 California Institute of Technology  
 (Physical chemistry)

Robert E. Newnham (1978)  
 Materials Research Laboratory  
 Pennsylvania State University  
 (Physics)

Michael G. Rossman (1980)  
 Department of Biological Science  
 Purdue University  
 (Crystallography)

Hugo Steinfink (1979)  
 Department of Chemical Engineering  
 University of Texas at Austin  
 (Physical chemistry)

Executive Secretary: William Spindel

R. A. Young (1978)  
 Crystal Physics Branch  
 Georgia Institute of Technology  
 (Physics)

*Ex Officio*  
 Richard B. Bernstein  
 Office of Chemistry and Chemical  
 Technology

Charles N. Caughlan, Philip Coppens,  
 Jenny P. Glusker, Carroll K.  
 Johnson, and Deane K. Smith, Jr.  
 American Crystallographic Association

Jerome Karl  
 International Union of Crystallography

Thomas F. Malone (nonvoting)  
 Foreign Secretary  
 National Academy of Sciences

*Assembly Liaison Representative*  
 Ralph O. Simmons  
 Department of Physics  
 University of Illinois at Urbana

#### U.S. COMMISSION ON MATHEMATICAL INSTRUCTION

The objectives of the U.S. Commission on Mathematical Instruction are to provide liaison between the NAS and the International Commission on Mathematical Instruction, which is a commission of the International Mathematical Union, and to foster U.S. participation in the activities of the International Commission.

Since early in 1977, the primary concern of the U.S. Commission has been the International Congress on Mathematical Education (ICME), which will take place in 1980 in the United States. A committee to recommend possible sites for the Congress reported to the U.S. Commission, and it was decided to accept the invitation of the University of California, Berkeley, to hold the Congress there on August 11-16, 1980.

Requests for support for the planning and operation of the Congress have been sent to various foundations and business firms; in addition, a proposal for such support is being prepared for submission to the National Science Foundation.

## Membership

*U.S. Commission on Mathematical Instruction*

Shirley A. Hill (Chairman) (1979)  
 Department of Mathematics  
 University of Missouri  
 (Mathematics education, development  
 of logical and reasoning abilities)

Henry L. Alder (1981)  
 Department of Mathematics  
 University of California at Davis  
 (Number theory)

John C. Egsgard (1981)  
 Department of Mathematics  
 Twin Lakes Secondary School  
 Orillia, Ontario, Canada  
 (Mathematics education)

Executive Secretary: Jacob K. Goldhaber

*U.S. Program Committee for ICME 1980 (Ad Hoc)*

Shirley A. Hill (Chairman)  
 Department of Mathematics  
 University of Missouri  
 (Mathematics education, development  
 of logical and reasoning abilities)

Donald J. Albers  
 Department of Mathematics  
 Menlo College  
 (Mathematics education)

Henry L. Alder  
 Department of Mathematics  
 University of California at Davis  
 (Number theory)

Emalou Brumfield  
 Shaker Heights High School (Ohio)  
 (Mathematics education)

John C. Egsgard  
 Department of Mathematics  
 Twin Lakes Secondary School  
 Orillia, Ontario, Canada  
 (Mathematics education)

Gail S. Young, Jr. (1979)  
 Department of Mathematics  
 University of Rochester  
 (Mathematics, topology, analysis)

*Assembly Liaison Representative*  
 William Browder  
 Department of Mathematics  
 Princeton University

E. Glenadine Gibb  
 Department of Mathematics  
 University of Texas  
 (Mathematics education)

Henry O. Pollak  
 Mathematics and Statistics Research  
 Center  
 Bell Laboratories  
 (Function theory)

Gwendolyn H. Shufelt  
 Fulton County Board of Education  
 (Georgia)  
 (Mathematics education, secondary  
 curriculum, teacher education)

Gail S. Young, Jr.  
 Department of Mathematics  
 University of Rochester  
 (Mathematics, topology, analysis)



*Site Selection Committee for ICME 1980 (Ad Hoc) (Discharged April 7, 1978)*

James D. Gates (Cochairman)  
Executive Director  
National Council of Teachers of  
Mathematics  
(Mathematics education)

Louis S. Cohen  
Thomas Jefferson Senior High  
School (Minnesota)  
(Mathematics education)

David P. Roselle (Cochairman)  
Department of Mathematics  
Virginia Polytechnic Institute and  
State University  
(Combinatorial analysis, number  
theory)

Roy Dubisch  
Department of Mathematics  
University of Washington, Seattle  
(Mathematics education)

William G. Chinn  
City College of San Francisco  
(Mathematics education)

Jesse A. Rudnick  
Division of Mathematics Education  
Temple University  
(Mathematics education in general  
and for inner city youth)

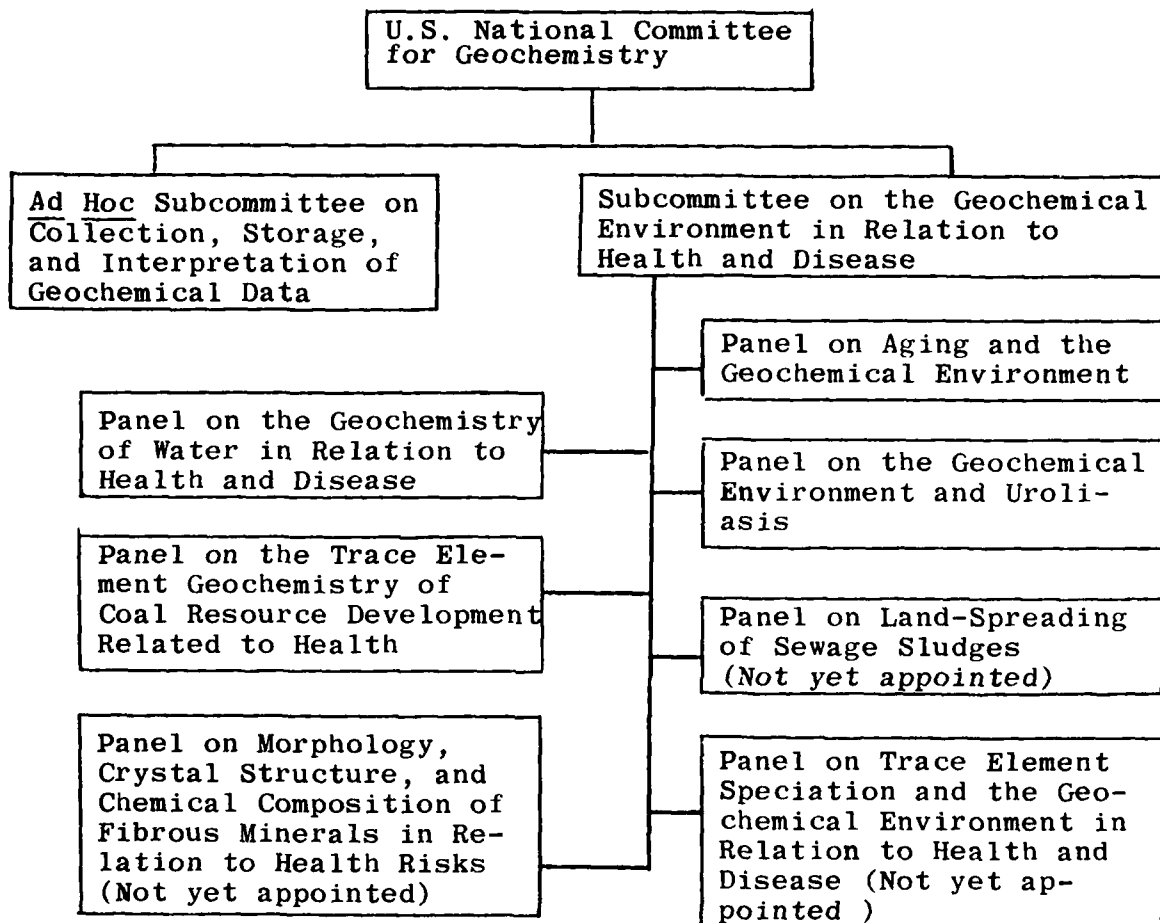
#### U.S. NATIONAL COMMITTEE FOR GEOCHEMISTRY

Since it was organized in 1967, the U.S. National Committee for Geochemistry has fostered geochemistry and represented U.S. geochemists and the National Academy of Sciences in the International Association for Geochemistry and Cosmochemistry (IAGC). The U.S. National Committee has in progress several projects to strengthen geochemistry in the United States. As an outgrowth of a study conducted by its *ad hoc* Panel on Geochemical Concentration of Elements, which was chaired by H. S. Yoder, Jr., the U.S. National Committee is cooperating with the Geophysics Research Board's Geophysics Study Committee on a study of future directions of research on mineral deposits (see description in section on the Geophysics Research Board). Another *ad hoc* subcommittee, chaired by Bruno Giletti, prepared a brief report on "The Contribution by Geochemistry Toward Solving Critical U.S. Problems," which is undergoing review, with the intention of publishing it as a brochure for use by decision makers, scientists, students, and the general public. A third *ad hoc* subcommittee has in progress a study dealing with the collection, storage, and interpretation of geochemical data. Chaired by Earl W. Baker, the group is attempting to develop guidelines and procedures to ensure that the vast amounts of geochemical and related data being collected are adequately analyzed.

The U.S. National Committee provides a forum for and reviews suggestions relating to the geochemistry programs of the Department of Energy, National Science Foundation, and U.S. Geological Survey. Through invited guest experts at its meetings, the Committee maintains a continuing review of the wide variety of problems and opportunities in geochemistry, such as the current concern about the efficacy of radioactive waste disposal procedures and the need for a solution to the problem of safe disposal.

As a result of the Committee's active role in IAGC affairs, several of its nominees were elected to the IAGC Council in May 1977. Currently serving

## U.S. NATIONAL COMMITTEE FOR GEOCHEMISTRY



as President of IAGC is George W. Wetherill of the United States. His efforts to hold regular meetings of the widely dispersed Council are expected to overcome some of the problems of distance and communication that affect most international organizations, to generate greater interest and financial support, and to result in long-term improvements for the IAGC and geochemistry.

To assist attendance of U.S. geochemists at the IAGC General Assembly, scheduled to meet in conjunction with the International Geologic Congress in Paris in July 1980, the U.S. National Committee has established a Travel Grant Program. Some \$20,000 will be sought to ensure the best possible U.S. representation, including top-ranking younger geochemists, who will present papers at the Congress or its related symposia.

The U.S. National Committee oversees the work of one standing subcommittee, on the geochemical environment in relation to health and disease, the activities of which are described in the section that follows.

Subcommittee on the Geochemical Environment  
in Relation to Health and Disease

This Subcommittee was organized in 1969 as a multidisciplinary component of the U.S. National Committee for Geochemistry. Although nonmedical in origin, it was immediately successful in attracting and maintaining the cooperation of biomedical and other specialists in related fields and in achieving a balanced approach to the problem of improving the understanding of health effects related to the distribution of geochemical (naturally occurring, as opposed to man-made) elements. The Subcommittee operates under the leadership of two cochairmen, one a geochemical environmentalist, the other a biomedical specialist.

The Subcommittee sponsored a series of three large workshops, the results of which have been published in the three-volume report *Geochemistry and the Environment*. Publication of the third volume, which deals with the distribution of trace elements in relation to cancer, cardiovascular disease, and urolithiasis, occurred in CY 1978. This collection of papers deals with the means by which geochemical elements are transferred through the food chain from rocks, soil, water, plants, and animals to man, as well as the relationship of geochemical elements in the environment to the incidence of certain diseases: cancers of the alimentary canal, hypertension and stroke, and formation of kidney stones. The study also reports on a variety of innovative techniques for gathering, storing, retrieving, manipulating, and presenting biomedical and environmental data to aid such interdisciplinary studies.

To reduce the time of preparation and thus improve the timeliness of its reports, the Subcommittee changed from the workshop mode of operation to that of small *ad hoc* panel studies on specific topics. Beginning in spring 1976, four panels were established.

The *Panel on the Geochemical Environment and Urolithiasis* is concerned with isolating the factors and understanding the mechanisms related to the incidence of kidney stones in the so-called "stone belt" of the southeastern United States compared with occurrences in other areas. Completion of the study has been delayed by difficulties in obtaining a needed set of comparative data. The Panel is considering issuing an interim report, with completion of the study and the final report to follow when the needed data become available.

The *Panel on Aging and the Geochemical Environment* is concerned with identification and evaluation of geochemical factors in the environment that could be related to the significant differences in human longevity between the high plains of the Upper Midwest section of the United States, where people tend to live longer, and the Atlantic Coastal Plain. A first draft of the panel's report is nearing completion.

The *Panel on the Geochemistry of Water in Relation to Cardiovascular Disease* has investigated and evaluated the geochemical factors, and contradictory epidemiological evidence, related to the protective effects of hard water and the occurrence of cardiovascular disease. The Panel has tentatively concluded that the so-called protective effects of hard water have been overstated. Completion of the report is expected by the end of CY 1978, with publication following early in 1979.

The *Panel on Trace Element Geochemistry of Coal Resource Development Related to Health* is concerned with the potential health effects that could

result from a greatly increased use of coal. Many trace elements occur in varying amounts in the coal from different regions of the United States. Some of these trace elements are beneficial, but others are hazardous to health. Some coal-use processes, such as those involved in the production of synthetic fuels from coal, appear to reduce or at least to localize detrimental health effects. This report was undergoing review during CY 1978, with publication anticipated by early 1979.

With these four panel studies nearing completion, the Subcommittee plans to establish three new panels, which should begin their work early in 1979. The Panel on Land Spreading of Sewage Sludges and the Geochemical Environment in Relation to Health and Disease will study the uptake of cadmium in sewage sludge by plants and develop recommendations for research to achieve optimum use of sewage sludge as a valuable soil amendment rather than a troublesome waste product. The Panel on Trace Element Speciation and the Geochemical Environment in Relation to Health and Disease will be concerned with the characteristics of various chemical forms. Many elements occur in more than one chemical form, for example, nitrogen, nitrate, and nitrite. Some forms are more beneficial or toxic than others, because of the biochemical ability of plants and animals to absorb one form more readily than another. The study of the characteristics of these chemical forms is called speciation. E. A. Jenne, who will chair this panel study, recently organized a symposium on "Chemical Modeling--Speciation, Sorption, Solubility, and Kinetics in Aqueous Systems," which was sponsored by the Society for Environmental Geochemistry and Health and the American Chemical Society. The third proposed panel study will deal with morphology, crystal structure, and chemical composition of fibrous minerals in relation to health risks. Worldwide concern about the health hazards posed by certain types of fibrous minerals, including asbestos, attapulgite, wallastonite, and erionite, is growing. The definition of asbestos currently includes minerals occurring in a wide variety of rocks mined for many different purposes, for example, vermiculite, talc, talc-amphibole schists quarried for use in ceramics, and serpentinites quarried for construction stone. Regulations based on this definition that are in effect or pending could seriously affect mining, construction, and other related activities. Believing that the morphology, chemical content, and crystal structure have not been adequately considered in establishing cause and effect relationships to diseases associated with fibrous minerals, the Subcommittee plans to establish a panel to evaluate the data relating exposure to mineral particles with diseases commonly experienced by asbestos workers and to develop recommendations to strengthen the data base for decision making and the evolution of useful, meaningful regulations. A panel composed of representatives of both medical and geoscience specialties would conduct a two-year study and produce a report. In the planning and subsequent review of this study, the Subcommittee would maintain close liaison with the Board on Toxicology and Environmental Health Hazards of the Assembly of Life Sciences and the National Materials Advisory Board of the Commission on Sociotechnical Systems.

## Membership

*U.S. National Committee for Geochemistry*

Rosemary J. Vidale (Chairman) (1981)  
Nuclear Chemistry Group  
Los Alamos Scientific Laboratory  
(Experimental petrology)

Bruno J. Gilletti (Vice Chairman) (1979)  
Department of Geology  
Brown University  
(Isotope geochemistry)

Earl W. Baker (1979)  
College of Science  
Florida Atlantic University  
(Organic geochemistry)

Robert A. Berner (1981)  
Department of Geology and Geophysics  
Yale University  
(Marine geochemistry)

John R. Castaño (1980)  
Geochemical Service  
Shell Development Company  
(Sedimentary petrology)

Lawrence M. Cathles III (1979)  
Department of Geosciences  
Pennsylvania State University  
(Geophysics and geochemistry)

Harold J. Gluskoter (1980)  
Coal Section  
Exxon Production Research Company  
(Coal geochemistry)

James J. Papike (1981)  
Department of Earth and Space Sciences  
State University of New York at Stony  
Brook  
(Crystallography and mineralogy)

Arthur W. Rose (1981)  
Department of Geosciences  
Pennsylvania State University  
(Exploration geochemistry)

E-an Zen (1980)  
Geologic Division  
U.S. Geological Survey  
(Phase equilibrium petrology)  
*Liaison*

Robert I. Tilling  
U.S. Geological Survey

Clayton R. Nichols  
U.S. Department of Energy

*Assembly Liaison Representatives*  
Jack E. Oliver  
Department of Geological Sciences  
Cornell University

Preston E. Cloud  
U.S. Geological Survey  
Biogeology Clean Laboratory  
University of California at  
Santa Barbara

*Ex Officio*  
Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

Richard B. Bernstein  
Chairman, Office of Chemistry and  
Chemical Technology

Jack E. Oliver  
Chairman, Office of Earth Sciences

George W. Wetherill  
President, International Association  
of Geochemistry and Cosmochemistry

Executive Secretary, committee, subcommittee, and panels: William L. Petrie

*Subcommittee on the Geochemical Environment in Relation to Health and Disease*

Ivan C. Smith (Cochairman) (1979)  
Chemistry Section  
Midwest Research Institute  
(Analytical chemistry)

Lucille S. Hurley (1979)  
Department of Home Economics  
University of California at Davis  
(Research nutritionist)

Leonard T. Kurland (Cochairman) (1980)  
Department of Medical Statistics,  
Epidemiology and Genetics  
Mayo Clinic  
(Epidemiology)

Everett A. Jenne (1981)  
Water Resources Division  
U.S. Geological Survey  
(Soil science and hydrology)

Harold J. Gluskoter (1980)  
Coal Section  
Exxon Production Research Company  
(Coal geochemistry)

Albert L. Page (1981)  
Kearny Foundation of Soil Science  
University of California at Riverside  
(Soil chemistry)

Rolf Hartung (1981)  
Department of Environmental and  
Industrial Health  
University of Michigan  
(Toxicology)

Harold G. Petering (1980)  
Kettering Laboratory  
University of Cincinnati  
(Biochemistry)

Donald J. Horvath (1979)  
Division of Animal and Veterinary  
Sciences  
West Virginia University  
(Animal nutrition and physiology)

George B. Schreiber (1979)  
Planning and Evaluation Directorate  
Canadian Department of National  
Health and Welfare  
(Geoepidemiology)

*Ex Officio*

Rosemary J. Vidale  
Chairman, U.S. National Committee  
for Geochemistry

*Panel on the Geochemistry of Water in Relation to Cardiovascular Disease*

Ernest E. Angino (Chairman)  
Department of Geology  
University of Kansas  
(Geochemistry, oceanography)

Robert G. Corbett  
Department of Geology  
University of Akron  
(Economic geology, geochemistry)

Harold H. Sandstead (Vice Chairman)  
Human Nutrition Laboratory  
U.S. Department of Agriculture  
(Internal medicine, nutrition)

Jack P. Strong  
Department of Pathology  
Louisiana State University  
(Pathology)

George W. Comstock  
Training Center for Public Health  
Research  
Johns Hopkins School of Hygiene  
(Epidemiology)

A. Wouter Voors  
Department of Preventive Medicine  
and Public Health  
Louisiana State University  
(Epidemiology)

*Liaison Representatives*

Gardner C. McMillan  
 Division of Heart and Vascular  
 Disease  
 National Institutes of Health  
 (Pathology)

A. Richey Sharrett  
 Division of Heart and Vascular  
 Disease  
 National Institutes of Health  
 (Epidemiology)

*Panel on the Geochemical Environment and Urolithiasis*

George K. Davis (Chairman)  
 Nutrition Laboratory  
 University of Florida  
 (Biology, animal nutrition)

Sterling R. Olsen  
 Soil, Fertilizer and Management  
 Research  
 U.S. Department of Agriculture,  
 Ft. Collins  
 (Soil science, chemistry)

Everett A. Jenne  
 Water Resources Division  
 U.S. Geological Survey  
 (Soil science, hydrology)

M. J. Vernon Smith  
 Division of Urology  
 Medical College of Virginia  
 (Urology)

Leonard T. Kurland  
 Department of Medical Statistics,  
 Epidemiology and Genetics  
 Mayo Clinic  
 (Epidemiology)

*Liaison Representative*

Nancy B. Cummings  
 National Institute of Arthritis,  
 Metabolism and Digestive Diseases  
 National Institutes of Health

*Panel on Aging and the Geochemical Environment*

Howard C. Hopps (Chairman)  
 Department of Pathology  
 University of Missouri  
 (Geographic pathology)

Walter D. Keller  
 Department of Geology  
 University of Missouri  
 (Geology, sedimentary petrology)

Kenneth C. Beeson  
 Consultant  
 Sun City, Arizona  
 (Plant, soil, nutrition)

Herbert I. Sauer  
 Environmental Health Research Center  
 University of Missouri  
 (Epidemiology)

Gerald L. Feder  
 Water Resources Division  
 U.S. Geological Survey  
 (Hydrology)

*Liaison Representative*  
 Charles H. Barrows, Jr.  
 Gerontology Research Center  
 National Institute of Aging

*Panel on the Trace Element Geochemistry of Coal Resource Development Related to Health*

Bobby G. Wixson (Chairman)  
 Environmental Research Center  
 University of Missouri at Rolla  
 (Trace-metal geochemistry)

Albert L. Page (Vice Chairman)  
 Department of Soil Science and  
 Agricultural Engineering  
 University of California at  
 Riverside  
 (Soil chemistry)

Jack L. Beckner  
Mining Consultant  
Environmental Programs  
(Coal resources evaluation)

James F. Boyer  
Environmental Control Research  
Bituminous Coal Research, Inc.  
(Coal geology)

Leonard D. Hamilton  
Medical Research Center  
Brookhaven National Laboratory  
(Experimental medicine)

Richard C. Neavel  
Synthetic Fuels  
Exxon Research and Engineering Company  
(Coal chemistry and petrography)

Rodney R. Ruch  
Coal Section  
Illinois State Geological Survey  
(Analytical chemistry)

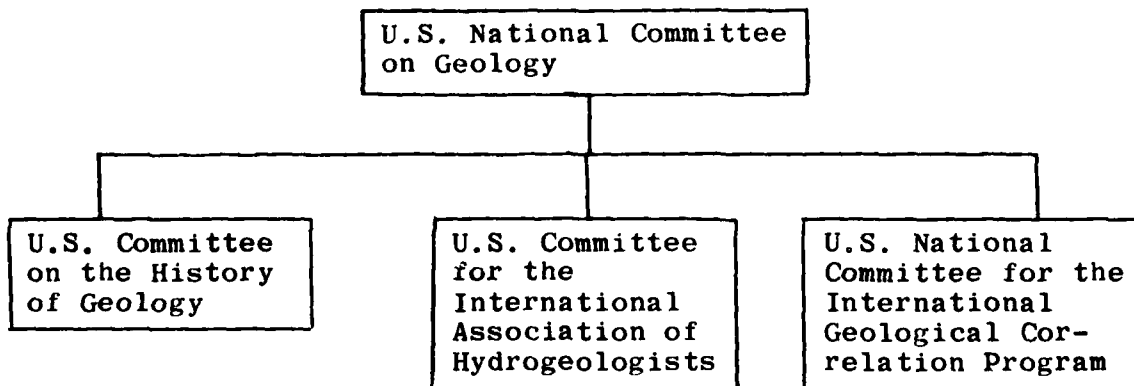
*Liaison Members*  
Pope A. Lawrence  
Office of Federal Activities  
Environmental Protection Agency  
(Industrial hygiene)

Vernon E. Swanson  
Geologic Division  
U.S. Geological Survey  
(Coal stratigraphy)

U.S. NATIONAL COMMITTEE ON GEOLOGY

The U.S. National Committee on Geology was established in 1961 as the U.S. adhering body to the International Union of Geological Sciences (IUGS). The U.S. Committee is sponsored by the National Academy of Sciences and the Department of the Interior. Its members, who serve four-year terms, are appointed jointly by the President of the Academy and the Secretary of the Interior.

U.S. NATIONAL COMMITTEE ON GEOLOGY





The functions of the Committee include providing for appropriate U.S. representation in IUGS and its related organizations, promoting international geological research activities, and informing the U.S. geological community about international geological affairs. The Committee may sponsor or make arrangements for international geological meetings in the United States, and some Committee members usually serve as members of the official U.S. delegation to the quadrennial meetings of the IUGS Council.

The U.S. National Committee met twice during the past year, in Washington, D.C. It received reports from U.S. representatives to the various commissions and associations affiliated with the International Union and reviewed the status of technical cooperation in the geological sciences between the U.S. Government and developing countries. The Committee continues to be concerned about the low level of U.S. influence in international mineral resource affairs and has encouraged the Agency for International Development to provide more assistance to developing countries in energy and mineral resources. There are some indications that, with the incentive of the Administration's nuclear nonproliferation policy, the AID program in this field will be expanded, although probably not to the level that existed a decade ago.

Two international research programs in the geological sciences have been of long-standing interest to the U.S. National Committee. The International Geodynamics Project is a joint undertaking of the IUGS and the International Union of Geodesy and Geophysics. It is scheduled to end in 1979, but preliminary plans already have been made for a follow-on program that would emphasize continental geodynamics. Responsibility for planning the U.S. component of this new program rests with the U.S. Geodynamics Committee of the Geophysics Research Board. The U.S. National Committee on Geology has endorsed in principle the concept of a post-IGP program in crustal dynamics of the continents and has transmitted this endorsement to the President of the IUGS.

The International Geological Correlation Program, sponsored by IUGS and UNESCO, represents an international effort to acquire a better understanding about worldwide geological correlations (in the strict sense) and their application to energy and mineral resource assessments and international environmental problems. U.S. participation in the Program is coordinated by the U.S. National Committee for the International Geological Correlation Program, a subcommittee of the U.S. National Committee on Geology. A concern of both Committees is a proposal to change the organizational structure of the Program, giving UNESCO substantially greater authority than IUGS in appointing the members of the governing board for the Program. This proposal is viewed as likely to lead to a politicization of the Program, with a commensurate decline in its scientific stature. The U.S. National Committee on Geology has recommended to IUGS and UNESCO that no substantive changes be made in the present structure of the Program, especially since it has been reasonably successful to date.

During the past year the U.S. National Committee also considered specific problems related to the free circulation of scientists, cooperation with the People's Republic of China in IUGS and International Geological Correlation Program activities, and plans for the 26th International Geological Congress, which will take place in France in 1980. It reviewed and commented on the UNESCO program in the earth sciences for 1977-1978 and for 1979-1980, and it

invited the Board for the International Geological Correlation Program to meet in the United States in 1979, an invitation that was accepted.

The U.S. National Committee does not usually plan or conduct specific studies, and none is anticipated for CY 1979. However, it might undertake an analysis of future goals for IUGS as an adjunct to a similar study by the IUGS Executive Committee.

#### U.S. Committee on the History of Geology

This Committee was created in 1974 and reorganized in 1977. Its objectives are to promote research on the history of geology in the United States and to serve as the national adhering organization to the International Committee on the History of the Geological Sciences, a constituent body of IUGS.

In 1977, when the History of Geology Division was organized in the Geological Society of America, the Committee's function as the focus for research in the United States on the history of geology became essentially that of the new unit. However, Committee members are active in the affairs of the new Division, and the Committee, as a whole, met with the officers of the Division at the 1977 annual meeting of the Geological Society of America to discuss the status of U.S. research in this field.

The U.S. Committee sent representatives to a meeting of the IUGS Committee on the History of the Geological Sciences, which met in Munster, West Germany, in September 1978. Main task of the meeting was planning of a symposium on the history of geology to be convened in conjunction with the 1980 International Geological Congress.

#### U.S. Committee for the International Association of Hydrogeologists

The principal objective of this Committee, organized in 1974, is the coordination of U.S. participation in the activities of the International Association of Hydrogeologists (IAH). It also promotes international research programs in hydrogeology and informs U.S. hydrogeologists about opportunities for participation in such programs. The Committee operates as a subcommittee of the U.S. National Committee on Geology.

The Committee met in Toronto in conjunction with the 1978 annual meeting of the Geological Society of America. The Hydrogeology Division of the Society works closely with the U.S. Committee, and both are currently concerned with plans for U.S. participation in the 1980 General Assembly of the IAH.

Committee membership will rotate early in CY 1979, and a slate is currently being prepared for submission to the NAS for appointment. As the IAH is an organization with individual members, the nominees for Committee membership will be selected from among those who are affiliated with it.

U.S. National Committee for the  
International Geological Correlation Program

Organized in 1974, the U.S. National Committee for the International Geological Correlation Program has responsibility for developing and coordinating U.S. participation in this international scientific endeavor. The Committee operates as a subcommittee of the U.S. National Committee on Geology.

At meetings during the past year, the Committee reviewed progress reports on U.S. participation in 26 of the 63 projects of the International Geological Correlation Program. In some instances these reports were delivered in person by the chairmen of U.S. working groups for the various projects. The Committee was generally satisfied with the scope and progress of the U.S. component of the Program but noted that several working groups were essentially inactive. The Committee intends to terminate these groups unless they report significant accomplishments for 1978. U.S. working groups were established for two new projects under the Program, and the Committee is making inquiries about possible U.S. interest in three other projects.

During each of the past two years, the National Science Foundation made a grant to the American Geological Institute, based on a proposal developed by the U.S. National Committee, for support of U.S. working groups. These funds are for domestic and foreign travel and expenses of international conferences in the United States. The Committee is concerned that the level of funding is not adequate to meet the essential needs of the working groups, exclusive of research funds; it has attempted, so far unsuccessfully, to obtain additional funds from the NSF or to identify other sources of support. This effort is continuing, particularly as the growing number of U.S. working groups increases the need for greater financial support for the Program.

The Program is sponsored jointly by IUGS and UNESCO, each of which currently has equal responsibility for appointing members of the Board for the Program. Several proposals by member countries, however, would give UNESCO much greater authority for selecting members of this Governing Board and for determining in other ways the future direction of the Program. The U.S. National Committee is opposed to these proposals, believing that they would lead to a de-emphasis on science in the Program. The U.S. National Committee's views have been transmitted directly to the Board and Secretariat and, through the U.S. National Committee on Geology, to IUGS and UNESCO.

During the coming year, the Committee intends to continue its monitoring of U.S. participation in the Program and to represent U.S. interest in it. It will also make the necessary arrangements for the March 1979 meeting in the United States of the Board and Scientific Committee for the International Geological Correlation Program. The meeting will take place at the NAS.

The Committee is planning to prepare for publication a document describing U.S. participation in the Program, and it is also working on the first issue of a newsletter for circulation to all members of U.S. working groups. Printing and distribution will be handled by the U.S. Geological Survey.

## Membership

*U.S. National Committee on Geology*

William A. Oliver, Jr. (Chairman)  
(1979)

U.S. Geological Survey  
(Paleontology)

Linn Hoover (Secretary)  
U.S. Geological Survey  
(Geology)

Doris M. Curtis (1982)  
Shell Development Company  
(Geology)

Charles L. Drake (1981)  
Department of Geology  
Dartmouth College  
(Geophysics)

John F. Havard (1979)  
Kaiser Engineers  
(Mining geology)

Robert L. Heller (1981)  
Department of Geology  
University of Minnesota  
(Stratigraphy, paleontology)

Harold L. James (1981)  
U.S. Geological Survey  
(Geology)

Wann Langston, Jr. (1979)  
Balcones Research Center  
(Vertebrate paleontology)

Charles J. Mankin (1981)  
U.S. Geological Survey  
(Geology)

John D. Moody (1981)  
New York, New York  
(Geological engineering)

Siegfried J. Muessig (1982)  
Getty Oil Development Company  
(Geology)

Otto W. Nuttli (1979)  
Department of Earth and Atmospheric  
Sciences  
St. Louis University  
(Seismology)

J. Daniel Skelton (1982)  
Exxon Company  
(Electrical engineering)

Rosemary J. Vidale (1981)  
Los Alamos Scientific Laboratory  
(Geology)

Peter J. Wyllie (1982)  
Hinds Geophysical Laboratory  
University of Chicago  
(Geology, geochemistry)

*Ex Officio*

Preston Cloud  
Chairman, NAS Section on Geology

Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

Henry W. Menard  
U.S. Geological Survey

Jack E. Oliver  
Chairman, Office of Earth Sciences

*Assembly Liaison Representative*  
Preston Cloud  
U.S. Geological Survey  
Biogeology Clean Laboratory  
University of California at  
Santa Barbara

Executive Secretary: Joseph W. Berg, Jr.

*U.S. Committee for the History of Geology*

- Cecil J. Schneer (Chairman) (1980)  
Department of Geology and Geography  
University of New Hampshire  
(Mineralogy)
- Robert Hazen (Secretary) (1979)  
Geophysical Laboratory  
Carnegie Institution of Washington  
(Mineralogy)
- Claude C. Albritton, Jr. (1981)  
Department of Geological Sciences  
Southern Methodist University  
(Physical geology)
- Harold L. Burstyn (1981)  
U.S. Geological Survey  
(History of science)
- Robert H. Dott, Jr. (1980)  
Department of Geology and Geophysics  
University of Wisconsin  
(Sedimentology)
- June Z. Fullmer (1981)  
Department of History of Science  
Ohio State University  
(Chemistry, history of science)
- Stephen J. Gould (1980)  
Department of Geological Sciences  
Harvard University  
(Invertebrate paleontology)
- John C. Greene (1979)  
Department of History  
University of Connecticut  
(History of science)
- Joseph T. Gregory (1980)  
Department of Paleontology  
University of California at Berkeley  
(Vertebrate paleontology)
- Hollis D. Hedberg (1980)  
Department of Geological and  
Geophysical Sciences  
Princeton University  
(Stratigraphy)
- Aurele La Rocque (1979)  
Department of Geology  
Ohio State University  
(Paleoecology)
- Ursula B. Marvin (1981)  
Smithsonian Astrophysical Ob-  
servatory  
(Planetary geology)
- Rhoda Rappaport (1980)  
Department of History  
Vassar College  
(History of science)
- Hubert C. Skinner (1979)  
Department of Geology  
Tulane University  
(Micropaleontology)
- Paul Tasch (1981)  
Department of Geology  
Wichita State University  
(Paleobiology)
- Kenneth Taylor (1979)  
Department of the History of  
Science  
University of Oklahoma  
(History of science)
- George W. White (1979)  
Department of Geology  
University of Illinois  
(Glacial geology)
- Ellis L. Yochelson (1979)  
U.S. Geological Survey  
(Invertebrate paleontology)
- Ex Officio*  
William A. Oliver, Jr.  
U.S. National Committee on Geology

*U.S. National Committee for the International Geological Correlation Program*

Daniel F. Merriam (Chairman) (1979)  
 Department of Geology  
 Syracuse University  
 (Mathematical geology, stratigraphy)

Linn Hoover (Secretary)  
 U.S. Geological Survey  
 (Geology)

Robert G. Coleman (1979)  
 U.S. Geological Survey  
 (Petrology)

John C. Davis (1979)  
 Kansas State Geological Survey  
 (Mathematical geology)

John W. Harbaugh (1981)  
 Department of Applied Earth Sciences  
 Stanford University  
 (Economic geology)

William W. Hay (1981)  
 Rosenstiel School of Marine Sciences  
 University of Miami  
 (Micropaleontology)

Hollis D. Hedberg (1979)  
 Department of Geological and Geo-  
 physical Sciences  
 Princeton University  
 (Stratigraphy)

Robert B. Neuman (1979)  
 U.S. Geological Survey  
 (Invertebrate paleontology)

Thomas B. Nolan (1980)  
 U.S. Geological Survey  
 (Structural geology)

Laurence L. Sloss (1979)  
 Department of Geological Sciences  
 Northwestern University  
 (Stratigraphy)

J. Lamar Worzel (1980)  
 Marine Science Institute  
 University of Texas at Galveston  
 (Marine geophysics)

*Ex Officio*  
 William A. Oliver, Jr.  
 U.S. National Committee on Geology

U.S. NATIONAL COMMITTEE FOR  
 THE INTERNATIONAL ASTRONOMICAL UNION

The U.S. National Committee for the International Astronomical Union (IAU) is responsible for the general oversight of participation in meetings (general assemblies, symposia, colloquia, and the like) and other IAU activities by U.S. astronomers, including foreign astronomers permanently employed in the United States. It also helps to implement recommendations of the IAU insofar as they affect U.S. astronomy. Further, it responds to requests from the IAU for the U.S. opinion on administrative matters to be acted on at IAU Executive Committee meetings and General Assemblies.

The level of activity of the U.S. National Committee generally follows the three-year cycle of triennial General Assemblies. It begins to rise more than a year before the next Assembly, reaches a peak a few months before the Assembly, and decreases a few months afterward. This report period includes the inter-Assembly minimum and the beginning of the phase of rising activity that will lead to the 17th General Assembly, scheduled for August 1979 in Montreal.

In anticipation of the 1979 General Assembly, the U.S. National Committee has begun work on the following immediate tasks:

1. The dissemination of information on qualifications for nomination to IAU membership in 1979, the solicitation of applications from prospective candidates, the screening of the applications, and the nomination of successful applicants. It will be recalled that the IAU is unique among the international scientific unions in having individual membership, as well as the usual national membership of participating academies. This is almost unanimously regarded as the IAU's greatest strength. Although it has created some problems for the IAU, these have been almost totally resolved in recent years. The *ad hoc* six-person subcommittee on membership of the IAU Executive Committee, on which the U.S. National Committee was represented, submitted a thorough analysis, with proposals or suggestions for further minor reforms. The general tenor of these is to ensure that the IAU is an association not only of all practicing astronomers (and scientists in related fields with strong ties to astronomy), but also an association of *active* members of the IAU. Only one reform has been officially adopted, namely, a simplification of the documentation needed for nomination. A subcommittee of the U.S. National Committee will be responsible for handling nominations for U.S. citizens and residents, subject to the approval of the whole Committee.

2. The setting up of procedures for issuing invitations to nonmembers. This will be more difficult than in the past because the IAU wishes to enforce a rule (previously generally ignored or overlooked) that the IAU be given the names of proposed invitees five months before the General Assembly. Invitees are of two main classes: nominees for membership (mostly young astronomers only several years past their doctorates) and those invited to give special reviews or lectures (often nonastronomers). The first class presents no difficulty; but invited speakers often do not receive or accept their invitations so far in advance. The U.S. Subcommittee on Membership also has responsibility for invitations.

3. The negotiation of a block travel grant to assist participation in the 1979 Assembly and associated symposia by persons selected by the U.S. National Committee, with priority given to (a) those whose presence is important for administrative reasons (official U.S. delegates, officers of commissions, authors of commissioned reports, etc.), (b) authors of invited reviews or papers on major new developments, and (c) young or retired persons. Procedures for handling the administration of the grant (i.e., announcing availability of grants, screening applications, etc.) are being established, contingent on the receipt of funds for this purpose. In making grants, members and invited participants receive equal consideration.

In November 1977, at the invitation of the IAU, seconded by the U.S. National Committee for the IAU, the NAS was the host to an important international IAU-sponsored symposium on the Hertzsprung-Russell (temperature-luminosity) diagram, a fundamental tool for the study of stellar constitution and evolution. The symposium, No. 80 in the IAU series, celebrated the centenary of the birth of Henry Norris Russell, prominent member of the Academy from his election in 1918 until his death, the founder of many branches of contemporary astrophysics, and widely regarded as the foremost U.S. astronomer of his time. The symposium was attended by more than 200 astronomers

from 19 countries and by Russell's descendants and relatives. The proceedings, which comprise more than 80 invited and contributed papers, were published by D. Reidel, the IAU's official press, and appeared during summer 1978. The symposium received financial support from the National Science Foundation, the Dudley Observatory (the home institution of the Chairman of the Scientific Organizing Committee), and the Astronomical Society of New York. The Staff Officer for IAU served as Chairman of the Local Organizing Committee, which was made up of astronomers from institutions in the Washington area.

#### Subcommittee on Inter-American Astronomy

The Subcommittee on Inter-American Astronomy was established in 1960 in response to a recommendation by the IAU to extend to fainter stars in the southern celestial hemisphere a fundamental system of coordinates already existing for the northern hemisphere. The purpose of the recommendation was not only to establish fundamental coordinates for fainter stars (which would be useful) but also to improve the existing coordinate system and its by-products (precession, galactic rotation from proper motions, etc.) by eliminating certain systematic errors that had arisen from the highly asymmetrical distribution of the stars on which it was based. All countries that could help were asked to do so. The Subcommittee was instrumental in establishing and later supervising the 15-year Southern Hemisphere Astrometrics Program, funded by the National Aeronautics and Space Administration and the National Science Foundation, which supported in part a southern field station of the U.S. Naval Observatory and also observational programs in Australia, Ecuador, and Argentina. The U.S. Naval Observatory is responsible for the computerized reduction of its own transit-circle observations and those of the Felix Aguilar Observatory (San Juan, Argentina) and for producing a master catalog of fundamental positions based on a weighted compilation of observations made by all participating countries (including the Federal Republic of Germany, France, and the Soviet Union in addition to those already mentioned).

The observational phase of the Southern Hemisphere Astrometrics Program formally ended in 1975, although it is being continued by some participants; the completion of all loose ends still awaits the receipt of information on some parts of the program. After the Subcommittee reviews and approves a final report, it will be discharged.

#### Membership

*U.S. National Committee for the International Astronomical Union*

Elske v. P. Smith (Chairman) (1980)  
Astronomy Program  
University of Maryland

John E. Gaustad (Vice Chairman)  
(1980)  
Astronomy Department  
University of California at  
Berkeley



Laurence W. Fredrick (Secretary) (1980)  
Leander McCormick Observatory  
University of Virginia

*Category I*

Halton C. Arp (1980)  
Arthur A. Hoag (1981)  
Kenneth I. Kellermann (1979)  
American Astronomical Society

*Category II*

Jeremiah P. Ostriker (1980)  
Elske v. P. Smith (1979)  
Council representatives to Assembly  
from American Astronomical Society

*Category III*

George W. Clark (1979)  
John E. Gaustad (1980)  
NAS Astronomy Section

*Category IV*

Anne P. Cowley (1979)  
Co-opted member, U.S. National  
Committee for the International  
Astronomical Union

*Category V (ex officio, voting)*

Bernard F. Burke (1979)  
Past Chairman, U.S. National  
Committee for the International  
Astronomical Union

Laurence W. Fredrick (1980)  
Secretary, American Astronomical  
Society

Staff Officer: Edward R. Dyer, Jr.

*Subcommittee on Inter-American Astronomy\**

(To be discharged when review of report on program is completed)

Horace W. Babcock  
Hale Observatories  
(Astronomy)

Frank K. Edmondson  
Goethe Link Observatory  
(Astronomy)

Leo Goldberg (1980)  
Chairman, NAS Astronomy Section  
Immediate Past President, Inter-  
national Astronomical Union

David S. Heeschen (1982)  
Vice President, International  
Astronomical Union

Ivan King (1980)  
President, American Astronomical  
Society

*Category VI (ex officio, nonvoting)*

Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

Ralph O. Simmons  
Chairman, Office of Physical  
Sciences

Edward R. Dyer, Jr.  
Staff Officer for IAU Affairs

*Assembly Liaison Representative*  
Jeremiah P. Ostriker  
Princeton University Observatory

Nicholas U. Mayall  
Tucson, Arizona  
(Astronomy)

Allan R. Sandage  
Hale Observatories  
(Astronomy)

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\* Gerald M. Clemence served as chairman until his death in 1974. As the Subcommittee's work was completed except for review of the reports of the calculations being prepared by the participating observatories, a new chairman was not appointed.

Jan Schilt  
 Leonia, New Jersey  
 (Astronomy)

Charles D. Shane  
 Lick Observatory  
 (Astronomy)

U.S. NATIONAL COMMITTEE OF THE  
 INTERNATIONAL COMMISSION FOR OPTICS

The International Commission for Optics is an affiliate of the International Union of Pure and Applied Physics. The U.S. National Committee was organized in 1946 to (a) promote the advancement of optics in its various phases and the dissemination of the results of research in optics, (b) ensure appropriate U.S. participation in the International Commission for Optics, and (c) carry out the duties required of a national committee under the statutes of the International Commission and the parent International Union of Pure and Applied Physics.

At the U.S. National Committee meeting in Toronto in October 1977, a delegation of three, plus alternates, was chosen to represent the United States at the 11th Congress of the International Commission for Optics in Madrid, Spain, in September 1978. The theme of the Congress was "Optics Today and Tomorrow," and the subjects covered included vision, image formation and processing, and optical physics.

The level of activity of this Committee is not expected to change significantly in CY 1979 from that established over previous years.

Membership

Douglas C. Sinclair (Chairman) (1978)  
 Institute of Optics  
 University of Rochester  
 (Optics)

J. Warren Blaker (1980)  
 New York, New York 10028  
 (Optics)

William B. Bridges (1979)  
 Department of Electrical Engineering  
 and Applied Physics  
 California Institute of Technology  
 (Electrical engineering)

John Lott Brown (1979)  
 Center for Visual Science  
 University of Rochester  
 (Psychophysiology, electro-  
 physiology of vision)

Jay M. Enoch (1978)  
 Department of Ophthalmology  
 College of Medicine  
 University of Florida  
 (Physiological optics)

Nicholas George (1979)  
 Department of Electrical Engineering  
 California Institute of Technology  
 (Electrical engineering)

Joseph W. Goodman (1978)  
 Department of Electrical Engineering  
 Stanford University  
 (Electrical engineering)

Lewis Larmore (1978)  
 Office of Naval Research  
 (Physics)

Emmett N. Leith (1980)  
 Department of Electrical and  
 Computer Engineering  
 University of Michigan  
 (Optics)

William C. Martin (1978)  
 Physics  
 National Bureau of Standards  
 (Spectroscopy)

James C. Wyant (1980)  
 Optical Sciences Center  
 University of Arizona  
 (Optics)

Frits Zernike (1980)  
 Philips Laboratories  
 (Physics)

Staff Officer: George W. Wood

*Ex Officio*

James G. Baker, Stanley S. Ballard,  
 Bruce H. Billings, W. Lewis Hyde,  
 Roderic M. Scott, and F. Dow  
 Smith

International Commission for Optics

Thomas F. Malone  
 Foreign Secretary  
 National Academy of Sciences

Ralph O. Simmons  
 Chairman, Office of Physical Sciences

*Assembly Liaison Representative*

Ralph O. Simmons  
 Department of Physics  
 University of Illinois

U.S. NATIONAL COMMITTEE FOR THE  
 INTERNATIONAL GEOGRAPHICAL UNION

Since its organization in 1928, the U.S. National Committee for the International Geographical Union has planned and arranged for appropriate U.S. participation in congresses, regional conferences, commissions, and other activities of the International Geographical Union (IGU) that foster the exchange of ideas and discussion among geographic scholars from nearly every country. As the official representative of U.S. Geographers to the IGU, the major efforts of the U.S. National Committee have been to support and make recommendations to strengthen the operation of the IGU and its Executive Committee. For example, the Committee has recommended to the IGU Executive Committee the creation of a Program Committee to help national committees with the planning of IGU congresses and regional conferences. It has also recommended the appointment of a standing Finance Committee to improve the financial stability of this underfunded major Union. With an improved financial base, the IGU could better support and foster the progress of geography.

The Committee participates in program planning by suggesting topics for symposia at IGU congresses and conferences, IGU commissions and working groups, and international exchanges of geographers. It also conducts travel grant programs to ensure adequate U.S. representation at the quadrennial IGU Congresses and the regional conferences that occur in intervening years. The Committee is also concerned with the nomination of U.S. geographers to IGU commissions and working groups, with arranging for appropriate U.S. exhibits at international meetings, and with encouraging broader U.S. participation

in IGU activities through such programs as information sessions about upcoming congresses and conferences during the annual meetings of the Association of American Geographers.

The most recent IGU Congress took place in Moscow in 1976 and was attended by some 3200 geographers, of whom 200 were from the United States. Through the Committee's Travel Grant Program, with funds provided by the National Science Foundation and National Geographic Society, 33 U.S. participants received travel assistance.

Eleven U.S. geographers received travel grants under a program sponsored by the U.S. National Committee to assist participation in the IGU Regional Conference in Nigeria in July and August 1978. Support for this purpose was provided by the Department of State.

The XXIV IGU Congress will be held in Tokyo in 1980, and the Committee plans to organize a Travel Grant Program for it.

The U.S. National Committee has considered the possibility of a U.S. invitation to hold either the 1988, 1992, or 1996 IGU Congress in the United States. This undertaking would require substantial work and support but would stimulate interest and progress in this field in the United States.

#### Membership

(Terms expire December 31, 1980)

Ronald J. Fuchs (Chairman)  
Department of Geography  
University of Hawaii

James R. Anderson (Vice-Chairman)  
Land Information and Analysis Office  
U.S. Geological Survey

George J. Demko (Secretary)  
Department of Geography  
Ohio State University

Barry C. Bishop  
Committee for Research and  
Exploration  
National Geographic Society

Harm J. de Blij  
Department of Geography  
University of Miami

Alvin A. Munn  
Defense Intelligence Agency  
Department of Defense

Sarah K. Myers  
American Geographical Society

Barbara B. Petchenik  
Cartographic Services  
R. R. Donnelley and Sons Company

Joseph P. Stoltman  
Department of Geography  
Western Michigan University

H. Jesse Walker  
Department of Geography and  
Anthropology  
Louisiana State University

John A. Wolter  
Geography and Map Division  
Library of Congress

*Liaison Member*

J. Warren Nystrom  
Executive Director  
Association of American Geographers

*Assembly Liaison Representative*  
 Jack E. Oliver  
 Department of Geological Sciences  
 Cornell University

*Ex Officio*  
 Thomas F. Malone  
 Foreign Secretary  
 National Academy of Sciences

Jack E. Oliver  
 Chairman, Office of Earth  
 Sciences

Executive Secretary: William L. Petrie

#### U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF BIOCHEMISTRY

The U.S. National Committee provides for U.S. participation in the International Union of Biochemistry (IUB). It reports annually, in writing, to the Council of the American Society of Biological Chemists and to the Executive Committee of the Division of Biological Chemistry of the American Chemical Society on the activities of the IUB and on developments of international significance in biochemistry. It maintains liaison with corresponding national committees of the IUB in other countries, especially in the planning of meetings and related activities, and with other U.S. national committees in related disciplines. The U.S. National Committee met in April 1978 to plan for the Tenth General Assembly of the IUB, which will take place in Toronto, Canada, in July 1979. The Committee recommended a U.S. delegation to consist of Bert L. Vallee (Chairman), Alton Meister, Frank W. Putnam (alternate), and Earl Stadtman.

#### Membership

Bert L. Vallee (Chairman) (1980)  
 Biophysics Research Laboratory  
 Harvard Medical School  
 (Biochemistry, biophysics)

Alton Meister (Vice Chairman) (1983)  
 Department of Biochemistry  
 Cornell University Medical School  
 (Biochemistry)

C. P. Lee (1984)  
 Department of Biochemistry  
 Wayne State University  
 School of Medicine  
 (Biochemistry, physical chemistry)

Frank W. Putnam (1979)  
 Department of Zoology  
 Indiana University  
 (Biochemistry)

Lester J. Reed (1980)  
Clayton Foundation Biochemical  
Institute  
University of Texas at Austin  
(Biochemistry)

Earl R. Stadtman (1981)  
Laboratory of Biochemistry  
National Heart, Lung, and Blood  
Institute  
(Biochemistry)

Thressa C. Stadtman (1982)  
National Heart, Lung, and Blood  
Institute  
(Biochemistry)

Herbert Tabor (1982)  
Laboratory of Biochemical  
Pharmacology  
National Institute of Arthritis,  
Metabolism, and Digestive Diseases  
(Biochemistry, pharmacology)

*Ex Officio*

Daniel E. Atkinson  
Division of Biological Chemistry  
American Chemical Society

Executive Secretary: William Spindel

Alexander G. Bearn  
Division of Medical Sciences  
Assembly of Life Sciences

Richard B. Bernstein  
Office of Chemistry and Chemical  
Technology

Robert H. Burris  
Division of Biological Sciences  
Assembly of Life Sciences

Mildred Cohn  
American Society of Biological  
Chemists

Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

William J. Whelan  
International Union of Biochemistry

*Assembly Liaison Representative*  
William G. Dauben  
Department of Chemistry  
University of California, Berkeley

U.S. NATIONAL COMMITTEE FOR THE  
INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

This U.S. National Committee works to advance the development of geodesy and geophysics and to effect U.S. participation in activities of the International Union of Geodesy and Geophysics (IUGG).

Currently the U.S. National Committee is engaged in preparations for the XVII General Assembly, which will take place in Canberra, Australia, in December 1979. The American Geophysical Union is seeking a block grant from the National Science Foundation through which it hopes to make available travel grants to assist participation in this meeting.

In preparation for the General Assembly, the U.S. National Committee is developing proposals aimed at re-establishing IUGG's adherence to the principle of universality of science (i.e., "the right of scientists of any country or territory to adhere to or to associate with international activity without regard to race, religion or political philosophy ... [or]

recognition of the government of the country or territory concerned.") It is hoped that the Taiwanese scientists will attend this 1979 meeting, even though they must sign a waiver in accordance with special guidelines.

A U.S. National Report for the period 1975-1979 is in progress, with E. A. Flinn serving as editor. The American Geophysical Union will publish this report.

The U.S. National Committee meets twice annually in conjunction with meetings of the American Geophysical Union.

### Membership

- |  |  |
|--|--|
| Arthur E. Maxwell (Chairman) (1980)<br>Woods Hole Oceanographic Institution<br>(Oceanography)  | James W. Head III (1982)<br>Department of Geological Sciences<br>Brown University<br>(Stratigraphy, planetary geology)   |
| A. Ivan Johnson (Vice Chairman) (1980)<br>U.S. Geological Survey<br>(Hydrology)  | James King (1980)<br>Jet Propulsion Laboratory<br>(Meteorology)  |
| A. Frederick Spilhaus, Jr. (Secretary)<br>(1980)<br>American Geophysical Union<br>(Oceanography)   | Carl Kisslinger (1980)<br>Cooperative Institute for Research<br>in Environmental Sciences<br>University of Colorado<br>(Seismology)                                      |
| Louis J. Battan (1982)<br>Institute of Atmospheric Physics<br>University of Arizona<br>(Meteorology)                                     | J. Virginia Lincoln (1982)<br>World Data Center A for Solar-<br>Terrestrial Physics<br>National Oceanic and Atmospheric<br>Administration<br>(Geophysics, solar physics) |
| A. Alvin Bishop (1980)<br>Department of Agricultural and<br>Irrigation Engineering<br>Utah State University<br>(Hydrology)               | Alexander R. McBirney (1980)<br>Center for Volcanology<br>University of Oregon<br>(Volcanology)  |
| John D. Bossler (1982)<br>National Geodetic Survey<br>National Oceanic and Atmospheric<br>Administration<br>(Geodesy, photogrammetry)    | Ivan I. Mueller (1980)<br>Department of Geodetic Science<br>Ohio State University<br>(Geodesy)   |
| Joseph C. Cain (1980)<br>U.S. Geological Survey<br>(Geomagnetism)  | Jack E. Oliver (1980)<br>Department of Geological Sciences<br>Cornell University<br>(Seismology)   |
| William J. Campbell (1982)<br>Ice Dynamics Project<br>U.S. Geological Survey<br>University of Puget Sound<br>(Meteorology, oceanography) |  |

Dallas L. Peck (1980)  
U.S. Geological Survey  
(Geology)

Brian A. Tinsley (1982)  
Department of Physics  
University of Texas at Richardson  
(Space physics)

Warren M. Washington (1982)  
National Center for Atmospheric  
Research  
(Meteorology)

Owen W. Williams (1982)  
Defense Mapping Agency  
(Geodesy, geophysics)

Warren S. Wooster (1980)  
Institute for Marine Studies  
University of Washington  
(Oceanography)

*Ex Officio*  
Bernard Chovitz  
National Oceanic and Atmospheric  
Administration

Jean-Claude De Bremaecker  
Department of Geology  
Rice University

Robert W. Decker  
Department of Earth Sciences  
Dartmouth College

Executive Secretary: Joseph W. Berg, Jr.

Herbert Friedman  
Chairman, Geophysics Research  
Board

Warren W. Hastings  
Arlington, Virginia

Eugene C. LaFond  
Naval Undersea Center at San Diego

Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

Juan G. Roederer  
Department of Physics  
University of Denver

Stanley Ruttenberg  
National Center for Atmospheric  
Research

Ralph O. Simmons  
Chairman, Office of Physical  
Sciences

Charles A. Whitten  
Silver Spring, Maryland

*Assembly Liaison Representative*  
Richard S. Lindzen  
Division of Engineering and Applied  
Physics  
Harvard University

U.S. NATIONAL COMMITTEE FOR THE  
INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

This Committee effects U.S. participation in the International Union of Pure and Applied Chemistry (IUPAC) and encourages cooperative international studies and activities to promote the advancement of chemistry and chemical technology. It maintains liaison with other national committees in the United States and abroad in planning meetings, symposia, and cooperative research programs and keeps U.S. delegates, representatives, and the chemical community informed



about matters that come before IUPAC and about IUPAC recommendations on nomenclature, terminology, standardization, calibration, atomic weights, and the like. It generally meets twice each year, in October and February.

The U.S. National Committee continues to solicit the aid of U.S. chemical corporations for the work of the International Union as Company Associates of IUPAC. Sixty-four U.S. corporations subscribed to this program in 1978.

The Committee sent a U.S. Delegation to the XXIX General Assembly of IUPAC in Poland in August 1977 and prepared a 60-page report (*XXIX General Assembly of the International Union of Pure and Applied Chemistry: Report of the Delegation from the NAS-NRC*, issued in May 1978) for the chemical community on that Assembly, as well as on the XXVI IUPAC Congress held in Tokyo in September 1977.

In cooperation with the American Chemical Society, the U.S. National Committee coordinated U.S. participation in the planning, publicity, and financial support of the first CHEMRAWN (Chemical Research Applied to World Needs) Conference on "Future Sources of Organic Raw Materials" in Toronto, in July 1978, and fostered U.S. efforts to provide assistance to selected participants from developing countries.

The Committee has followed with interest, and made a number of constructive suggestions for, new initiatives under the CHEMRAWN theme. A second CHEMRAWN Conference on "Chemistry, Agriculture and World Food Supply" is tentatively scheduled for 1980 or 1981. Experience gained from the Toronto Conference will influence plans for this next conference.

Stimulated by a proposal for an international chemical society initiated by Glenn T. Seaborg during his term as President of the American Chemical Society, the U.S. National Committee formed a Subcommittee on International Communication and Interaction. This Subcommittee is charged with developing, on behalf of the U.S. National Committee, a proposal for consideration by IUPAC to accept individual scientists as Divisional members on an experimental basis in those Divisions that agree to the plan. The Committee believes that such a program will stimulate increased involvement of outstanding scientists in important discipline-oriented IUPAC activities.

During the coming year, the Committee plans to organize a travel award program to assist U.S. chemists' participation in the 27th IUPAC Congress in Helsinki, in August 1979, and to recommend delegates for the 30th IUPAC General Assembly in Davos, Switzerland, in September 1979.

#### Membership

Bryant W. Rossiter (Chairman) (1979)  
Chemistry Division  
Eastman Kodak Company  
(Organic chemistry)

Ronald Breslow (1980)  
Department of Chemistry  
Columbia University  
(Organic chemistry)

Bryce Crawford, Jr. (Vice Chairman)  
(1981)  
Molecular Spectroscopy Laboratory  
University of Minnesota  
(Physical chemistry)

Robert J. Fawcett (1980)  
Research and Development  
The B.F. Goodrich Company  
(Organic chemistry)

Henry Freiser (1979)  
 Department of Chemistry  
 University of Arizona  
 (Analytical chemistry)

Anna J. Harrison (1981)  
 Department of Chemistry  
 Mount Holyoke College  
 (Physical chemistry)

William A. Lester, Jr. (1979)  
 National Resource for Computation  
 in Chemistry  
 Lawrence Berkeley Laboratory  
 (Physical chemistry)

George A. Olah (1980)  
 Department of Chemistry  
 University of Southern California  
 (Organic chemistry)

Robert W. Parry (1981)  
 Department of Chemistry  
 University of Utah  
 (Inorganic chemistry)

Harold A. Scheraga (1979)  
 Chemistry Department  
 Cornell University  
 (Physical chemistry)

H. Frederick Wilson (1980)  
 Rohm and Haas Company  
 (Organic chemistry)

Executive Secretary: William Spindel

F. H. Winslow (1981)  
 Polymer Research and Development  
 Bell Laboratories  
 (Physical chemistry)

*Ex Officio*  
 Richard B. Bernstein  
 Office of Chemistry and Chemical  
 Technology

Robert W. Cairns  
 International Union of Pure and  
 Applied Chemistry

Thomas F. Malone  
 Foreign Secretary  
 National Academy of Sciences

Raymond P. Mariella  
 Executive Director  
 American Chemical Society

Charles G. Overberger  
 International Union of Pure and  
 Applied Chemistry

Gardner W. Stacy  
 American Chemical Society

*Assembly Liaison Representative*  
 Richard B. Bernstein  
 Department of Chemistry  
 Columbia University

U.S. NATIONAL COMMITTEE FOR THE  
 INTERNATIONAL UNION OF PURE AND APPLIED PHYSICS

The U.S. National Committee for the International Union of Pure and Applied Physics (IUPAP) was established in 1923 for the purpose of (a) promoting the advancement of physics and the dissemination of physics research, (b) representing the United States in the International Union, and (c) carrying out the duties of a national committee as required under the statutes of the IUPAP.

The April 1978 meeting of the Committee, held in conjunction with the annual meeting of the American Physical Society, was devoted mainly to preparation for the XVI General Assembly of IUPAP in Stockholm, Sweden, in September 1978. Members of the U.S. delegation were selected and U.S. scientists to be nominated for officers or members of IUPAP Commissions and the IUPAP Executive Committee were chosen. The U.S. National Committee also reviewed the agenda for the General Assembly and formulated positions on a number of issues, including amalgamation of certain Commissions, changing the sizes of Commissions, establishing a new Commission on Applied Physics, and the status of plans for and of IUPAP involvement in the 1979 UN Conference on Science and Technology for Development. Several resolutions that might be introduced by the U.S. National Committee were also considered. The Committee next reviewed six proposals for international conferences to be held in the United States in 1979 and selected those that it would recommend to IUPAP for sponsorship.

The level of activity of this Committee is not expected to change significantly from that established over previous years.

#### Membership

D. Allan Bromley (Chairman) (1979)  
Department of Physics  
Yale University  
(Nuclear physics)

Arthur L. Schawlow (Vice Chairman)  
(1979)  
Department of Physics  
Stanford University  
(Optics)

Lewis Slack (Secretary) (1979)  
American Institute of Physics  
(Spectroscopy)

*Society Representatives*  
William F. Brinkman (1980) and  
Mary LaSalle Shoaf (1979)  
American Physical Society

Richard K. Cook (1978)  
Acoustical Society of America

Howard J. Laster (1978)  
American Association of Physics  
Teachers

Lewis Slack (1978)  
American Institute of Physics

#### *Members at Large*

Henry H. Barschall (1979)  
Department of Nuclear Engineering  
University of Wisconsin

Herman Feshbach (1980)  
Department of Physics  
Massachusetts Institute of Technology  
(Theoretical physics)

William W. Havens, Jr. (1978)  
American Physical Society  
(Nuclear physics)

Frederick Seitz (1980)  
New York, New York (Retired)  
(Solid-state physics)

Alexander Zucker (1978)  
Oak Ridge National Laboratory  
(Nuclear physics)

#### *Ex Officio Voting*

Fay Ajzenberg-Selove  
Commission on Nuclear Physics  
Commission on Symbols, Units  
and Nomenclature

Walter Benenson, E. Richard Cohen, and  
Walter H. Johnson, Jr.  
Commission on Atomic Masses and  
Fundamental Constants

Robert T. Beyer  
Commission on Acoustics

D. Allan Bromley  
Vice President, International Union  
of Pure and Applied Physics

Herbert B. Callen  
Commission on Thermodynamics and  
Statistical Mechanics

Marvin L. Cohen  
Commission on Semiconductors

Henry Ehrenreich  
Commission on Solid State Physics

Anthony P. French  
Commission on Physics Education

Edwin L. Goldwasser and  
Francis E. Low  
Commission on Particles and Fields

Melvin B. Gottlieb  
Commission on Plasma Physics

James A. Krumhansl and  
A. W. K. Metzner  
Commission on Publications

Benjamin Lax  
Commission on Quantum Electronics

Staff Officer: George W. Wood

Arthur L. Schawlow  
Commission on Atomic and Molecular  
Physics and Spectroscopy

Ralph O. Simmons  
Chairman, Office of Physical  
Sciences

Mary Beth G. Stearns  
Commission on Magnetism

Michael Tinkham  
Commission on Very Low Temperature  
Physics

Cecil J. Waddington  
Commission on Cosmic Rays

*Affiliated Commission Member*  
Douglas C. Sinclair  
U.S. National Committee for the  
International Commission for  
Optics

*Ex Officio (nonvoting)*  
Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

*Assembly Liaison Representative*  
Ralph O. Simmons  
Department of Physics  
University of Illinois

U.S. NATIONAL COMMITTEE FOR THE  
INTERNATIONAL UNION FOR QUATERNARY RESEARCH

This U.S. National Committee, organized in 1960, plans and arranges for the participation of U.S. Quaternary specialists in the congresses and other programs of the International Union for Quaternary Research (INQUA). Quaternary science encompasses some 18 recognized disciplines (mostly earth sciences)

whose specialists are concerned with a wide variety of research dealing with the environment and conditions of the Quaternary Period--about the last two million years of geologic time, which includes the Pleistocene glaciation and the recent geologic past. A better understanding of this period is particularly important because it offers the best approach to predicting climate and assessing many of our future energy needs.

The U.S. National Committee also officially represents individual U.S. Quaternary scientists, members of the American Quaternary Association, and the NAS in INQUA and its Executive Committee. Delegations from the NAS, headed by the Chairman of the U.S. National Committee, represent the United States at meetings of the International Council of INQUA and the INQUA General Assembly.

The Committee conducts travel grant programs as a part of its effort to ensure that the United States is represented in INQUA activities by delegations of key U.S. Quaternary officials and scientists. It also arranges for timely U.S. exhibits and works with local committees to suggest and help to arrange symposia, field trips, and other elements of programs.

The Xth INQUA Congress took place in Birmingham, England, in August 1977. Some 45 U.S. participants received travel assistance through the Committee's travel grant program. Each was required to submit a trip report on the scientific benefits. These were transmitted to the agencies providing funds (National Oceanic and Atmospheric Administration, National Science Foundation, Department of Energy, and Nebraska Academy of Sciences).

U.S. contributions to the exhibits at the Congress were well received. These exhibits consisted of a series of panels on Landsat Imagery and on the San Francisco Bay Study, which were provided by the U.S. Geological Survey, and a book exhibit of some 23 new titles (published since 1973) by U.S. authors or published in the United States. The volumes on display were donated by publishers and were presented to the University of Birmingham at the close of the Congress.

A highlight of the Congress was the symposium on climate modeling arranged by John Imbrie of the U.S. National Committee in cooperation with several of his colleagues in the United Kingdom. A majority of the papers were by U.S. scientists. This symposium stimulated an unusual amount of discussion and favorable comment.

U.S. participation in INQUA commissions and subcommissions was significant, although all met simultaneously on the first day of the Congress. In general, the quality of papers presented at the Congress was considered higher than at other INQUA congresses in recent years.

Members of the NAS delegation to the Congress prepared informal reports on participation (in addition to the trip reports by travel grant recipients) that were used in developing a Preliminary Report on the Xth INQUA Congress to serve as the basis for brief summary reports in scientific news magazines.

Toward the end of the year following each Congress, the U.S. National Committee elects a new chairman, considers nominees submitted by various societies, and nominates members to reconstitute the Committee. These nominations are then submitted to the President of the NAS. The next INQUA Congress will take place in the Soviet Union in 1982 (a year later than usual, thus the newly appointed U.S. Committee members will serve for terms of five years rather than four). Planning for the Moscow meeting and selection of subcommittees to prepare for U.S. participation have already begun.

## Membership

(Terms expire December 31, 1982)

Robert S. Hoffmann (Chairman)  
Museum of Natural History  
University of Kansas

Estella B. Leopold (Vice Chairman)  
Quaternary Research Center  
University of Washington

Richard G. Klein (Secretary-Treasurer)  
Department of Anthropology  
University of Chicago

Paul A. Colinvaux  
Department of Zoology  
Ohio State University

George H. Denton  
Department of Glacial Geology  
University of Maine

Alan D. Hecht  
Division of Atmospheric Sciences  
National Science Foundation

David M. Hopkins  
Geologic Division  
U.S. Geological Survey

Roger B. Parsons  
Soil Conservation Service  
U.S. Department of Agriculture

William F. Ruddiman  
Department of Paleoclimatology  
Columbia University, Palisades

Stanley A. Schumm  
Department of Earth Resources  
Colorado State University

Minze Stuiver  
Geology and Zoology Department  
University of Washington

S. David Webb  
Department of Paleontology  
University of Florida

*Ex Officio* (voting)  
A. Lincoln Washburn  
Vice President, International Union  
for Quaternary Research

C. Vance Haynes  
President, American Quaternary  
Association

Margaret B. Davis  
President-Elect, American Quaternary  
Association

*Ex Officio* (nonvoting)  
Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

Jack E. Oliver  
Chairman, Office of Earth Sciences

R. Duncan Luce  
Chairman, Assembly of Behavioral  
and Social Sciences

Robert H. Burriss  
Chairman, Division of Biological  
Sciences  
Assembly of Life Sciences

C. O. McCorkle, Jr.  
Chairman, Board on Agriculture and  
Renewable Resources  
Commission on Natural Resources

*Assembly Liaison Representative*  
Preston Cloud  
U.S. Geological Survey  
Biogeology Clean Laboratory  
University of California at Santa  
Barbara

Executive Secretary: William L. Petrie

U.S. NATIONAL COMMITTEE FOR THE  
INTERNATIONAL UNION OF RADIO SCIENCE

The International Union of Radio Science (URSI) was established in 1919 to effect worldwide cooperation in radio research. Its objectives are to promote the systematic study of radio science, to aid and organize radio research on an international scale, to facilitate agreement on common methods of measurement and the standardization of measuring instruments, and to stimulate and coordinate studies of the scientific aspects of telecommunications using guided and unguided electromagnetic waves. The U.S. National Committee for URSI coordinates the activities of U.S. scientists and engineers in support of these objectives and organizes U.S. participation in URSI.

In 1975, the International Union reorganized its activities under nine new commissions: Electromagnetic Metrology, Fields and Waves, Signals and Systems, Physical Electronics and Devices, Electromagnetic Interference Environment, Wave Phenomena in Nonionized Media, Ionospheric Radio and Propagation, Waves in Plasmas, and Radio Astronomy. Subsequently, the U.S. National Committee for URSI reorganized its commission structure to correspond to the international commissions, which are responsible for organizing meetings and fostering international cooperation in their various fields. The U.S. National Committee has also reconstituted its membership, in response to suggestions of the Assembly of Mathematical and Physical Sciences, so that there are now 11 representatives from national societies and other relevant groups, 3 members at large, and the 9 chairmen of the U.S. Commissions serving on it.

At its meeting in Boulder, Colorado, in January 1978, the U.S. National Committee received reports on the activities of its commissions and on the journal *Radio Science*, which it has published. The Committee approved a proposal to relinquish its interest in this undertaking to the American Geophysical Union, effective December 1978.

Plans for U.S. participation in the XIXth General Assembly in Helsinki, in August 1978, were reviewed at the January meeting, and an *ad hoc* committee was appointed to screen applications for travel grants to attend this Assembly. Subsequently, some 40 grants were awarded. Total U.S. attendance at the General Assembly was some 250. The International Union has accepted the invitation of the National Academy of Sciences to hold its 1981 General Assembly in Washington, D.C.

In May 1978, the U.S. National Committee held a joint meeting with the Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers.

The 1978 Annual Meeting of the U.S. National Committee for URSI, consisting of business and technical sessions, took place in Boulder, Colorado, in November 1978.

## Membership

- C. Gordon Little (Chairman) (1981)  
Environmental Research Laboratory  
National Oceanic and Atmospheric  
Administration  
(Physics)
- Thomas A. B. Senior (Secretary) (1981)  
Radiation Laboratory  
University of Michigan  
(Mathematical physics)
- William E. Gordon (1981)  
School of Natural Sciences  
Rice University  
(Radio engineering)
- John V. Evans (1981)  
Lincoln Laboratory  
Massachusetts Institute of  
Technology  
(Radio physics)
- Members-at-Large*  
Donald E. Barrick (1980)  
Environment Research Laboratory  
Department of Commerce
- A. W. Guy (1979)  
Bioelectromagnetic Research Laboratory  
University of Washington
- Leonard S. Taylor (1981)  
Mathematical and Physical Sciences  
and Engineering  
University of Maryland
- Society Representatives*  
David Atlas (1978)  
American Meteorological Society
- Michael K. Barnoski (1978)  
Optical Society of America
- Robert A. Bartolini (1980)  
IEEE Quantum Electronics  
Application Techniques Society
- Kenneth J. Button (1980)  
IEEE Microwave Theory and Techniques  
Society
- Mohammed S. Ghauri (1979)  
IEEE Circuits and Systems Society
- Robert C. Hansen (1979)  
IEEE Antennas and Propagation  
Society
- Amos E. Joel (1980)  
IEEE Communications Society
- Christopher T. Russell (1979)  
American Geophysical Union
- Ernst Weber  
Institute of Electrical and  
Electronics Engineers
- Jack K. Wolf (1978)  
IEEE Information Theory Group
- Ex Officio*  
Jules Aarons  
U.S. Commission G
- Ramon C. Baird  
U.S. Commission A
- Henry G. Booker  
Honorary President
- Kenneth J. Button  
U.S. Commission D
- Robert K. Crane  
U.S. Commission F
- Frederick W. Crawford  
U.S. Commission H
- George A. Deschamps  
U.S. Commission A
- Leopold B. Felsen  
International Commission B
- Robert W. Fredricks  
U.S. Commission H



George H. Hagn  
International Commission E

Alan T. Moffet  
U.S. Commission J

Mischa Schwartz  
U.S. Commission C

Arthur D. Spaulding  
U. S. Commission E

Alan T. Waterman, Jr.  
International Commission F

Jack K. Wolf  
International Commission C

*Ex Officio* (nonvoting)  
Ralph O. Simmons  
Office of Physical Sciences

Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

*Honorary*  
Harold H. Beverage  
Stony Brook, Long Island, New York

Arthur H. Waynick  
Office of Naval Research

Staff Officer: Richard Y. Dow

*Liaison Representatives*

Allan W. Anderson  
Department of the Army

Wilfred K. Klemperer  
National Science Foundation

Emil Paroulek  
Department of Defense

Samuel E. Probst  
National Telecommunications and  
Information Administration

Allan C. Schell  
Department of the Air Force

Erwin R. Schmerling  
National Aeronautics and  
Space Administration

Leo Young  
Department of the Navy

*Assembly Liaison Representative*  
Jeremiah P. Ostriker  
Princeton University Observatory

U.S. NATIONAL COMMITTEE FOR MATHEMATICS

The U.S. National Committee for Mathematics effects participation of U.S. mathematicians in the International Mathematical Union (IMU) and fosters the advance of mathematical sciences.

On the recommendation of the U.S. National Committee, the following delegates and alternates were appointed to the General Assembly of the International Mathematical Union, held in Otaniemi, Finland, in August 1978:

*Delegates*

Lipman Bers (Chairman)  
Columbia University

R. H. Bing  
University of Texas at Austin

S. S. Chern  
University of California at  
Berkeley

Edwin Hewitt  
University of Washington at  
Seattle

Peter D. Lax  
Courant Institute of Mathematical  
Sciences  
New York University

*Alternate Delegates*  
George D. Mostow  
Yale University

Daniel Gorenstein  
California Institute of  
Technology

Allen L. Shields  
University of Michigan

At the request of the U.S. National Committee, the IMU General Assembly Executive Committee has placed on the agenda a discussion of the ICSU resolutions of September 1974 and October 1976 on the Free Circulation of Scientists.

The National Science Foundation supported travel grant programs to the International Congress of Mathematicians in Helsinki in August 1978 and to the 41st Session of the International Statistical Institute in New Delhi in December 1977. The availability of travel grants through the NRC was publicized and there were many applicants. For the mathematics congress, 76 of 294 applicants were awarded grants; 24 of the 95 applicants for travel assistance to attend the International Statistical Institute received awards.

### Membership

*U.S. National Committee for Mathematics*

Lipman Bers (Chairman) (1979)  
Department of Mathematics  
Columbia University  
(Complex function theory and its  
generalizations, partial  
differential equations)

Richard L. Anderson (1981)  
Department of Statistics  
University of Kentucky  
(Experimental statistics,  
time series analysis,  
econometrics)

Walter Feit (1979)  
Department of Mathematics  
Yale University  
(Group theory and algebra)

Shirley A. Hill (1979)  
Department of Mathematics  
University of Missouri  
(Educator, mathematical  
logic)

Herbert B. Lawson, Jr. (1981)  
Department of Mathematics  
University of California at  
Berkeley  
(Minimal surfaces, Riemannian  
geometry, foliations)

Peter D. Lax (1979)  
Courant Institute of Mathematical  
Sciences  
New York University  
(Theory of partial differential  
equations, functional analysis)

Allen L. Shields (1981)  
 Department of Mathematics  
 University of Michigan at Ann  
 Arbor  
 (Mathematical analysis)

John T. Tate (1979)  
 Department of Mathematics  
 Harvard University  
 (Algebra, algebraic number  
 theory)

Hans F. Weinberger (1979)  
 Department of Mathematics  
 University of Minnesota  
 (Applied mathematics, approximation  
 of eigenvalues, quadratic  
 functionals, partial differential  
 equations)

Executive Secretary: Jacob K. Goldhaber

*Committee on Travel Grants for the 1978 International Congress of  
 Mathematicians (Discharged June 1978)*

Frederick W. Gehring (Chairman)  
 Department of Mathematics  
 University of Michigan  
 (Mathematics, analysis)

Patrick X. Gallagher  
 Department of Mathematics  
 Columbia University  
 (Analytic number theory)

William Browder  
 Department of Mathematics  
 Princeton University  
 (Mathematics, topology)

Robert C. Hartshorne  
 Department of Mathematics  
 University of California at  
 Berkeley  
 (Mathematics)

Donald L. Burkholder  
 Department of Mathematics  
 University of Illinois  
 (Probability)

F. Reese Harvey  
 Department of Mathematics  
 Rice University  
 (Partial differential equations)

Richard C. Di Prima  
 Department of Mathematics  
 Rensselaer Polytechnic Institute  
 (Hydrodynamics)

Bernard Maskit  
 Department of Mathematics  
 State University of New York  
 at Stony Brook  
 (Riemann surfaces, topology)

*Ex Officio*  
 Thomas F. Malone  
 Foreign Secretary  
 National Academy of Sciences

William Browder  
 Chairman, Office of  
 Mathematical Sciences

*Assembly Liaison Representative*  
 William Browder  
 Department of Mathematics  
 Princeton University

Jane Cronin Scanlon  
 Department of Mathematics  
 Rutgers University  
 (Topological degree, functional  
 analysis)

George B. Seligman  
 Department of Mathematics  
 Yale University  
 (Lie algebras)

#### U.S. NATIONAL COMMITTEE FOR ROCK MECHANICS

The U.S. National Committee for Rock Mechanics was formed in 1967. It represents U.S. interests in the science and engineering of rock mechanics, addresses problems in rock mechanics through advisory studies and reports, provides for U.S. participation in international activities, primarily through adherence to the International Society for Rock Mechanics (ISRM), and informs the U.S. rock-mechanics community concerning national and international activities and developments in this field. The scientific and engineering questions with which the U.S. National Committee is concerned, ways to solve them, and applications and technology associated with rock mechanics span a wide range of disciplines, physical phenomena, and societal problems.

The U.S. National Committee held its 1978 annual meeting in April, in conjunction with the 19th Annual Symposium on Rock Mechanics for which the Mackay School of Mines, University of Nevada, Reno, served as host. Major topics for discussion at that meeting included reports by the Chairmen of the Panels on Educational Requirements and on Domestic and International Activities, the status of plans for a study of rock-mechanics research requirements, and plans for future annual symposia.

Three *ad hoc* panels of the U.S. National Committee completed their studies and issued their reports in late 1977 and early 1978. The Panel on Rock Mechanics Problems that Limit Energy Resource Recovery and Development held a three-day workshop in January 1977 in which 57 scientists and engineers (40 panel and subpanel members plus 17 observers) participated. In workshop sessions six subpanels prepared consensus papers discussing serious limitations to energy-resource recovery in their respective fields. After the workshop the Panel prepared a report, which it presented to the parent Committee at its annual meeting and subsequently completed and submitted for publication in fall 1977. The report *Rock Mechanics Limitations to Energy-Resource Recovery and Development* was issued in January 1978; the findings and recommendations were also summarized in the U.S. National Committee's *Report for 1977*, published in June 1978, and are reflected in the plans (described subsequently) for a new study on rock-mechanics research requirements.

The Panel on Rock Mechanics Problems Related to Underground Construction and Tunneling also completed its study, begun in mid-1976, and submitted its report to the parent Committee for publication in the Committee's *Report for 1977*. Problems identified by the Panel as most significant were

1. Identification and determination/quantification of rock properties, for example, rock mass discontinuities on the scale of faults, shear zones, and folds;

2. Support methods and requirements (support requirements for different types of behavior such as overstress, loosening, and swell; prediction of requirements before construction; rational design of different support elements; range of applicability of different support systems; and mechanism and behavior of reinforced rock mass);

3. Moleability (support of difficult ground and sudden ground changes);

4. Implementation, education, and interaction (a summary and general description of methodology used by practitioners, useful as a guide to practice);

5. Documentation of field behavior (the need to quantify and correlate with geologic setting, to document actual problems and solutions, to summarize and correlate behavior in case histories, and to make case history reports of tunnels accessible to the interested public).

The Panel on Rock Mechanics Problems Related to Seismology and Earthquake Engineering began its study early in 1976 and presented a preliminary report to the parent Committee in spring 1977. In the report the Panel identified key rock-mechanics problems in earthquake engineering and recommended several research approaches to the solution of these problems. In particular, it recommended

1. A continued research program aimed at understanding the physics of basic processes in earthquake movements, including friction, seismic-wave attenuation, dilatancy, diffusion, mechanical properties of fault gouge, slow rate effects, and mixed brittle plastic processes;

2. An expanded effort to solve the scaling problem by conducting carefully designed, medium- and large-scale experiments and a continued effort to improve numerical modeling techniques and computer codes;

3. An enlarged field observation and instrumentation program designed to improve the ability of the rock-mechanics community to collect meaningful data from the growing number of deep boreholes expected to be available in the near future.

The report was completed in September 1977 and published in the parent Committee's *Report for 1977* in June 1978.

The U.S. National Committee, having reviewed the work of these three Panels at its June 1977 meeting, noted that six technical problems in rock mechanics were critical in relation to energy resource recovery, construction (both civil and military), and seismology/earthquake prediction, hazard assessment, and mitigation. These technical problems are (a) porosity/permeability determination, (b) *in situ* stress determination, (c) fracture pattern mapping, (d) thermo-properties determination, (e) rock fragmentation, and (f) laboratory-to-field test scaling. Although not a technological problem *per se*, numerical modeling was also identified as a related study topic. Mathematical models are valuable for their ability to simulate complicated engineering situations at a small fraction of the cost of full-scale tests or as substitutes for such tests over long periods of time. However, computer simulations should be capable of validation, and although millions of dollars are spent on such simulations, their adequacy to handle realistic boundary conditions and constitutive equations of state is open to serious question.

As a result of its review and the critical importance of cited problems to high-priority national needs, the U.S. National Committee approved the development of a new panel study to define rock-mechanics future research requirements for each of seven major problems that were identified. The study will be a direct follow-on to the work of the three previous Panels. The study should develop and recommend a detailed research program, including the types of research that should be undertaken, guidelines for the conduct of research and for determining what organization or organizations are best equipped to conduct it, and projections of costs and time scales.

Plans call for a panel of specialists to study past and current rock-mechanics research and to identify opportunities for further research that would help to solve the seven sets of problems identified by the previous panels as affecting energy resource development, construction, and earthquake-hazard reduction. Seven subpanels will be formed, each consisting of four or five members who have had specialized experience in the technical subject assigned to a subpanel. These members will be drawn from government, industry, and universities in order to achieve a broad and balanced perspective. The seven topics to be studied by subpanels are

1. Research to determine and predict porosity, permeability, and fluid flow *in situ*;
2. Research to develop better methods for determining and obtaining shallow and deep *in situ* stresses;
3. Research to improve the ability to map fracture patterns, particularly major fractures and faults, at depth;
4. Research to improve the understanding of rock-fragmentation processes for increasing the effectiveness of drilling and excavation systems;
5. Research to increase understanding of the relation of laboratory-measured quantities to *in situ* conditions;
6. Research to provide the thermophysical and thermomechanical properties of rock, including fractured rock;
7. Numerical modeling.

It is expected that each subpanel, in its review of current work and identification of opportunities for future research, will be assisted by a specialist in the same technical subject who will be employed full time for a period of one to two months. With the guidance of subpanel members, each specialist engaged for this work will survey in depth past and current research in the assigned field and tentatively identify highest priority research opportunities. He will also prepare a draft report for the subpanel's consideration.

Making use of the specialist's draft report, each subpanel will then develop a consensus and prepare its report and recommendations to the Panel. After discussion and evaluation of the reports of the seven subpanels, the Panel will develop a comprehensive report of the study. This report will summarize the results achieved in each of the seven study fields and offer detailed recommendations for future research that can help to meet needs.

The time scale for the proposed study is October 1978 through March 1980.

### Panel on Fundamental Problems in Rock Mechanics and Educational Requirements

This Panel, which has been an ongoing activity of the U.S. National Committee since it was formed in 1967, is concerned with evaluation of educational requirements and of what is being done to meet them. Currently the Panel is engaged in a survey of rock-mechanics skills in the United States. A questionnaire for use in this survey was formulated by the Panel in 1977 and approved by the parent Committee. In 1978, the data-collection phase of the study got under way.

### Panel on Domestic and International Activities

This Panel is primarily concerned with organization of the annual rock-mechanics symposia, selection of annual award recipients, and liaison and coordination with the ISRM and other international activities in or related to rock mechanics.

Each year the U.S. National Committee cooperates with a host university in cosponsoring the annual rock-mechanics symposium. The Panel is responsible for selecting the university on the basis of tentative programs submitted, for coordinating organizational details, and for determining final program content for the symposium.

The 19th Annual Symposium on Rock Mechanics was held at Lake Tahoe, Nevada, in May 1978, with the Mackay School of Mines, University of Nevada, Reno, serving as host. Topics of the various sessions included hydraulic fracturing in rock mechanics, deep mining and other excavation problems at depth, earthquake-hazard reduction and rock mechanics, probabilistic approaches in rock mechanics, surface excavation, underground excavation, and general subjects.

The Subpanel on Awards selected the recipients of the 1978 U.S. National Committee for Rock Mechanics awards, which were presented at the 19th Symposium. There were three student awards, a basic research award to five authors, and an applied research award to four authors.

Currently the Panel is assisting the University of Texas, Austin, in its preparation for the 20th Symposium to be held in June 1979. A call for papers has been issued, requesting submission of abstracts on such topics as rock engineering, rock measurements (laboratory, field, remote sensing), reservoirs (oil, gas, geothermal), modeling and analysis, oil shale, coal, *in situ* methods, fracture mechanics, blasting, underground storage, surface excavation and stability, tunneling, earthquake, underground openings, drilling, incompetent rocks, and general rock mechanics.

International activities during 1977 and 1978 included participation in the ISRM Council meeting in Stockholm in 1977, arranging for affiliate membership in the ISRM for 157 U.S. scientists and engineers, and participation of individuals from the United States in ISRM commission studies. In addition, one *ex officio* member of the U.S. National Committee, John W. Handin, serves as ISRM Vice President for North America.

The U.S. National Committee has nominated 17 papers for presentation at the Fourth International Congress on Rock Mechanics to be held in September 1979 in Montreux, Switzerland. These papers were selected from 37 abstracts

submitted for review on themes chosen for the Congress (rheologic behavior of rocks and rock masses, use of tests and monitoring in the design and construction of rock structures, design of underground structures with respect to modern construction methods, and surface displacement as a consequence of excavation activities).

### Membership

#### *U.S. National Committee for Rock Mechanics*

Sidney J. Green (Chairman) (1980)      Fitzhugh T. Lee (1980)  
Terra Tek, Inc.      Geological Society of America  
(Mechanical engineering, rock mechanics) (Geology, rock mechanics)

Don C. Banks (Chairman-Elect) (1981)      Egons R. Podnieks (1980)  
Waterways Experiment Station      American Society for Testing  
U.S. Army Corps of Engineers      and Materials  
(Rock and soil mechanics research)      (Mechanical engineering)

Thomas C. Atchison (Past Chairman)  
(1979)      James T. Engelder (1981)  
Department of Civil and Mineral      American Geophysical Union  
Engineering      (Geology)  
University of Minnesota  
(Mining, rock fragmentation,  
excavation)

Arthur B. Arnold (1981)  
Association of Engineering Geologists  
(Geological studies for power  
plants and other projects)

#### *Society Representatives*

Society of Mining Engineers  
(To be nominated)

M. Nafi Toksoz (1980)  
Society of Exploration Geophysicists  
(Geophysics, electrical engineering)

Don C. Banks (1979)  
American Society of Civil Engineers  
(Rock and soil mechanics research)

#### *Members at Large*

Neville G. W. Cook (1981)  
Department of Material Science  
and Mineral Engineering  
University of California at Berkeley  
(Engineering, geophysics)

William F. Brumund (1980)  
Transportation Research Board  
(Geotechnical and mining projects)

Arfon H. Jones (1981)  
American Society of Mechanical  
Engineers  
(Applied mechanics, rock mechanics)

James H. Coulson (1981)  
Tennessee Valley Authority  
(Rock mechanics, soil mechanics,  
geology)

Kenneth E. Gray (1980)  
Society of Petroleum Engineers  
(Petroleum engineering)



Fred A. Donath (1981)  
 Department of Geology  
 University of Illinois  
 Urbana-Champaign  
 (Structural geology, experimental  
 rock deformation)

Melvin Friedman (1979)  
 Center for Tectonophysics  
 Texas A&M University  
 (Geology, petrofabrics, stress,  
 rock deformation)

Kate H. Hadley (1981)  
 Exxon Production Research Company  
 (Geology)

William W. Hakala (1981)  
 National Science Foundation  
 (Civil engineering, earthquake  
 hazards mitigation)

Madan M. Singh (1980)  
 Engineers International, Inc.  
 (Mining, drilling engineering,  
 soil mechanics)

Executive Secretary, committee and panels: Robert L. Bangert  
 Assistant Executive Secretary, committee and panels: Susan V. Heisler

*Panel on Domestic and International Activities*

Don C. Banks (Chairman) (1979)  
 Waterways Experiment Station  
 U.S. Army Corps of Engineers  
 (Rock and soil mechanics research)

George B. Clark (1978)  
 Excavation Engineering and Earth  
 Mechanics Institute  
 Colorado School of Mines  
 (Mining engineering, rock mechanics)

Herbert H. Einstein (1978)  
 Department of Civil Engineering  
 Massachusetts Institute of Technology  
 (Rock mechanics, underground  
 construction)

William A. Hustrulid (1978)  
 Department of Mining Engineering  
 Colorado School of Mines  
 (Rock mechanics, excavation)

*Liaison Representatives*  
 John P. Gnaedinger  
 Building Research Advisory Board

John W. Guinnee  
 Transportation Research Board

Eugene C. Robertson  
 Interagency Committee on Excavation  
 Technology

*Ex Officio* (nonvoting)  
 John W. Handin  
 Center for Tectonophysics  
 Texas A&M University

*Assembly Liaison*  
 George William Housner  
 Department of Civil Engineering  
 California Institute of Technology

William R. Judd (1978)  
 School of Civil Engineering  
 Purdue University  
 (Geology, rock mechanics)

Yung Sam Kim (1978)  
 Department of Mining Engineering  
 Mackay School of Mines  
 University of Nevada  
 (Mining engineering, drilling)

Fun-Den Wang (1978)  
 Excavation Engineering and Earth  
 Mechanics Institute  
 Colorado School of Mines  
 (Mining and metallurgical  
 engineering)

*Panel on Fundamental Problems in Rock Mechanics and Educational Requirements*

William A. Hustrulid (Chairman) (1978)  
 Department of Mining Engineering  
 Colorado School of Mines  
 (Rock mechanics, excavation)

Gerald B. Rupert (1978)  
 Rock Mechanics and Explosives  
 Research Center  
 University of Missouri at Rolla  
 (Geophysics, rock mechanics)

Thomas C. Atchison (1978)  
 Department of Civil and Mineral  
 Engineering  
 University of Minnesota  
 (Mining, rock fragmentation,  
 excavation)

*Observers*

Charles A. Babendreier (1978)  
 Engineering Mechanics Section  
 National Science Foundation  
 (Mechanical engineering)

Edward J. Cording (1978)  
 Department of Civil Engineering  
 University of Illinois  
 (Civil engineering, rock mechanics)

John W. Corwine (1978)  
 Mining Research Resources  
 U.S. Bureau of Mines  
 (Mining research)

U.S. NATIONAL COMMITTEE ON  
 THEORETICAL AND APPLIED MECHANICS

Thirty-one countries currently adhere to the International Union of Theoretical and Applied Mechanics (IUTAM). The purposes of the U.S. National Committee on Theoretical and Applied Mechanics are to promote the development of this field, to represent the United States in IUTAM, and to act as the central organization through which ten engineering, scientific, and mathematical societies with a common interest in mechanics can act on issues of mutual concern.

The U.S. National Committee met during the National Congress of Applied Mechanics at the University of California at Los Angeles, in June 1978. Discussion at the meeting dealt with (a) plans for participation in the 1980 IUTAM Congress, (b) interdisciplinary symposia, and (c) research and education in theoretical and applied mechanics. The Committee also considered plans for the Ninth U.S. National Congress of Applied Mechanics, which will be held in 1982.

The U.S. National Committee will sponsor a small travel grant program to assist U.S. participation in the 1980 IUTAM Congress.

Membership

Paul M. Naghdi (Chairman) (1980)  
 Department of Mechanical Engineering  
 University of California at Berkeley  
 (Solid mechanics)

Ronald S. Rivlin (Vice Chairman)  
 (1980)  
 Center for the Application of  
 Mathematics  
 Lehigh University  
 (Solid mechanics)

François N. Frenkiel (Secretary)  
(1980)  
Computation and Mathematics Department  
David Taylor Naval Ship Research  
and Development Center  
(Fluid dynamics)

Howard Brenner (1979)  
Department of Chemical Engineering  
University of Rochester

Bernard Budiansky (1980)  
Structural Mechanics  
Harvard University

Stephen H. Davis (1980)  
Department of Mechanics and  
Materials Science  
The Johns Hopkins University

Joseph B. Keller (1980)  
Courant Institute of Mathematical  
Sciences  
New York University

Earll Murman (1979)  
Flow Industries, Inc.  
(Fluid dynamics)

Anatol Roshko (1979)  
Aeronautical Laboratory  
California Institute of Technology  
(Solid mechanics)

Richard A. Toupin (1979)  
Thomas J. Watson Research Center  
IBM Corporation  
(Mathematical physics)

*Society Representatives*  
H. Norman Abramson (1982)  
American Institute of Aeronautics  
and Astronautics

Melvin L. Baron (1981)  
American Society of Civil Engineers

James W. Dally (1982)  
Society for Experimental Stress  
Analysis

François N. Frenkiel (1979)  
American Physical Society

George H. Handelman (1979)  
Society for Industrial and Applied  
Mathematics

Louis N. Howard (1980)  
American Mathematical Society

Hershel Markovitz (1980)  
Society of Rheology

Julius Miklowitz (1980)  
American Society of Mechanical  
Engineers

Paul C. Paris (1981)  
American Society for Testing and  
Materials

William R. Schowalter (1979)  
American Institute of Chemical  
Engineers

*Officers/Personal Members of  
IUTAM Resident in the United States*  
Bruno A. Boley (1980)  
Northwestern University

J. H. Burgers  
University of Maryland

Julian D. Cole (1980)  
University of California at  
Los Angeles

Daniel C. Drucker (1980)  
University of Illinois

Nicholas J. Hoff (1980)  
Stanford University

K. H. Ku (1980)  
University of Pennsylvania

*Assembly Liaison Representative*  
George W. Housner  
Division of Engineering and Applied  
Science  
California Institute of Technology

*Ex Officio*  
Ralph O. Simmons  
Office of Physical Sciences

Thomas F. Malone  
Foreign Secretary  
National Academy of Sciences

William Browder  
Office of Mathematical Sciences

Courtland D. Perkins  
Assembly of Engineering

Staff Officer: Richard Y. Dow.

## APPENDIX: REPORTS ISSUED BY THE ASSEMBLY IN 1978

BIOLOGICAL INVESTIGATIONS OF MARINE ANTARCTIC SYSTEMS AND STOCKS (BIOMASS), VOLUME II. SELECTED PAPERS FROM WOODS HOLE CONFERENCE ON LIVING RESOURCES OF THE SOUTHERN OCEAN. Polar Research Board (published by the Scientific Committee on Antarctic Research of the International Council of Scientific Unions)

COMMENTS OF THE NATIONAL ACADEMY OF SCIENCES TO FCC REPORT AND ORDER--IN THE MATTER OF AMENDMENT OF PART 2 OF THE COMMISSION'S RULES AND REGULATIONS TO ADD A NEW FOOTNOTE TO THE TABLE OF FREQUENCY ALLOCATIONS TO REFLECT THE NEED FOR SPECIAL CONSIDERATION IN PLANNING THE USE OF CERTAIN BANDS SO AS TO MINIMIZE POTENTIAL INTERFERENCE TO RADIO ASTRONOMY OPERATIONS IN ADJACENT BANDS. June 27, 1978. Committee on Radio Frequencies

COMMENTS OF THE NATIONAL ACADEMY OF SCIENCES TO THE FCC EIGHTH NOTICE OF INQUIRY--IN THE MATTER OF AN INQUIRY RELATIVE TO PREPARATION FOR A GENERAL WORLD ADMINISTRATIVE RADIO CONFERENCE OF THE INTERNATIONAL TELECOMMUNICATION UNION TO CONSIDER REVISION OF THE INTERNATIONAL RADIO REGULATIONS. JUNE 27, 1978. Committee on Radio Frequencies

CONTINENTAL MARGINS: GEOLOGICAL AND GEOPHYSICAL RESEARCH NEEDS AND PROBLEMS. Panel to Investigate Geological and Geophysical Research Needs and Problems of Continental Margins, Ocean Sciences Board

THE CONTINUING QUEST--LARGE-SCALE OCEAN SCIENCE FOR THE FUTURE. Post-IDOE Planning Committee, Ocean Sciences Board

CRUSTAL DYNAMICS. A FRAMEWORK FOR RESOURCE SYSTEMS. U.S. Geodynamics Committee, Geophysics Research Board

DOCUMENTS OF THE XV MEETING OF SCAR [Scientific Committee on Antarctic Research], MAY 16-27, 1978, CHAMONIX, FRANCE. Polar Research Board

EARTH SCIENCE INVESTIGATIONS IN THE UNITED STATES ANTARCTIC RESEARCH PROGRAM (USARP) FOR THE PERIOD JULY 1, 1977--JUNE 30, 1978. Polar Research Board

ELEMENTS OF THE RESEARCH STRATEGY FOR THE UNITED STATES CLIMATE PROGRAM. Climate Dynamics Panel, U.S. Committee for the Global Atmospheric Research Program

EVALUATION PROCEDURES FOR LONG-RANGE WEATHER FORECAST EXPERIMENTS. Long-Range Weather Forecast Verification Panel, Committee on Atmospheric Sciences.

AN EVALUATIVE REPORT ON THE EXPERIMENTAL TECHNOLOGY INCENTIVES PROGRAM, NATIONAL BUREAU OF STANDARDS--FISCAL YEAR 1977. Evaluation Panels for the National Bureau of Standards.

AN EVALUATIVE REPORT ON THE INSTITUTE FOR APPLIED TECHNOLOGY, NATIONAL BUREAU OF STANDARDS--FISCAL YEAR 1977. Evaluation Panels for the National Bureau of Standards

AN EVALUATIVE REPORT ON THE INSTITUTE FOR BASIC STANDARDS, NATIONAL BUREAU OF STANDARDS--FISCAL YEAR 1977. Evaluation Panels for the National Bureau of Standards

AN EVALUATIVE REPORT ON THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, NATIONAL BUREAU OF STANDARDS--FISCAL YEAR 1976. Evaluation Panels for the National Bureau of Standards

AN EVALUATIVE REPORT ON THE INSTITUTE FOR MATERIALS RESEARCH, NATIONAL BUREAU OF STANDARDS--FISCAL YEAR 1977. Evaluation Panels for the National Bureau of Standards

GEOCHEMISTRY AND THE ENVIRONMENT. VOLUME III: DISTRIBUTION OF TRACE ELEMENTS RELATED TO THE OCCURRENCE OF CERTAIN CANCERS, CARDIOVASCULAR DISEASE, AND UROLITHIASIS. Subcommittee on the Geochemical Environment in Relation to Health and Disease, U.S. National Committee for Geochemistry

GEODESY: TRENDS AND PROSPECTS. Committee on Geodesy

GEOLOGICAL PERSPECTIVES ON CLIMATIC CHANGE. *Ad Hoc* Committee on Geology and Climate

GEOPHYSICAL PREDICTIONS. Panel on Geophysical Predictions, Geophysics Study Committee, Geophysics Research Board

THE GLOBAL WEATHER EXPERIMENT--PERSPECTIVES ON ITS IMPLEMENTATION AND EXPLOITATION. First GARP Global Experiment Advisory Panel, U.S. Committee for the Global Atmospheric Research Program

HIGH-MAGNETIC-FIELD RESEARCH AND FACILITIES. Panel on High Magnetic Field Research and Facilities, Solid State Sciences Committee

INTERNATIONAL PERSPECTIVES ON THE STUDY OF CLIMATE AND MAN: A REPORT OF THE INTERNATIONAL WORKSHOP ON CLIMATE ISSUES. Climate Research Board

LETTER REPORT ON DIRECTED ENERGY WEAPONS RESEARCH, MARCH 27, 1978. Naval Studies Board

LETTER REPORT ON THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, NATIONAL BUREAU OF STANDARDS. Evaluation Panels for the National Bureau of Standards

LIMITATIONS OF ROCK MECHANICS IN ENERGY-RESOURCE RECOVERY AND DEVELOPMENT. Panel on Rock Mechanics Problems that Limit Energy Resource Recovery and Development, U.S. National Committee for Rock Mechanics

MATERIALS PROCESSING IN SPACE. Committee on Scientific and Technological Aspects of Materials Processing in Space, Space Applications Board, Assembly of Engineering [the Solid State Sciences Committee of this Assembly cooperated in this study by selecting a group to work with the Space Applications Board on the scientific aspects of the Program]

NAS-ESF [European Science Foundation] SPACE TELESCOPE INSTRUMENT REVIEW COMMITTEE, FIRST REPORT. Space Science Board

NATIONAL NEEDS FOR CRITICALLY EVALUATED PHYSICAL AND CHEMICAL DATA. Committee on Data Needs, Numerical Data Advisory Board

NEUTRON RESEARCH ON CONDENSED MATTER: A STUDY OF FACILITIES AND SCIENTIFIC OPPORTUNITIES IN THE UNITED STATES. Panel on Research Needs for Low- and Medium-Energy Sources, Solid State Sciences Committee

NOAA OCEAN DUMPING PROGRAM REVIEW. REPORT AND RECOMMENDATIONS OF AN AD HOC OCEAN SCIENCES BOARD GROUP, OCTOBER 1978. *Ad Hoc* Group to Review NOAA Ocean Dumping Program, Ocean Sciences Board

PROGRAM AND ABSTRACTS. TWELFTH SYMPOSIUM ON NAVAL HYDRODYNAMICS. JUNE 5-9, 1978. Naval Studies Board

THE PROPOSED NOAA *OCEANLAB* PROJECT. REPORT AND RECOMMENDATIONS OF AN AD HOC OCEAN SCIENCES BOARD GROUP. *Ad Hoc OCEANLAB* Study Group, Ocean Sciences Board

RECOMMENDATIONS ON QUARANTINE POLICY FOR MARS, JUPITER, SATURN, URANUS, NEPTUNE, AND TITAN. Committee on Planetary Biology and Chemical Evolution, Space Science Board

REPORT FOR 1977--U.S. NATIONAL COMMITTEE FOR ROCK MECHANICS. U.S. National Committee for Rock Mechanics

REPORT OF THE AD HOC PANEL ON INFORMATION STORAGE AND RETRIEVAL IN CHEMISTRY. *Ad Hoc* Panel on Information Storage and Retrieval in Chemistry, Office of Chemistry and Chemical Technology (Unpublished report to the Assembly on the conclusions and recommendations of an *ad hoc* meeting)

REPORT ON UNITED STATES ANTARCTIC RESEARCH ACTIVITIES FOR FEBRUARY 1977--OCTOBER 1978; UNITED STATES ANTARCTIC ACTIVITIES PLANNED FOR OCTOBER 1978--SEPTEMBER 1979. REPORT #20 TO SCAR [Scientific Committee for Antarctic Research]. Polar Research Board

RESPONSE TO THE OZONE PROTECTION SECTION OF THE CLEAN AIR ACT AMENDMENTS OF 1977: AN INTERIM REPORT. Committee on Impacts of Stratospheric Change

SCIENCE AND THE FUTURE NAVY. A SYMPOSIUM. Naval Studies Board

SOME POSSIBLE CONTRIBUTIONS OF CRYOGENIC TECHNOLOGY TO INERTIAL NAVIGATION. *Ad Hoc* Panel on Advanced Navigation Technology, Naval Studies Board

SPACE PLASMA PHYSICS: THE STUDY OF SOLAR SYSTEM PLASMAS. VOLUME I: REPORTS OF THE STUDY COMMITTEE AND ADVOCACY PANELS. Space Science Board

A STRATEGY FOR SPACE ASTRONOMY AND ASTROPHYSICS FOR THE 1980's. Committee on Space Astronomy and Astrophysics, Space Science Board

A STRATEGY FOR THE EXPLORATION OF THE INNER PLANETS. Committee on Planetary and Lunar Exploration, Space Science Board

SUMMARY OF THE MEETING OF THE COMMITTEE ON US-USSR COOPERATION IN PHYSICS, FEBRUARY 1978. Committee on US-USSR Cooperation in Physics

THE TROPOSPHERIC TRANSPORT OF POLLUTANTS AND OTHER SUBSTANCES TO THE OCEANS. Steering Committee for the Study of Tropospheric Transfer of Pollutants to the Oceans, Ocean Sciences Board

TOWARD A U.S. CLIMATE PROGRAM PLAN: A REPORT OF THE WORKSHOP TO REVIEW THE U.S. CLIMATE PROGRAM PLANS. Climate Research Board

XXIX GENERAL ASSEMBLY OF THE INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY-- REPORT OF THE DELEGATION FROM THE NATIONAL ACADEMY OF SCIENCES--NATIONAL RESEARCH COUNCIL. U.S. National Committee for the International Union of Pure and Applied Chemistry