

SCAR BULLETIN

No 56, May 1977

FOURTEENTH MEETING OF SCAR, MENDOZA

18 to 23 October 1976

Present: President: T. Gjelsvik
Vice-president: T. Nagata
Secretary: G. A. Knox
Executive Secretary: G. E. Hemmen
Honorary Members: G. R. Laclavère and G. de Q. Robin

Delegates: Argentina, R. M. Martínez Abal; Australia, P. G. Law; Chile, P. Welkner; France, G. R. Laclavère; Japan, T. Nagata; New Zealand, R. H. Clark; Norway, T. Gjelsvik; South Africa, J. A. Brink; UK, G. de Q. Robin; USA, J. H. Zumberge; USSR, G. A. Avsiuk; IUBS, G. A. Knox; IUGG, T. Nagata; IUGS, C. Craddock; URSI, G. Pillet; WMO, J. Echeveste.

Advisers: Argentina, A. Corte, R. Dalinger, N. Fourcade, F. Muller, C. Rodríguez, J. R. Romero Cajal, P. Skvarca, A. P. Tomo, J. Trilnick, J. M. T. Vaca; Australia, W. F. Budd, D. F. Styles; Chile, O. González Ferrán, H. Lorca, C. Marangunic, J. Valencia; France, J. P. Bloch, C. Lorius, G. Pillet, J. Vaugelade; Japan, M. Murayama, Y. Yoshida; New Zealand, G. A. Knox, R. B. Thomson; Norway, O. Orheim; South Africa, L. E. Kent, C. van Rensburg; UK, R. M. Laws, C. W. M. Swithinbank; USA, C. B. Bull, C. Craddock, L. DeGoes, A. N. Fowler, R. H. Rutford; USSR, K. Korotkevitch.

Observer: Poland, S. R. Suszczewski.

Opening of meeting

At an opening ceremony, His Excellency the Governor of the Province of Mendoza, Brigadier Mayor Jorge Sixto Fernandez, welcomed the participants on behalf of the Province. Contraalmirante Jorge Alberto Fraga extended a welcome on behalf of the Dirección Nacional del Antártico and Capitán R. Martínez Abal on behalf of the Instituto Antártico Argentino. The president of SCAR responded on behalf of all participants and thanked HE the Governor for providing the excellent facilities for the meeting in the Provincial Legislature Building; he also expressed gratitude to all the national and regional organizations, private enterprises and individuals who had contributed to the preparations for the meeting.

At the opening of SCAR business, the president invited the participants to stand in silence as a token of respect for the first vice-president of SCAR, K. E. Bullen, who had died recently, and also for colleagues who had lost their lives in accidents in Antarctica since the last meeting.

The president read a letter that had been received from R. N. Panzarini, honorary member and past vice-president, sending good wishes for the meeting but regretting his inability to be present due to ill health. It was agreed to send him a message of greeting from XIV SCAR. The president also reported that a congratulatory telegram had been sent, on behalf of all SCAR members, to L. M. Gould on the occasion of his eightieth birthday in August 1976.

S. R. Suszczewski had been nominated by the Polish Academy of Sciences to present to XIV SCAR a report on Poland's Antarctic marine research during 1975-76 and on the country's future plans for work in the Antarctic. The SCAR Executive had agreed to accept Dr Suszczewski as an observer to XIV SCAR under Standing Resolution 2 of 1972. The president welcomed the observer from Poland.

Reports of Thirteenth Meeting

The reports of the Thirteenth Meeting of SCAR held in Jackson Hole, USA, during September 1974, which had been circulated and published in *SCAR Bulletin*, No 49, were confirmed.

Executive Meeting, June 1975

The report of the meeting of the SCAR Executive held in Cambridge during June 1975, published in *SCAR Bulletin*, No 51, was accepted.

Recommendations from XIII SCAR

It was agreed to adopt two XIII SCAR recommendations as General Standing Resolutions, one concerning procedures for the election of officers, and the other concerning subsidiary groups seeking financial support for their activities from other international organizations; these are now included in the summary of SCAR constitution, structure and procedures which will be published separately.

The recommendation (REC XIII FIN-1) that a 30 per cent increase on dues be applied as from 1978 onwards was adopted by the meeting, although some delegates stressed that the ability to pay increased dues would be dependent upon increased funds being made available to their governing organizations.

The recommendations from working group meetings at XIII SCAR, which had been approved by the Final Plenary Session, were reviewed. No further action was considered necessary at this time.

SCAR membership

The delegates were informed of the development of interest in Antarctic scientific research in a number of non-SCAR countries, namely:

Poland. Dr S. R. Suszczewski, the Polish observer, presented to the delegates, on behalf of the Polish Academy of Sciences, a statement (Appendix A) of Poland's recent Antarctic programmes and plans for future scientific research in the Antarctic.

Federal Republic of Germany. G. E. Hemmen, at the suggestion of the Deutsche Forschungsgemeinschaft, informed the delegates of the recent and proposed future Antarctic research programmes of the Federal Republic of Germany and sought advice on the conditions under which this country might seek membership of SCAR.

Brazil. Brazil had acceded to the Antarctic Treaty and had announced her intention to establish an Antarctic research programme in the near future, but had not made any formal approaches to SCAR.

Netherlands. The Netherlands Academy of Sciences had informed SCAR that its scientific committee on Antarctic research was considering resuming research in the Antarctic.

Italy. SCAR National Committees had been informed of a 1975-76 independent mountaineering expedition from Italy which had visited the Antarctic and intended to return in future years. It was not apparent that this expedition was supported by the Italian National Research Council. The supporters of the expedition had been advised that any approaches to SCAR should come from the National Research Council.

In view of these developments, and the fact that improved transportation facilities permitted intensive research during austral summers, it was confirmed that the establishment of a wintering station was not a prerequisite for membership of SCAR; the only conditions should be a significant programme of scientific research in the Antarctic and adherence to the principles of preservation of the Antarctic environment. It was agreed that a continuing marine science programme constituted, in principle, grounds for membership, although it was hoped that countries with such programmes would also develop interests in other Antarctic scientific disciplines.

When a non-SCAR country indicated its intention of establishing a scientific station in the Antarctic, it should be encouraged by SCAR to consult with other countries with stations in the general area of its interest with a view to establishing the most mutually advantageous site for the station, taking into account the scientific studies that would be undertaken there. It was agreed that new guidelines were required to identify more clearly for countries such as the Federal Republic of Germany, Poland and Brazil the requirements for sending observers to SCAR meetings or seeking membership of SCAR.

The meeting adopted a number of recommendations (XIV-GEN-4-11) which National Committees were subsequently asked to confirm by correspondence and which are incorporated in an overall statement of SCAR constitution, structure and procedures which will be published separately.

Activities of SCAR permanent working groups

Biology. The report of an informal meeting of the working group, held in Cambridge, UK, 17-18 May 1976, with appended reports of meetings of the subcommittees on Conservation and Bird Biology, was received. It was noted that this report had been received shortly before XIV SCAR and had not yet been referred to National Committees in accordance with SCAR rules for the acceptance of reports of working group meetings at times other than full SCAR meetings. It was agreed (REC XIV-GEN-1) that the following be added to rule 2 of the procedures for adopting reports of meetings held at times other than SCAR meetings (*SCAR Manual*, 1972, p 47-48):

However, should a General Meeting of SCAR occur within two months of such a report being received by SCAR, that General Meeting may adopt the report and recommendations as though the working group had met at the SCAR General Meeting.

In accordance with the above recommendation, the Working Group on Biology's report and recommendations were adopted, subject to minor editorial corrections. A summary was to be published in *SCAR Bulletin*, No 55.

It was also agreed:

REC XIV-GEN-2, that National Committees be invited to convey to their governments relevant parts of the reports of the meetings of the Subcommittee on Conservation and the Working Group on Biology, in response to recommendations from the Eighth Antarctic Treaty Consultative Meeting.

A request for the working group to meet at XV SCAR, with meetings in the preceding week of the subcommittees on Conservation, Bird biology, and Biological monitoring, was approved in principle.

Geodesy and Cartography. A report was received from the secretary of the group who, it was noted, was to resign in February 1977. On behalf of SCAR, the president expressed appreciation of the services over many years of the retiring secretary, B. P. Lambert.

Geology. In accordance with REC XIV-GEN-2, the report and recommendations of a meeting of the group in Sydney, 19-20 August 1976, were approved. A summary would be

published in *SCAR Bulletin*, No 55. A formal meeting of the working group would be held in Madison, USA, in August 1977, at the time of the SCAR/IUGS/ICG Symposium on Antarctic Geology and Geophysics.

The chairman of the Working Group on Geology reported that the material for the Antarctic stratigraphic lexicon, based on contributions from the various SCAR countries, was in the final stages of preparation by the Bureau of Mineral Resources in Canberra. He pointed out that Antarctica was the only continent without a lexicon and that the working group was anxious for it to be published. The preparation of the lexicon had been in progress for about 10 years and the final manuscript would amount to 400–500 typed pages. It was suggested that the chairman of the Working Group on Geology prepare a statement outlining the scope, importance and content of the publication. National Committees might then be invited to consider means of supporting this venture, which SCAR wished to encourage.

Glaciology. A report was received from the secretary. The report of the meeting of the group at XIV SCAR (Appendix B), which included recommendations XIV-GLAC-1-5, and a report of a meeting on Ice Shelf Drilling Projects, was adopted. A formal meeting of the group would be held in Ottawa, Canada, in August 1978, in conjunction with the International Glaciological Society Symposium on the Dynamics of Large Ice Masses; it was noted that the group might propose a further formal meeting in conjunction with a symposium on Antarctic glaciological exploration in 1981 or 1982.

Human Biology and Medicine. A report from the secretary was received. A formal meeting of the group would be held in July 1977 in Paris, in association with the 27th Congress of IUPS. Proposals of the working group for the establishment of an accident reporting system and procedures for medical examination of summer visitors were referred to the Working Group on Logistics for consideration. XIV SCAR approved, in principle, the concept of a special international biomedical expedition and invited the Working Group on Logistics to give advice to the Working Group on Human Biology and Medicine on how it might be implemented.

Logistics. A report was received from the secretary. During the week preceding XIV SCAR the working group had made considerable progress with a number of items on its agenda—in particular, with discussions on a Co-operative Air Transport System for Antarctica (CATSA). The report of the meeting of the group at XIV SCAR (Appendix C) was adopted. It was agreed that the Annex to this report, 'A Co-operative Air Transport System for Antarctica', after further editing, should be sent by SCAR to National Committees for comments, which should be requested within two months and then incorporated into a revised version of the document. Then, it was recommended:

REC XIV-GEN-12, that National Committees be invited to convey a copy of the revised SCAR document, 'A Co-operative Air Transport System for Antarctica', to their governments for information in relation to Antarctic Treaty Recommendation VIII-7.

Meteorology. A report from the secretary was received. His proposal to convene a formal meeting of the group at XV SCAR, to be preceded by meetings to discuss plans for FGGE and POLEX-South, was approved in principle.

Oceanography. A report from the secretary was received. SCAR accepted the decision of SCOR to disband the joint Working Group on Ocean Processes in the Antarctic and noted with interest the SCOR proposal to discuss, in some detail, at its next Executive Committee meeting in May 1977, the desirability of furthering international collaboration in ocean science in the Antarctic. National Committees were invited to discuss with their corresponding SCOR National Committees the formulation of suggestions which might be conveyed to this meeting. SCAR expressed strong interest in participating in any new activity which might result from the SCOR discussions in 1977.

Solid Earth Geophysics. In September 1975 C. Bentley (USA) had been elected secretary

of the working group; his report was received. The report of an informal meeting of the group, held in Grenoble on 27 August and 4 September 1975 during the IUGG General Assembly, had been published in *SCAR Bulletin*, No 53. The president expressed the appreciation of SCAR to the Japanese Geographical Survey Institute for agreeing to undertake the compilation of a magnetic map of the Antarctic, as recommended in SEG-75-2. A formal meeting of the group would be held in Madison, USA, in August 1977. Joint meetings with the Working Group on Geology would also be held at that time.

Upper Atmosphere Physics. A report was received from the chairman. It was agreed that SCAR accept an invitation from IAGA to co-sponsor a symposium on the interim results of the International Magnetosphere Study to be held during the IAGA-IAMAP Joint General Assemblies in August-September 1977. An informal meeting of the group was held in August 1975 in Lima, Peru, during a General Assembly of URSI.

Activities of SCAR groups of specialists

Late Cenozoic Studies. The group was organizing a SCAR symposium on Antarctic glacial evolution and world paleoenvironments to be held in Birmingham, UK, on 17 August 1977, as part of the Tenth INQUA Congress. Professor T. L. Pewe, USA, was added to the membership of the group.

Ice Shelf Drilling Projects. Ice shelf drilling was discussed as part of the Working Group on Glaciology meetings. The convenor, P. Webb, was planning a fuller scientific meeting in Madison, USA, in August 1977, during the SCAR/IUGS/ICG Symposium on Antarctic Geology and Geophysics.

Seals. A report from the convenor, R. M. Laws, was received. He emphasized that the Convention for the Conservation of Antarctic Seals was not yet in force because only four countries had so far ratified the convention and seven ratifications were required. A workshop meeting would be held in Cambridge, UK, in 1977 and the Finance Committee was asked to make provision for a contribution to this meeting and for the eventual publication of a handbook of seal research methods.

Living Resources of the Southern Ocean. The report of the meeting of the group held at Woods Hole, 17-24 August 1976, was presented by A. P. Tomo. Dr Laws outlined the scope and significance of the Biological Investigation of Marine Antarctic Systems and Stocks (BIOMASS) proposal and G. Hemmen reviewed the action taken by SCOR at its Thirteenth General Meeting in September 1976 in relation to the group's report.

At XIV SCAR the report's recommendations 1 to 7 were approved, together with the concept of the international research programme elaborated in the BIOMASS proposal. The report was also approved for publication in *SCAR Bulletin*, No 55, subject to minor editorial correction. It was agreed that the BIOMASS proposal be revised by the chairman of the group, taking into account comments received from participants and in consultation with the members of the group of specialists and some nominees of IABO, and then be published jointly by SCAR and SCOR as a separate report. Following publication of the BIOMASS proposal, the meeting recommended:

REC-XIV-GEN-3, that National Committees be invited to convey to their governments the BIOMASS proposal together with the report of the Woods Hole meeting, as prepared for publication in *SCAR Bulletin*.

SCOR would convey these documents to IOC. A selection of the background papers presented at the Woods Hole meeting would be published jointly with SCOR.

It was agreed that the chairman of the group of specialists, S. Z. El-Sayed, be thanked for the excellent work he had carried out in preparation for the meeting, and that appreciation

be conveyed to the United States Polar Research Board for the exceptional support facilities that had been provided. A further meeting of the group of specialists would be held in 1977.

Symposia

SCAR/SCOR Polar Oceans Conference, Montreal, May 1974. It was reported that the editor of the proceedings, M. Dunbar, had completed work on the papers and that final typing had commenced. The Arctic Institute of North America (AINA) was providing about \$12 000 to support the publication of the proceedings, SCAR and SCOR having provided some financial assistance for editorial work and preparation. SCAR recorded its appreciation of the AINA support and urged Dr Dunbar to use his best endeavours to ensure publication as soon as possible.

SCAR/SCOR Symposium on Antarctic Biology, Washington, August 1974. Publication of the proceedings of the symposium by the Gulf Publishing Company, Houston, Texas, was expected by April 1977. A grant of \$71 500 from the National Science Foundation, Division of Polar Programs, to support editorial assistance and to subsidize the publication, would ensure a moderate selling price for the volume of nearly 1 500 pages. SCAR recorded its appreciation of this generous NSF grant, and expressed its sincere gratitude to G. Llano for the considerable amount of hard work he had devoted to editing the papers.

SCAR/CMG Symposium on Circum-Antarctic Marine Geology, Sydney, August 1976. The symposium, convened by D. E. Hayes, had been held on three successive half days during the 25th International Geological Congress. Publication of the proceedings by Elsevier Scientific Publishing Company was expected in mid-1977. SCAR was pleased to note the interest of CMG in the Southern Ocean and hoped that this would continue to flourish in co-operation with the SCAR working groups on Geology and Solid Earth Geophysics.

Future symposia

SCAR/IUGS/ICG Third Symposium on Antarctic Geology and Geophysics, Madison, USA, 22-27 August 1977. An announcement of the symposium had been distributed in August 1975, and published in *SCAR Bulletin*, No 52. C. Craddock reported that to date he had received about 100 abstracts and 150 expressions of interest in attending. He informed SCAR that both IUGS and ICG had already agreed to support the symposium financially and requested SCAR also to provide financial support for some participants. The delegates agreed that some financial support should be provided for this symposium.

SCAR/INQUA Symposium on Antarctic Glacial Evolution and World Paleoenvironments, Birmingham, 17 August 1977. An announcement of this symposium, which would be held as part of the Tenth INQUA Congress, had been announced in *SCAR Bulletin*, No 54. The delegates considered that modest financial support might be made available.

Sale of symposia proceedings

SCAR was disposing of its remaining stocks of the following publications at approximately half their original selling prices: *Antarctic oceanography* [1966] and free supplement of *Antarctic ice and water masses* [1970]; *International Symposium on Antarctic Glaciological Exploration (ISAGE)* [1968]; *Antarctic telecommunications* [1972]. Universitetsforlaget was disposing of its stock of *Antarctic geology and geophysics* [1970] at approximately 40 per cent of the original selling price.

Relations with ICSU and other ICSU organizations

ICSU. The president represented SCAR at the ICSU General Assembly, Washington, 10-15 October 1976. At that meeting ICSU granted a further \$10 000 in 1977, in addition to

the \$17 000 granted in 1976, to enable SCAR to undertake special activities arising from the Eighth Antarctic Treaty Consultative Meeting. XIV SCAR expressed its great appreciation of this support provided by ICSU.

IUGG. A report from the IUGG delegate to SCAR was received. T. Nagata drew particular attention to the publication of the proceedings of a 1975 IAGA Symposium on Substorm Observations in Antarctica with Special Emphasis on Unmanned Observatories; in his view, the development of this technique could be applied to scientific observations in the Antarctic in disciplines other than upper atmosphere physics.

IUGS. C. Craddock (USA) had been appointed IUGS delegate to SCAR.

URSI. A report from the secretary general of URSI was received in which reference was made to the preparation of a high latitude supplement to the *URSI Handbook on ionogram interpretation and reduction*. The URSI delegate, Mme G. Pillet, drew attention to an URSI 'open' symposium on propagation in non-ionised media in La Baule, France, from 28 April to 6 May 1977.

SCOPE. A report was received from the SCAR member of SCOPE.

SCOR. A report was received from the SCAR member of SCOR. The meeting was interested to learn of the possibility of SCOR establishing a working group on selected problems of ocean science in the Arctic, and wished to be kept informed.

COSPAR/Use of Space Vehicles. The SCAR representative on COSPAR reminded the meeting of the fruitful discussions that had been held with representatives of COSPAR during XIII SCAR about the potential use of space vehicles for land and sea observations. COSPAR had confirmed its desire to continue co-operation with SCAR on this subject.

XIV SCAR noted the increasing value of obtaining data directly from satellites by operating ground receiving stations in the Antarctic, and it was agreed to draw this possibility to the attention of National Committees. A number of satellite telemetry receiving stations were currently in operation in the Antarctic—two primarily for purposes related to IMS—all of which had potential value for other scientific investigations. A meteorological satellite receiver at McMurdo station was thought to be capable of receiving METSAT data, and it was suggested that there might be considerable value in establishing a LANDSAT receiver at the South Pole with the costs being shared by the nations wishing to utilize the facility. The meeting confirmed its continuing interest in this field and its desire for continued liaison with COSPAR Working Group 6 and other COSPAR working groups. SCAR also recorded its appreciation of the facilities made available by NASA to the scientific community and drew to the attention of National Committees the possibilities presented by the NASA Space Science Fellowships.

SCOSTEP. A report was received from the SCAR representative of SCOSTEP, who drew particular attention to the proposed IMS study of the Antarctic auroral zone in 1978. SCAR agreed to bring to the notice of National Committees a resolution of SCOSTEP urging suitably equipped Antarctic stations to intensify appropriate observations during the relevant period.

IAMAP/ICPM. SCAR accepted an invitation from IAMAP to co-sponsor with ICPM two symposia ('Models and parameterizations of important physical processes in the polar regions', and 'GARP polar sub-programme including plans for POLEX') on 1-2 September at the IAMAP General Assembly, Seattle, 22 August-3 September 1977. The Working Group on Meteorology was to be asked to nominate a representative to the programme committee for the symposia.

Relations with intergovernmental bodies

Antarctic Treaty. Action taken by the Executive in relation to recommendations 1-13 of the Eighth Antarctic Treaty Consultative Meeting, June 1975, had been reported in *SCAR Bulletin*, No 51.

The Special Preparatory Meeting for the Ninth Antarctic Treaty Consultative Meeting, Paris, June-July 1976, had welcomed the document submitted by the secretariat of SCAR (in response to Treaty recommendation VIII-14 following consultation with National Committees) giving a preliminary assessment of the possible effect on the Antarctic environment if mineral exploration or exploitation should occur there. The Preparatory Meeting had suggested that a more detailed assessment of the matter based on existing knowledge should be undertaken for consideration by the Ninth Antarctic Treaty Consultative Meeting and invited SCAR to consider further action along certain lines (*SCAR Bulletin*, No 54). In order to undertake this task, XIV SCAR established a Group of Specialists on Environmental Impact Assessment of Mineral Resource Exploration and Exploitation in the Antarctic (EAMREA), the terms of reference of which are given in Appendix D, together with the list of members.

The group's activities would fall into two phases:

- (a) Preparation of the more detailed assessment on the basis of existing knowledge, and the formulation of a long-term research programme to fill any serious gaps in knowledge.
- (b) Execution of this long-term research programme. Although recommendations concerning implementation of the long-term programme had not been requested by Treaty meetings, it was considered that the implications of such a programme should be taken into account by SCAR at this time.

In developing such a programme, it would be necessary to have some appreciation of the time scale on which information was needed by the contracting parties to the Antarctic Treaty in order that policies may be formulated on a sound scientific basis in ample time to meet future problems. SCAR did not consider itself competent to make an estimate of a suitable time scale, since such an estimate would involve judgements in the economic, technical and political areas. SCAR would therefore welcome guidance from governments on this matter.

Although it should be possible to provide a more detailed assessment than the preliminary document in time for the Ninth Antarctic Treaty Consultative Meeting, it was considered that an adequate study would require a further 12 months work and a budget of \$100 000 if the report was to be comprehensive and of high quality. Finance would be needed for travel, workshops and other support. Although ICSU had responded favourably to a request from SCAR for funds to contribute to such expenses in 1976 and 1977, SCAR could not look to ICSU for adequate continuing financial support.

Because much effort from leading scientists associated with SCAR was to be involved, as well as considerable new research programmes, SCAR would welcome a statement that governments would be willing to make funds available in the future for both long-term support for the group of specialists and additional research programmes undertaken by SCAR nations. Some National Committees had expressed concern that the formulation of these new research programmes could have a detrimental effect on the basic research programmes of SCAR. It would be most unfortunate if, through the execution of research in response to invitations from the Treaty governments, SCAR's basic research programme were to suffer.

XIV SCAR encouraged the early establishment of the membership of this group of specialists and an early initial meeting.

WMO. A report was received from the permanent WMO delegate to SCAR on WMO activities relating to Antarctic meteorology. The main requirement for support for FGGE from Antarctic programmes was in connection with the deployment of drifting buoys, which was already under consideration by the Working Group on Logistics. There was a general discussion on SCAR involvement with FGGE and POLEX-South and it was agreed to draw to the attention of National Committees gaps in Antarctic requirements as outlined in the report of the JOC planning meeting on the GARP polar sub-programme, May 1976. SCAR's contri-

bution to a series of planned meetings in connection with this programme was also discussed. M. Rubin was nominated as a SCAR representative at the planning meeting on 'Tropical Wind Observing Ship Allocation and Utilization in the Southern Hemisphere during FGGE', Leningrad, 15-19 November 1976; and at the Council of Participants for the Southern Hemisphere Drifting Buoy System, Geneva, 10-14 January 1977.

IOC. The SCAR observer on the IOC International Co-ordination Group for the Southern Ocean, G. E. Hemmen, suggested that SCAR should be represented at the third meeting of the group in Australia in 1977, perhaps by a scientist from the region.

Scientific priorities

The delegates noted an increasing number of international programmes that called for contributions from the Antarctic and plans developing within SCAR for collaborative programmes. These included such activities as IMS, POLEX-South, BIOMASS, and possibly new research activities related to Antarctic Treaty requirements. SCAR could not determine priorities for these programmes because the degree of support for each would depend upon priorities assigned by national funding organizations. It was agreed, however, that it would be desirable to draw to the attention of National Committees the likelihood of these various programmes competing for the available support. When SCAR could influence the timing of programmes, possible competition with other activities should be borne in mind.

Finance

Statements of income and expenditure for 1974 and 1975 were received. The report of the Finance Committee meeting at XIV SCAR (Appendix E) was adopted. On behalf of SCAR, the president expressed particular appreciation to G. R. Laclavère for his guidance and advice on financial matters over many years.

Election of vice-president

P. Welkner (Chile) was elected vice-president for the period 1976-1980.

Future meetings of SCAR

XV SCAR. An invitation from France to host the next full meeting of SCAR was accepted. The French delegate reported that the proposed location was Chamonix and that the meeting might be held in the latter part of June 1978. It was agreed that it was necessary for the meeting to be held at this time to enable discussions on FGGE and POLEX-South to influence planning for the 1978-79 season.

Requests for subsidiary meetings had been made by the following working groups: Biology (with meetings of the subcommittees on Conservation, Bird Biology and Biological Monitoring in the preceding week); Geodesy and Cartography (which had been unable to meet at XIV SCAR); Meteorology (preceded by a meeting with participation of glaciologists and oceanographers to discuss plans for FGGE and POLEX-South); and Logistics (which meets at every SCAR meeting). The importance of holding meetings of the Working Group on Biology, with urgent matters for discussion in relation to the Antarctic Treaty, and of the Working Group on Meteorology, with the development of the GARP programme, was emphasized.

It was agreed to request the Working Group on Geodesy and Cartography to defer its meeting, perhaps until the 1979 meeting of IUGG.

XVI SCAR. New Zealand repeated the invitation extended at XIII SCAR to host a SCAR meeting, and Chile and the USSR gave notice that they also would extend invitations to host XVI SCAR.

Closing remarks

Before closing the meeting, the president paid tribute to the retiring vice-president, T. Nagata, for his outstanding services to SCAR not only as vice-president but over many years in his capacities as Japanese delegate to SCAR, chairman of the SCAR Working Group on Upper Atmosphere Physics and, since 1971, as IUGG delegate. In response, Professor Nagata said that he had derived pleasure and satisfaction from his association with SCAR which he hoped would continue. The president then welcomed the new vice-president, P. Welkner, to the Executive and thanked D. Styles for his services as secretary of the Working Group on Logistics from which post he had resigned on his retirement. He also recorded his gratitude to the secretary and executive secretary for their support. The president closed the meeting by sincerely thanking, on behalf of SCAR, all those who had contributed to its success.

APPENDIX A. Statement by Dr S. R. Suszczewski, Institute of Ecology of the Polish Academy of Sciences

It is the intention of Poland to continue scientific research in the Antarctic regions, started last year. In the austral summer season of 1976-77, a vessel of the Sea Fisheries Institute in Gdynia, the R/V *Professor Siedlecki*, will again be sent to the Antarctic regions to continue complex oceanographic studies, with the exploration of krill as a particular objective. Also during the 1976-77 season, the Polish Academy of Sciences is making arrangements for a scientific expedition composed of two vessels to establish a permanent Polish Antarctic station in the region of the South Shetland Islands or the Antarctic Peninsula, with 19 persons who will winter over. The station will be named after Professor Henryk Arctowski (1871-1958).

I am fully authorized to apply to the representatives of all SCAR countries and, in particular, to the representatives of Argentina, Great Britain, the Soviet Union and the United States of America, for their help and advice in finding a suitable site for the future Polish Antarctic station. Since complex studies in various fields of scientific research, in particular biological, will be conducted at the station, the following geographical regions are under consideration: the south-east and north-west capes of Livingston Island, the north-west cape of Greenwich Island, and the north-east cape of the Antarctic Peninsula. Selection of the site must take into account the fact that Poland does not have heavy icebreakers, and the possibility of regular and easy contact with the station by trawlers. The establishment of a permanent Antarctic station will give Polish scientists an opportunity to participate actively in the exploration of the Antarctic regions and to co-operate fully in the international programmes, in particular the multi-station and BIOMASS programmes.

I am deeply convinced that our endeavours to take an active part in the organization of the Antarctic programmes, as a country that was the first to join the twelve signatories of the Antarctic Treaty, will prove to be a valuable contribution to the scientific exploration of the Antarctic regions. I am pleased to inform you that we have established a committee on Antarctic research and that we wish to join the work of SCAR with, of course, all financial obligations. In the near future, when we are informed of the conditions for membership of SCAR, it is the intention of the Polish Academy of Sciences to submit an application for such membership.

APPENDIX B. Working Group on Glaciology

Present: W. Budd, Australia; C. Bull, USA; R. Dalinger, Argentina; L. Kent, South Africa; C. Lorius, France; C. Marangunić, Chile; O. Orheim, Norway; G. de Q. Robin, UK; C. Swithinbank (secretary), UK; Y. Yoshida, Japan (alternate).

Observers: J.-P. Bloch, France; J. Brink, South Africa; R. Clark, New Zealand; A. Corte, Argentina; C. Craddock, USA; T. Gjelsvik, Norway; L. DeGoes, USA; E. Korotkevich, USSR; P. Law, Australia; R. Laws, UK; R. Rutford, USA; P. Skvarča, Argentina; P. Webb, USA; J. Zumberge, USA.

Glaciology of the Antarctic Peninsula (GAP Project)

Reports of progress were presented by R. Dalinger, C. Marangunić, C. Bull, and C. Swithinbank. After considering the excellent progress made so far, the members re-affirmed their belief in the scientific importance of the project and agreed that the priorities as originally drafted should remain unchanged. There was a great need for a chain of ice coring sites extending from Byrd station through the Antarctic Peninsula and the Americas to Greenland in order to understand the nature of global climatic fluctuations. United States glaciologists plan to drill to 100 m at Siple station in 1977-78 and this drill would then be available for work in the Antarctic Peninsula during the same season. A need was identified for a low frequency (5-10 MHz) radio echo sounding system for use in the temperate ice conditions of Patagonia and the South Shetland Islands.

Satellite glaciology

C. Swithinbank and O. Orheim discussed the current extent of Landsat imagery of the Antarctic, pointing out that there were still small areas that had not been covered by cloud-free pictures. Dr Swithinbank showed examples of a Landsat photomosaic map series produced from imagery of the Alexander Island area, emphasizing the low cost of production compared with conventional contoured maps. The United States Geological Survey had produced photomosaic maps of parts of Antarctica at scales of 1:1 000 000, 1:500 000 and 1:250 000, and there was a need for maps at various scales for different purposes.

W. Budd reported on the work by H. J. Zwally and others with Electronic Scanning Microwave Radiometer (ESMR) 1.55 cm imagery obtained by the Nimbus-5 satellite. An atlas is being prepared of the 1973-74 ESMR imagery of Antarctica. O. Orheim drew attention to the weekly maps of the extent and concentration of sea ice being produced from satellite imagery and made available routinely by the Fleet Weather Facility of the United States Navy.

Group of Specialists on Ice Shelf Drilling Projects

A one-day symposium on this topic was held on 19 October 1976, under the chairmanship of P. N. Webb. The present group of specialists consists of P. N. Webb (convenor), P. J. Barrett (New Zealand), T. Kvinge (Norway), and S. Hoshiai (Japan). E. Seibold (Germany) serves as the SCOR representative, while E. Grainger (Canada) serves as IABO representative. Only P. N. Webb attended the Mendoza meeting.

The convenor noted that the first SCAR-sponsored meeting of those interested in ice shelf drilling was called during XI SCAR in 1970. A SCAR group of specialists was established with J. H. Zumberge as convenor and members from the USA, USSR, UK, Australia, New Zealand and Japan. A meeting of this group was convened at Canberra, in August 1972. P. N. Webb assumed the convenorship in late 1973 and reconstituted the group during 1974. He attended an ice core drilling symposium at Lincoln, Nebraska, in August 1974, and later circulated items to non-US personnel. In the original statement (REC XI-GEN-12) the ISDP group

was charged with offering guidance and advice to the Ross Ice Shelf Project (RISP) and future ice shelf projects. The present convenor had worked closely with RISP during its developmental phases and noted that a great deal of scientific and technical expertise had been generated during these preparational stages, which should be drawn upon in any future drilling plans.

The symposium programme contained a collection of papers which dealt with surface glaciology, shallow and deep ice drilling, glacio-chemistry and aerial echo-sounding of several ice shelves. Papers in the areas of physical oceanography, biology and geology were excluded from the meeting.

The Working Group on Glaciology advanced no drilling plans of RISP scope and the opinion was expressed that there should be more drilling by RISP—up to eight sites were mentioned. George VI Sound was suggested as a site for future ice shelf drilling. From a glaciological point of view detailed examination of ice shelf-sea water contacts was repeatedly stressed as an important objective in any future drilling. The convenor of ISDP stressed the importance of extracting as much information from one drill site as possible. It was recommended that if any proposal called for penetration through an ice shelf that serious consideration be given to some level of oceanographic, biological and geological sampling since a variety of equipment for sub-shelf work had been developed and should be utilized wherever possible. The working groups on Geology and Biology should be informed in advance of such plans.

International Antarctic Glaciological Project

Little time was allocated to discussion of IAGP because a report on a meeting of the IAGP Council held in Madison, Wisconsin, in September 1976, was shortly to be published.

GARP polar sub-programme

The working group took note of three documents: *Report of the JOC planning meeting on the GARP polar sub-programme* (Geneva, May 1976); *WMO activities relating to Antarctic meteorology* (XIV-SCAR-26); *The polar sub-programme of the Global Atmospheric Research Programme* (Seattle, August 1976). The intent of this programme was enthusiastically endorsed. However, it was suggested that the following words might be added to the summary on pages 88–89 of the last document under section 8.3: 'Continue and extend climatic studies based on polar ice cores'.

National reports

South Africa, Norway, USSR, United States, United Kingdom, and France presented reports of their recent glaciological activities, which were discussed.

Availability of ice drills

R. Rutford indicated that certain United States ice coring drills would in due course become available for use by others on a no-exchange-of-funds basis provided that potential users would agree to arrange appropriate training for their operators. The working group expressed its appreciation of this most generous offer. Interested parties should direct initial enquiries to J. Clough at the University of Nebraska and at the same time to the Division of Polar Programs, National Science Foundation, Washington DC.

Combined balances programme

Work on the heat, ice, and water balances of selected glacier basins had been undertaken on Meserve Glacier in Victoria Land, Spartan Glacier in Alexander Island, 'G-1' glacier on Deception Island, and Hodges Glacier in South Georgia. While results were of considerable

importance in that they had extended detailed glacier studies for the first time to high latitudes, it had become evident that the aerodynamic methods used were insufficiently accurate to determine satisfactorily the total energy exchange of a whole valley glacier.

Liaison with other organizations

IASH. The working group was asked to arrange liaison with IASH, which could best be done through Dr Swithinbank, who was already an officer of the Commission of Snow and Ice of IASH.

SCOPE. R. Dalinger noted that the proceedings of XII SCAR and XIII SCAR referred to the relationship between SCAR and SCOPE. He was asked to liaise with C. Lorius, SCAR representative to SCOPE, to consider what, if any, further action should be encouraged at this stage.

Election of secretary

C. Swithinbank was re-elected as secretary of the working group.

Reports to meetings

Members bringing written reports to future meetings were asked and agreed to provide an abstract to facilitate the rapid and proper summarizing of proceedings by the secretary.

Future meetings and symposia

The working group proposed a formal meeting in Ottawa, Canada, in August 1978 in conjunction with the International Glaciological Society Symposium on the Dynamics of Large Ice Masses. The secretary was asked to study the possibility of co-sponsorship with the Commission of Snow and Ice of IASH and/or with the International Glaciological Society for the subsequent formal meeting, which would appropriately take place in conjunction with a symposium on Antarctic glaciological exploration proposed by the working group for 1981 or 1982.

Recommendations

The working group made the following recommendations:

REC XIV-GLAC-1, that SCAR conveys its great appreciation to the United States authorities who have been responsible for providing Landsat imagery of the Antarctic. SCAR urgently requests NASA to complete this most valuable work by covering those small remaining areas for which one-time cloud-free imagery has never been obtained.

REC XIV-GLAC-2, that the SCAR nations publish, on a frequent and regular basis, the basic climate data obtained at their Antarctic and sub-Antarctic stations, especially monthly means of temperatures and pressure. An excellent example has already been established on a national basis by regular publication of such data in the *Soviet Antarctic Expedition Information Bulletin* and the *Antarctic Journal of the United States*.

REC XIV-GLAC-3, that SCAR acknowledges the outstanding work of the United States Navy Fleet Weather Facility, Suitland, Maryland, in providing satellite-derived weekly charts of the extent and concentration of sea ice in the polar regions, and compiling these into an atlas to facilitate subsequent analysis. Every encouragement should be given to the continuation and development of this service that is generously made available to all SCAR nations.

REC XIV-GLAC-4, that SCAR recognizes the great value of measurements of surface ice velocity by repeated doppler satellite positioning at inland points on the Antarctic ice sheet as well as in areas of particular interest such as ice streams. It urges member nations who conduct surface traverses for any purpose to make precise determinations of positions at points which can be revisited, even when there appears to be no certainty that all the points will be reoccupied. A less accurate but satisfactory alternative on fast-moving ice streams would be position-reporting transmitters yielding positions via satellites. These instruments can be airdropped and need not be revisited.

REC XIV-GLAC-5, that continued support for the work of obtaining microwave imagery of Antarctica and the surrounding seas should be provided, in particular for scientists studying ice and snow properties. Efforts should be made to distribute as soon as practicable future microwave imagery to the international glaciological community for detailed study.

APPENDIX C. Working Group on Logistics

Present: A. N. Fowler, USA; E. S. Korotkevitch, USSR; R. M. Laws, UK; H. Lorca, Chile; F. W. Muller, Argentina; M. Muřayama, Japan; O. Orheim, Norway; C. J. J. van Rensburg, South Africa; R. J. Romero Cajal, Argentina; D. F. Styles (secretary), Australia; R. B. Thomson, New Zealand; J. Vaugelade, France; J.-P. Bloch (part-time), France; G. E. Hemmen (part-time), SCAR; J. Trilnick (part-time), Argentina.

Observers: W. F. Budd, Australia; J. A. Brink, South Africa.

The working group elected R. B. Thomson as its secretary, to take office on 23 October 1976. Representatives of the group attended meetings of the Working Group on Glaciology in accordance with Recommendation XII-L2, paragraph 1.

Study of selected logistic problems

Topics of continuing interest. The working group exchanged information on a number of selected logistic problems requiring continuing scientific or technical investigation. Reports on recent experience with stations constructed on rock and snow described new designs and materials better suited to meet known Antarctic conditions and new demands. Methods for raising buildings in accumulation areas and a simple fire control system that could be installed in new or existing stations were among the topics discussed; other papers provided fresh information on heating, ventilating and electrical systems, fuel and water storage, access to stations, and ship loading facilities. Experience with the construction, maintenance and operation of two airfields, Marambio on permafrost and Dome C on ice at high elevation, planned or existing ice runways near Soviet stations, and a feasibility study for an airport near Dumont d'Urville were described in papers presented to the group. These are detailed in the CATSA report, a summary of which is contained in an Annex to this report. The group also discussed the continuing role of icebreakers and supply ships for the relief of Antarctic stations and information was exchanged on two new research ships (the Norwegian *Polarsirkel* and the Soviet *Mikhail Somov*) and one multi-purpose ship under construction, *RSA II*. In all, 22 papers were presented.

New topics

Global Atmospheric Research Programme (GARP) and other oceanographic programmes. Members of the working group confirmed their willingness to co-operate, as practicable within the capacity of the resources available, in the FGGE buoy deployment programme, and provided details of ships' itineraries and names of the people to be contacted when arrangements

were to be made. They were also willing in principle to co-operate with the ISOS programme (XBT launchings) and the BIOMASS programme when requested. The group noted that a large number of overlapping requests for help of this kind was being received and considered that the scientific bodies concerned should co-ordinate their requests for help, with an indication of priorities.

Upper wind observations from ships (FGGE). Members of the working group were informed of the requirements. The group pointed out that WMO would have to provide the necessary radiosonde equipment for those ships which lacked it. There would be difficulties in meeting the timing of Special Observing Periods *en route*, but not in the Antarctic.

Tidal observing network (GARP polar sub-programme). The group had received a request for the installation of tide measuring stations on the Antarctic coast and isolated islands, but insufficient details of their number and location had been given. The group expressed willingness to help in principle, but needed further details before it could respond in full.

Antarctic mineral resources. Attention was drawn to the Antarctic Treaty Special Preparatory Meeting on Antarctic mineral resources. Although SCAR had not specifically requested the group to consider this topic, there could be logistic problems of interest to SCAR, such as transport over ice and air transport. After a brief discussion it was agreed that members of the group would give thought to potential problems in anticipation of future requests for help.

Living resources of the Southern Ocean (BIOMASS programme). The group discussed the logistic aspects of the BIOMASS programme—an 11-year research programme in three phases. The preparatory phase was to begin in 1976; an active implementation phase would extend from 1978 to 1984, followed by a final data synthesis phase. The major programme activity would take place in the austral summer periods.

The Antarctic supply ships had a great potential contribution to make and national agencies operating these ships had been invited to help plan a programme of underway observations. Opportunities for time series measurements at the ice edge and in the pack ice from ice-breakers and support ships also needed to be fully utilized. Clearly the working group could help by identifying ships available for participation and listing contacts in each country. This information would also be relevant to other Southern Ocean programmes (ISOS, POLEX-South, GARP).

Logistic information was required too on the 39 coastal stations for shore-based programmes, which would complement data from the offshore activities. The working group agreed to compile the required information, which would again be useful in relation to other marine science programmes.

International Antarctic Glaciological Programme (IAGP). The group attempted to identify areas where its expertise might be called upon. W. Budd described the programme, which involved Australian, French, UK, USA, and USSR scientific collaboration in east Antarctica, mainly in the area between 95° and 165°E. The ice depth sounding programme had been halted by the C130 accidents on ice dome 'C' but would be resumed. In addition to airborne radio echo sounding there were plans for ground traverses inland from Dumont d'Urville, Casey and Mirny stations, as well as parallel to the coast between Dumont d'Urville and Casey stations. These traverses would provide needed comparisons with the results of airborne soundings. The discussion overlapped the CATSA problems and a special need was identified for suitably located prepared skiways with good bulk refuelling facilities at Dumont d'Urville and/or Davis stations, so as to enhance the air support and make the airborne science more cost-effective by reducing the flight distances.

Glaciology of the Antarctic Peninsula (GAP). The group noted the plans of GAP for an international programme involving national groups, but felt that it had no input to make, except in relation to CATSA.

Co-operation in air transport

A report of the discussions of the Subcommittee on a Co-operative Air Transport System for Antarctica (CATSA) is summarized in an Annex to this report. A co-operative air transport system could be considered in two stages. In the first stage existing resources could be improved and integrated, without major capital investment, in such a way as to give greater geographical coverage for scientific programmes and to allow inter-station air links to be used. The developments envisaged for the first stage would provide the basic feeder route network which would also be required for the second stage. This second stage would further develop the system to provide the full air-bus service envisaged in 1968, which would allow inter-continental air access and access by air to most stations in the Antarctic on a firm basis of planned operations. The most important investment required to provide such a system would be an inter-continental air terminal in east Antarctica between 0° and 140°E. The terrain near Davis station, based on rock and accessible from the sea, had the greatest potential for such a facility.

The subcommittee was encouraged to continue its work in accordance with the conclusions it had reached at XIV SCAR and to collect all relevant information, particularly on the detailed requirements for the first stage of operation, after which it was expected that a meeting of the subcommittee would be necessary to establish agreed standards.

Telecommunications requirements: compatibility of systems

At XIII SCAR it was agreed to disband the Group of Specialists in Telecommunications. The Working Group on Logistics accepted the responsibility for referring residual problems through SCAR to National Committees for investigation by appropriate authorities. At XIV SCAR the working group pointed out that the varied civil and military telecommunications systems used by Antarctic operators, as well as the air navigation aids, had different standards in such matters as frequencies and sidebands adopted, printed traffic equipment speeds, and error correcting equipment. The subject would be kept under review by the Subcommittee on CATSA which would call, as necessary, on the advice of experts.

Collection of data in the pack ice zone

The group could still see no solution that would allow scientists to work in safety in the pack ice zone in winter. Helicopters and air cushion vehicles were not recommended for winter use. Satellite-reporting expendable buoys, delivered by air, might solve the problem of collecting physical data in the future, but the collection of biological data and material in the pack ice zone was becoming increasingly important and required the presence of scientists to operate equipment. Ground truth data for remote sensing programmes might also require the presence of people. The group would continue to keep these problems under review.

Antarctic Treaty recommendations concerning conservation

Members presented information on the ways in which they were meeting the guidelines for the disposal of waste. The smaller stations presented few problems but there were difficulties with the larger stations. However, there was an improvement at most stations, and in general they were able to conform with the proposals.

The recommendations from the Eighth Antarctic Treaty Consultative Meeting concerning Specially Protected Areas (SPA's) and Sites of Special Scientific Interest (SSSI's) were reviewed and found to be in agreement with those proposals from the Working Group on Biology already accepted by the Working Group on Logistics at XIII SCAR. No specific new proposals had been put forward by the Working Group on Biology and so there was as yet no real conflict with logistic needs.

The group briefly discussed general principles but identified no problem areas except possible future marine SPA's or SSSI's, the proposals under 1976 BIOL-3 and BIOL-4, and the implementation of management plans. Some potential problems with existing SSSI's were discussed and the group emphasized that it expected to be informed by the secretariat as new proposals were put forward. It was agreed that further discussion be deferred until specific cases needed consideration.

Proposals from SCAR Working Group on Human Biology and Medicine

The group considered the proposals by the Working Group on Human Biology and Medicine for the medical screening of visitors. Members reported that they were satisfied with their existing medical examination arrangements, but would consider to what extent the new proposals might be introduced. With regard to the proposed accident report form, members reported that the information requested by this form was already recorded by national Antarctic operators.

The group considered the proposal for a biomedical field expedition in Antarctica and offered some suggestions to the Working Group on Human Biology and Medicine as to how to proceed. The first step should be to determine more specifically the scientific aims of the expedition, the value of the proposed work, the preferred area of the group in which to undertake its activities, and details of its support requirements for consideration by appropriate National Committees.

ANNEX

A CO-OPERATIVE AIR TRANSPORT SYSTEM FOR ANTARCTICA (CATSA)

A condensation of a report of a meeting of the
Subcommittee on CATSA held at XIV SCAR

In response to Antarctic Treaty Recommendation VIII-7 the Working Group on Logistics reviewed on behalf of SCAR the present and potential resources available for a co-operative air transport system, and the additional requirements for its implementation. The working group also reviewed the information available concerning the ways such a system might benefit the scientific programmes of the various countries.

The Subcommittee on CATSA considered that, in terms of both benefits and requirements, there were two general stages of development in co-operation in air transport. The second, and ultimate, stage would be the use of intercontinental trunks to three well spaced Antarctic terminals from which feeder routes would serve many, if not all, of the Antarctic stations and field sites—in other words, the air-bus first proposed in 1968. However, it was clear that the aviation assets and facilities presently in use in Antarctica, and those already being developed, could be more effectively used straight away for co-ordinated air support projects without additional major construction or investment. This 'stage 1' would not require construction of a major wheeled runway airfield with fuel depot, while stage 2 would. In stage 1 it would probably be possible to support selected projects tailored to fit specific routes, schedules and payloads based on a one- to two-year planning cycle. When stage 2 was achieved it would be possible to support air movement of many projects within the scope of the established co-operative transport system based on much shorter planning.

The following is a summary of discussions on benefits and requirements involved in the establishment of CATSA. The aircraft presently in use or intended for Antarctic operations are identified, and the report concludes with a summary of the facilities currently and potentially available.

Benefits

The Antarctic continent is isolated from ship access for eight or nine months of the year, and most of the research stations are isolated from each other by distance and lack of surface transport. Air transport offers the only reasonable prospect for solving the problems of easy access throughout the summer, transport between research stations, and access to remote interior areas. The working group noted that, in addition to the benefits to scientific programmes, the improved air transport of personnel and critical material would also benefit operational and logistic support projects.

With regard to scientific projects CATSA would expand opportunities both for intensive local investigations and for widely dispersed but closely integrated observations and measurements. All the scientific disciplines stand to benefit, in particular geology, cartography, glaciology, biology, geophysics, oceanography, meteorology, aeronomy, and upper atmospheric physics. Advance techniques of environmental data acquisition are rapidly becoming available. Deployment of automated data acquisition platforms, probes, and buoys, and their maintenance, relocation and recovery would be greatly aided by such a system. Indeed, for effective continent-wide integrated studies CATSA is virtually essential.

Other benefits to scientific and operational activities would include:

- (a) The attraction of more senior scientists, many of whom are burdened by academic responsibilities and schedules, by providing for short-term visits.
- (b) Movement of personnel earlier and later in the season, thus extending their effective work period and providing also for short-term visits.
- (c) More frequent and wider exchange of personnel between stations and national programmes, resulting in improved international co-operation and liaison.
- (d) The possibility of conducting summer season research projects at the most suitably located station, and moving interested scientists there from other stations to participate.
- (e) The improved opportunity to provide critical logistic assistance when necessary to field parties and stations, and to rescue or evacuate personnel in an emergency.

These benefits will largely be realized during stage 2 of CATSA, but there are a number of benefits that are stage 1 possibilities:

- (a) Airborne remote sensing in the form of radio echo sounding of the ice sheet and its underlying earth topography could be extended to additional areas by the provision of one or more landing and refuelling sites. For example, several stations on the coast of east Antarctica have potential adjacent sites for skiways for operation of LC-130 aircraft.
- (b) Other remote sensing studies and direct atmospheric sensing projects using aircraft could similarly benefit. The use of airborne and air-delivered buoy sensing and data collection methods in areas such as the Weddell Sea would benefit at stage 1 by the facility, at Rothera Point for example, for landing and refuelling.
- (c) The increased use of the small to medium sized fixed-wing ski aircraft, particularly the Twin Otter, would benefit field operations. The Twin Otter can best be delivered to coastal stations in east Antarctica by ferry from South America and via the Antarctic Peninsula. Co-ordinated arrangements under CATSA stage 1 would be within current capabilities and would allow the safe ferry of Twin Otters to virtually any station.

Requirements

In the review of current and planned aviation resources in Antarctica there are already many significant capabilities and improvements. CATSA stage 1 primarily requires improved co-ordination and co-operation in the use of these resources. There are two fundamental requirements, the first involving the interchangeable use of aviation fuel supplies. Some of the aircraft now in Antarctica will continue to be restricted because they require aviation fuel whereas only jet fuel is widely available. Even where compatible fuels are involved, transit or terminal bases must contain aviation fuel depots of about 50 000 l with means for pumping, quality control, and replenishment. This capability has already been demonstrated at inland sites such as Siple, Byrd and South Pole stations where replenishment is by LC-130 tanker. The same facilities are needed at some combination of skiway sites such as at Rothera Point, Marambio (runway), Halley Bay, Sanae, Syowa, Molodezhnaya, Mawson, Casey, and Leningradskaya stations.

The other fundamental requirement is for the development of a doctrine or set of standard criteria for the preparation and maintenance of skiways and compacted snow or ice runways. Such criteria have already been put into practice or are planned for use by various aircraft such as Twin Otter, Cessna 185, Pilatus Porter, AN-2, IL-14, IL-18, LC-130, C-130, and C-141. But there has been little effort to standardize the criteria for use of given sites by alternative aircraft.

For stage 2 the major requirements would be: long-range aircraft with a payload of about 20 tonnes; three intercontinental trunk air terminals capable of handling such aircraft in Antarctica; and a system of feeder routes with appropriate ski-wheel and helicopter aircraft. Suitable long-range aircraft already available include the C-130 and LC-130, the IL-18, C-141, and the C-160. Activation of the interstation links involved in stage 1 would establish the nucleus of the feeder route network.

Additional requirements would be the following:

Trunk terminals. In east Antarctica the USSR plans to complete development of a compacted snow runway at Molodezhnaya. Long-range wheeled aircraft could land there but only in the spring and autumn. There remains the need for a full season hard surface runway where ship-delivered fuel is available. The site near Davis station has the greatest potential for construction of such a runway. The McMurdo complex, with the use of the LC-130 aircraft, is an adequate terminal in that sector, but could be improved by the development of an all season hard surface runway. Marambio is being developed as an inter-continental terminal. The present 1 200 m runway is being extended to 2 200 m with a surface of aluminium matting, and ship-delivered fuel is being added.

Feeder routes. It would be desirable to have two Twin Otters normally operating from each trunk terminal to distribute and recover passengers on a scheduled basis on the feeder routes. The various skiway sites of stage 1 would suffice to serve the feeder routes joining the trunk terminals.

Ancillary requirements. In order to complete the system and provide for an adequate standard of safe operation it would also be necessary to provide:

- (a) *En route* and terminal aviation weather forecasting facilities at the three intercontinental trunk terminals.
- (b) Standardized air navigation and approach aids appropriate for use in the Antarctic.
- (c) Improved air navigation charts and published visual and instrument approach procedures.
- (d) Air to ground radio communications with compatibility between airborne and ground equipment.

- (e) Co-ordinated air traffic control and search and rescue procedures.
- (f) Standardized fuel arrangements, including storage, connecting fixtures, pumping, and filtering equipment.
- (g) Basic ground facilities such as protection for aircraft, workshops, and accommodation.
- (h) Crash and fire-fighting equipment at the trunk terminals.

Conclusions

Air transport to and in Antarctica will, with or without CATSA, expand rapidly in the next decade. The Antarctic environment causes unique problems for air operations. Co-ordination among operators is essential for compatibility of ground and airborne equipment in order to assure safety and efficiency. Existing international organizations involved in air operations, such as ICAO and WMO, cannot be expected to take the lead in preparing for expanded and internationally co-ordinated air operations in Antarctica. It is essential, therefore, that the Treaty nations, with SCAR and its Working Group on Logistics as the forum and source of technical advice, continue the effort to provide for co-ordinated air transport measures. To this end the Subcommittee on CATSA should continue its work, particularly on the detailed requirements at the stage 1 level. The members of the subcommittee must avail themselves of the necessary expertise and sources of information in order to formulate standards and criteria in the several areas of Antarctic air operations.

SUMMARY OF AIRFIELD RESOURCES IN ANTARCTICA

Station	Nation	Co-ordinates	Length × width (m)	Remarks
RUNWAYS (PRESENT)				
Marambio	Argentina	64°10'S 57°20'W	1 200 × 30	Earth surface. All year. Limited drummed fuel.
McMurdo	USA	77°53'S 166°48'E	3 000 × 78	Sea ice. Oct-Dec only. Full radio aids and bulk jet fuel.
Syowa	Japan	68°50'S 39°50'E	1 000 × ?	Sea ice. Jan only. Radio beacon, UHF/DF. 5 000 l JP-4 available.
RUNWAYS (PLANNED)				
Dumont d'Urville	France	67°00'S 139°30'E	1 450 × 60	Aluminium matting. First 900 m in 3 years after start.
Marambio	Argentina	64°10'S 57°20'W	1 200 × 30	Aluminium matting to be complete in 1977.
Marambio	Argentina	64°10'S 57°20'W	2 200 × 41	Aluminium matting and ship-delivered fuel by 1981.
Molodezhnaya	USSR	67°40'S 46°55'E	2 500 × 100	Compacted snow. 12 km east of station. To be done by 1978-79. Spring and autumn only.
RUNWAYS (POSSIBLE)				
Davis (Vestfold Hills)	Australia	68°30'S 78°20'E	Indefin- able	700 sq km area of ice-free rock offers possible runway site.
Hallett	USA (NZ)	72°30'S 170°00'E	Variable	Sea ice can be prepared for Oct to Dec. Station not now occupied.
Marble Point	USA	77°28'S 163°45'E	3 000 × 78	Possible to construct hard surface year-round runway. No present plans.
Novolazarevskaya	USSR	71°20'S 12°00'E	Variable	Blue ice area 10 km from station. Planned alternative for wheeled aircraft using Molodezhnaya runway.

SKIWAYS—PRESENT AND POSSIBLE

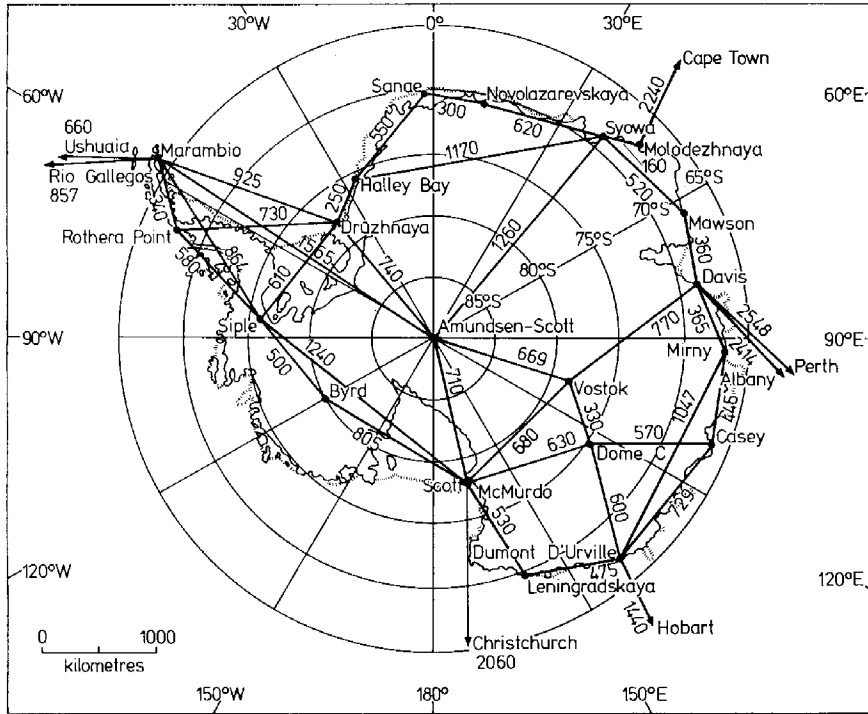
Argentina. Ski-wheel Twin Otters operate during the colder months from Marambio to Almirante Brown, Esperanza, San Martin, Matienzo, and Petrel stations.

Australia. Near Mawson station there is an area on the glacier plateau of 2 400 m length suitable for ski aircraft. It is located 13 km south-west of the station. There is a similar area on the unprepared snow surface 12 km east-south-east from Casey station that is suitable for ski operations. Fuel could be brought to each of these locations.

Chile. There is the possibility of preparing a 3 000 m skiway near O'Higgins station at King George Island.

Japan. There is a skiway 3 000 m long on the ice plateau 20 km east of Syowa station at an altitude of 500 m.

South Africa. There is an area on the ice shelf 17 km from Sanae station that is suitable for skiway operations.



Antarctic stations and distances (nautical miles).

United Kingdom. The new station at Rothera Point (67°40'S 67°05'W) will be completed at the end of the 1977-78 season. An extensive area (4 km × 16 km) suitable for skiway operations lies 4 to 5 km to the north-west. It would be possible to deliver bulk fuel by ship to be hauled to the skiway. There is also a good skiway site in the location of Halley Bay where ship-delivered fuel could be provided. A small marked skiway is available at Damoy Point, Wiencke Island.

USSR. There is a skiway 3 000 m long at Molodezhnaya. At Mirny there is a skiway less than 1 000 m with crevasses at one end and an ice front at the other. A small skiway at Leningradskaya station is suitable for AN-2 or Twin Otter only. If needed a longer skiway could be prepared further from the station. A good skiway exists at Vostok at 3 480 m altitude. It is 2 500 m × 60 m, but has no fuel. At Druzhnaya there is a 3 000 m × 60 m skiway on the ice shelf, and drummed fuel is available.

United States. Two skiways, 3 000 m × 90 m and 2 250 m × 80 m, are maintained on the ice shelf 11 km from McMurdo station. Bulk fuel is available. A 3 000 m × 90 m skiway with limited bulk fuel is available at the South Pole at 2 990 m altitude. An area close to the north-west of Siple station is suitable for skiway operations. Limited bulk fuel is available. At Palmer station ski-equipped Twin Otter aircraft have operated from the glacier near the station. A 3 000 m × 90 m skiway is located at the site of Byrd station, which was closed in 1971. A small camp with limited fuel is sometimes occupied in summer and the skiway surface maintained.

APPENDIX D. Group of Specialists on Environmental Impact Assessment of Mineral Resource Exploration and Exploitation in the Antarctic (EAMREA)

Terms of reference

1. To make a detailed assessment, in relation to both onshore and offshore exploration/exploitation of mineral resources, of the extent to which environmental characteristics, both biological and non-biological specific to the Antarctic region, would require protection of a significantly different kind from the measures generally adopted elsewhere. Relevant Arctic experience should be taken into account.

- (a) In collaboration with appropriate working groups and groups of specialists, to assess the sensitivity of Antarctic terrestrial and marine ecosystems and key species to different forms of environmental disturbance and pollution which might arise. Also, to identify terrestrial and marine environments and species that might require special protection.
- (b) To assess the environmental impact which mineral exploration/exploitation activities, were they to occur in the Antarctic Treaty Area, might have beyond the Antarctic, in particular on adjacent regions.
- (c) In collaboration with the appropriate working groups, to evaluate existing geological and geophysical data in order to identify the most likely areas for mineral exploration/exploitation.

2. To draw up, in collaboration with the appropriate working groups, research programmes needed to provide scientific information to answer questions raised and to further refine the assessments made by the group.

- (a) In collaboration with the appropriate working groups, to suggest geological and geophysical research programmes in the Antarctic Treaty Area that would provide relevant fundamental scientific data not already available on the geology of Antarctica and the surrounding sea bed.
- (b) In collaboration with appropriate working groups and groups of specialists, to formulate marine and terrestrial research programmes that would provide necessary information on environmental questions related to the potential impact of mineral exploitation on the Antarctic environment.

3. To develop the scientific basis on which the responsible authorities might formulate guidelines for mineral exploration/exploitation, and develop appropriate monitoring programmes, in advance of any possible mineral exploration and exploitation.

Membership

Dr J. H. Zumberge (convenor), Office of the President, Southern Methodist University, Dallas, Texas 75275, USA.

Dr H. A. Cole, Forde House, Moor Lane, Hardington Mandervill, Yeovil BA22 9NW, England.

- O. González F., Instituto Antártico Chileno, Avenue Luis Thayer Ojeda 814, Correo Sucursal 21, Santiago, Chile.
- Professor E. S. Korotkevitch, Arctic and Antarctic Research Institute, 34 Fontanka, Leningrad 192104, USSR.
- Dr R. M. Laws, British Antarctic Survey, Madingley Road, Cambridge CB3 0ET, England.
- Dr P. J. Lesta, Grupe Trabajo Costa Afuera, YPF Sede Central, Avda, Pte R Saenz Peña 777, Buenos Aires, Argentina.
- Dr G. A. Llano, Chief Scientist, Office of Polar Programs, National Science Foundation, 1800 G Street NW, Washington DC 20550, USA.
- Dr I. R. McLeod, Bureau of Mineral Resources, Geology and Geophysics, PO Box 378, Canberra City ACT 2601, Australia.
- Dr D. C. Neethling, Minerals Bureau, Private Bag X4, Braamfontein 2107, South Africa.
- Dr T. Nemoto, Ocean Research Institute, University of Tokyo, Nakano, Tokyo 164, Japan.
- Dr R. W. Stewart, Ocean and Aquatic Sciences, Pacific Region, 512 Federal Building, Victoria, British Columbia, Canada.
- J. Vaugelade, Expéditions Polaires Françaises, 47 avenue du Maréchal Fayolle, Paris 16e, France.
- Dr T. Vinje, Norsk Polarinstitutt, Rolfstangveien 12, Postboks 158, 1330 Oslo Lufthavn, Norway.

APPENDIX E. Finance Committee

SCAR's Finance Committee, G. R. Laclavère (chairman), G. de Q. Robin, and P. Welkner, examined the accounts for 1974 and 1975. Outstanding dues for 1975 amounted to \$1 217 and for 1976 to \$9 050, making a total of \$10 267 for the national contributions due at 13 October 1976. The reserve is invested in pounds sterling; while its amount expressed in sterling currency had remained the same since 1972, its value in US dollars had dropped due to depreciation of the pound from \$10 071 at 1 January 1974 to \$8 606 at 1 January 1976. The interest produced by the invested reserve had dropped from \$1 186.66, in 1974, to \$850 in 1976.

The Finance Committee recommended that the countries in arrears be urged to pay their outstanding dues as soon as possible; that the accounts for 1974 and 1975 be accepted; and that a further amount of \$10 000 be put in the reserve and invested in dollar securities, and that ICSU's advice be sought in this respect. The committee prepared budget estimates for 1976, 1977 and a tentative budget for 1978, noting that the increases in national contributions approved by the delegates to XIV SCAR would become effective in that year.

New guidelines permit nations to be members of SCAR without maintaining a wintering-over station. Taking this into account the Finance Committee proposed the following mechanism for determining national contributions:

REC XIV-FIN-1, that there shall be three classes of adhering nations: Class 1—nations maintaining wintering-over station(s); Class 2—nations not maintaining a wintering-over station; Class 3—nations with no current field research activity in Antarctica. For Class 1, the annual dues shall be related to the number of wintering personnel in accordance with established practices. However, a nation maintaining only a small wintering party and carrying out a large marine activity should select a category adjusted to its total scientific effort. For Class 2, a nation should be free to select one of the categories 1 to 5 in consideration of the level of its scientific activity. For Class 3, the annual dues shall be the basic contribution determined for category 0.

The Finance Committee noted the assistance G. Bollenbach, ICSU accountant, had provided in the management of SCAR finances.

CHANGES OF ADDRESS

Amendments to list of names and addresses published in *SCAR Bulletin*, No 50.

SCAR Executive Committee

Vice-president: Dr P. Welkner M, Comité Nacional de Investigaciones Antárticas Chile, Avenue Luis Thayer Ojeda 814, Correo Sucursal 21, Santiago, Chile.

Permanent delegates to SCAR

IGU: No delegate. Correspondence to Professor Dr W. Manshard, Secretary-General, Geographisches Institut II der Universität Freiburg, Werderring 4, D-78 Freiburg i Br, German Federal Republic.

IUPAC: No delegate. Correspondence to Dr M. Williams, IUPAC Secretariat, 2-3 Pound Way, Cowley Centre, Oxford OX4 3YF, UK.

IUPS: No delegate. Correspondence to Professor A. G. B. Kovach, Secretary, Experimental Research Department, Semmelweis Medical University, Ullői út 78/a, Budapest 1082, Hungary.

Permanent working groups

Geodesy and Cartography

Japan: Dr H. Suzuki, Geographical Survey Institute, 24-13 Higashiyama-3, Meguro-ku, Tokyo.

Geology

South Africa: Professor D. R. Hunter, Department of Geology, University of Natal, Box 375, Pietermaritzburg 3200.

Additional Member

Working Group on Solid Earth Geophysics (secretary): Dr C. R. Bentley, Geophysical Polar Research Center, University of Wisconsin, Madison, Wisconsin 53706, USA.

Glaciology

South Africa: L. G. Wolmarans, Geological Survey, Private Bag X112, Pretoria 0001.

Human Biology and Medicine

France: Dr J. Rivolier (secretary), 195 de l'Université, 75007 Paris.

South Africa: The Secretary, SASCAR, CSIR, PO Box 395, Pretoria 0001.

Logistics

New Zealand: R. B. Thomson (secretary), Antarctic Division, DSIR, PO Box 2110, Christchurch.

Oceanography

South Africa: F. P. Anderson, Director, NRIO, CSIR, Box 320, Stellenbosch 7600.

Solid Earth Geophysics

United Kingdom: Dr P. L. Willmore, IGS Global Seismology Unit, Murchison House, West Main Road, Edinburgh EH9 3LA, Scotland.

USA: Dr C. R. Bentley (secretary), Geophysical Polar Research Centre, University of Wisconsin, Madison, Wisconsin 53706.

Upper Atmosphere Physics

United Kingdom: W. R. Piggott, British Antarctic Survey, Madingley Road, Cambridge CB3 0ET, England.

Groups of Specialists*Late Cenozoic Studies*

Professor T. R. Péwé, Department of Geology, Arizona State University, Tempe, Arizona 85281, USA.

Living Resources of the Southern Ocean

IABO Representative: Professor G. Hempel, Inst. für Meereskunde an der Universität, Doosternbrookerweg 20, 23 Kiel, BRD.

ACRONYMS

CMG	Commission on Marine Geology
COSPAR	Committee on Space Research
FGGE	First GARP Global Experiment
GAP	Glaciology of the Antarctic Peninsula
GARP	Global Atmospheric Research Programme
IABO	International Association of Biological Oceanography
IAGA	International Association of Geomagnetism and Aeronomy
IAGP	International Antarctic Glaciological Programme
IAMAP	International Association of Meteorology and Atmospheric Physics
IASH	International Association of Scientific Hydrology
ICG	Inter-Union Commission on Geodynamics
ICPM	International Commission on Polar Meteorology
ICSU	International Council of Scientific Unions
IGU	International Geographical Union
IMS	International Magnetospheric Study
INQUA	Union Internationale pour l' Etude du Quaternaire
IOC	Intergovernmental Oceanographic Commission
ISDP	Ice Shelf Drilling Projects
ISOS	International Southern Ocean Studies
IUBS	International Union of Biological Sciences
IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
IUPAC	International Union of Pure and Applied Chemistry
IUPS	International Union of Physiological Sciences
JOC	Joint Organizing Committee
POLEX	Polar Experiment
RISP	Ross Ice Shelf Project
SCAR	Scientific Committee on Antarctic Research
SCOPE	Scientific Committee on Problems of the Environment
SCOR	Scientific Committee on Oceanic Research
SCOSTEP	Special Committee on Solar Terrestrial Physics
URSI	Union Radio Scientifique Internationale
WMO	World Meteorological Organization