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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

(of Unesco)

REPORT BY THE CHAIRMAN ON THE JOINT IOC/IHO GUIDING COMMITTEE FOR GEBCO

(SC-82/CONF. 218/COL 5)

CONTENTS

1. HISTORICAL BACKGROUND

The General Bathymetric Chart of the Oceans (GEBCO) was originally decided upon at the seventh International Geographical Congress in Berlin in 1899, and it became a reality when Prince Albert I of Monaco assembled a small group of scientists into a special Cabinet to work on the first edition in 1903. A project of 24 large sheets to cover the world on a scale of 1:10 million was developed and issued. A second edition was brought out by the Scientific Cabinet between 1912 and 1930.

With the invention of continuous echo sounding, however, the flood of data became so great that the International Hydrographic Bureau (IHB), Monaco, was asked by the Third International Hydrographic Conference to take over the programme. Between 1935 and 1969 the IHB produced the 3rd edition, which consisted of 21 sheets based on 1001 plotting sheets on a scale 1:1 million. As stocks of certain sheets of the 3rd edition were exhausted, work on the 4th edition was started, but only 2 sheets were issued in 1958 and 1961.

In 1974, once again the workload became so heavy that the IHB (which had changed its name in the meantime to the International Hydrographic Organization (IHO)) agreed to co-operate on this project with the Intergovernmental Oceanographic Commission of Unesco and to set up a joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans. This Committee is composed of ten members, five nominated by the IHO and five by the IOC. The IHO experts are selected from volunteering Hydrographic Offices in their Member States, whereas the IOC experts who are nominated after consultation with the Scientific Committee on Oceanic Research (SCOR) (of the International Council of Scientific Unions (ICSU)), the International Association for the Physical Sciences of the Ocean (IAPSO) (of the International Union of Geodesy and Geophysics (IUGG)) and the Commission for Marine Geology (CMG) (of the International Union of Geological Sciences (IUGS)) are marine geologists/geophysicists specialized in morphological charting of the sea-floor. These arrangements and those which follow accord with the recommendations of the SCOR Working Group on Morphological Mapping of the Ocean Floor (SCOR Working Group 41) at its second meeting in Wormley, 2-3 April 1973, which were endorsed by the ICSU/IAPSO/IHB Committee on GEBCO held in Monaco, 5-6 June 1973.

The IHO and the IOC work in close collaboration on this project and a rough division of activity has been agreed: IHO is responsible, in conjunction with 19 volunteering Hydrographic Offices in its Member States, for maintenance of 655 base master sounding sheets on a scale of 1:1 million, and for cartographic advice on, and supervision

over, the final product, which initially consists of 16 sheets on Mercator Projection covering the world between 72°N and 72°S, and two polar sheets; on the other hand, the IOC in conjunction with SCOR (one of its advisory bodies), IAPSO and CMG, has accepted responsibility for all scientific input into the project, including contouring of the bathymetric data and compilation of the final waterwork for each sheet.

The basic projection, grid and land-work is taken from the Carte générale du monde by permission of the Institut géographique national, France, and uses similar sheet limits.

The Joint Guiding Committee has held seven sessions since its formation - I Paris, 25-26 April 1974; II Monaco, 28-30 April 1975; III Ottawa, 23-24 April 1976; IV Paris, 2-3 May 1977; V Ottawa, 24-26 April 1978; VI Ottawa, 21-23 May 1979; VII Monaco, 6-8 October 1980; and the eighth session will take place in Paris, early 1982. In addition, two meetings of the GEBCO Officers have taken place in Ottawa, 8-10 April 1980 and 13-15 April 1981.

2. TERMS OF REFERENCE (Annexure I)

Annexure I is a full statement of the Terms of Reference which may be summarised as follows:

(a) To determine and respond to the needs of the various users of a world series of bathymetric charts;

(b) to draw up specifications for the GEBCO Fifth Edition;

(c) to establish an advisory sub-committee on geographical names and nomenclature of ocean bottom features for the GEBCO Fifth Edition;

(d) to advise the IHO on matters connected with the acquisition, storage and exchange of high-quality bathymetric data;

(e) to draw up comprehensive plans for the formation of a full-time geoscience unit for the preparation and compilation of bathymetry for the GEBCO charts;

(f) to recommend measures for fair-drawing, printing, publication and distribution of the GEBCO charts;

(g) to proceed with arrangements for the compilation and publication of the GEBCO Fifth Edition to uniformly modern standards and to formulate policy for updating and revision of charts.

3. MEMBERSHIP OF THE GEBCO GUIDING COMMITTEE, SUB-COMMITTEES, SHEET CO-ORDINATORS (Annexure II)

The Joint IOC-IHO Guiding Committee for GEBCO consists of ten members, five nominated by the IOC and five by the IHO. The IHO experts are selected from Hydrographic Offices participating actively in the IHO-GEBCO activities. The IOC members, who are nominated after consultation with SCOR, IAPSO and CMG, are experienced marine geologists and geophysicists. One representative each of the IOC and IHO Secretariats is also included in the full membership of the Guiding Committee. The Chairman and Permanent Secretary were elected by the Guiding Committee from its membership.

Annexure II also contains lists of members of Sub-Committees, and names of scientific co-ordinators for each sheet in the GEBCO Fifth Edition.

4. SPECIFICATIONS FOR THE GEBCO FIFTH EDITION (Annexure III)

The Joint Guiding Committee has adopted specifications listed in Annexure III for the preparation of the General Bathymetric Chart of the Oceans (5th Edition). These are based upon the outcome of deliberations by SCOR Working Group 41 as endorsed by the previous GEBCO Committee.

5. GEOGRAPHICAL NAMES AND NOMENCLATURE OF OCEAN BOTTOM FEATURES (Annexure IV)

The Joint IHO/IOC Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO) appointed, in 1974, a Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features. The main object of this Sub-Committee is to advise on names and nomenclature used on the GEBCO 1:10 million series of charts. As part of its task, the Sub-Committee developed a list of terms and definitions for undersea features, after making an exhaustive study of the many lists being used by national boards on geographical names, international organizations, marine geoscience and hydrographic literature, and widely recognized glossaries of geological terms.

The list, thus developed, was submitted, as a GEBCO contribution, to the Third United Nations Conference on the Standardization of Geographical Names (Athens, September 1977). The Conference recommended that the UN Group of Experts on the Standardization of Geographical Names co-ordinate its activities with IOC and IHO in order to develop a joint list of terms and definitions as well as an agreed statement to meet requirements for an internationally acceptable set of guidelines designed to ensure maximum standardization of undersea feature names.

The GEBCO Sub-Committee has since been collaborating with the UN Group of Experts and, as a consequence of extensive discussions, the attached jointly-agreed document (Annexure IV) has been developed, which includes:

a) Guidelines for the Standardization of Undersea Feature Names for National Use;

b) Undersea Feature Name Proposal Form;

c) List of Terms and Definitions.

The list at item c) is a somewhat modified version of the original terminology listing developed by the GEBCO Sub-Committee.

It will be noted that the attached booklet is bilingual English/French. Spanish and Russian texts are in preparation.

With the realisation that standard procedures, if implemented by the various national names authorities, would lead to a desirable degree of uniformity in naming new features, it is to be hoped that Member States will be encouraged to use the 'Guidelines' and the 'Terms and Definitions' to the maximum extent possible. It is, however, stressed that the terms and definitions, as well as the process of applying names, have no legal or political connotation; it being understood that there might be a distinction between the use of terms for naming purposes and their usage in legal terminology.

These guidelines have been used in the preparation and in scientific review of each sheet comprising the GEBCO Fifth Edition. It should be noted that they make provision for the procedure to be followed by individuals and agencies wishing to apply names to unnamed features in international waters, and the "Undersea Feature Name Proposal" form has been designed for the purpose of maintaining uniformity of essential information relating to each feature named (see Annexure IV).

The Standing GEBCO Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features will continue to address problems, queries and proposals in this connection.

6. DIGITAL BATHYMETRY (Annexure V)

A questionnaire was sent out to a large number of oceanographic institutions and hydrographic offices to survey the policy, status and direction towards automated digital bathymetry. The responses have been analysed by the Sub-Committee on Digital Bathymetry (Annexure V) and it has been decided that, while general implementation of automated digital bathymetry should be encouraged, the two systems in current use for data storage and exchange (automated digital bathymetry, and hand plotting of corrected soundings on 1:1 million scale and larger plotting sheets) will have to co-exist for the foreseeable future. Such a development does not alter the existing system; however there is a need for a central directory of digital data, complementary to the existing catalogue. It is recommended that the IHB (as the World Data Centre for Bathymetry) be invited to start work on such a directory.

The need is recognised for storage of the contours of the GEBCO Fifth Edition in digital form. No funds are available to the Guiding Committee, but the International Gravity Bureau in Toulouse requires this data base and will bear the cost of digitizing the contours and providing a copy of the magnetic tape containing information sufficient to replot the contours. The Canadian Hydrographic Service, as the GEBCO Copyright Holder, will hold this tape and make sub-copies available at the request and expense of the scientific and hydrographic community. The tape is expected to be available by mid-1983, after which it will be possible to plot out the shoreline and bathymetric contours of any ocean area on any scale and any projection required.

7. TECHNICAL PROBLEMS RELATING TO THE THIRD UN CONFERENCE ON THE LAW OF THE SEA (Annexure VI)

A new sub-committee has recently been formed to identify problems which may arise in the application of the article in the draft convention on the Law of the Sea which deals with the "Definition of the Continental Shelf", since both IHO and IOC may in due course be consulted by the proposed Commission on the Limits of the Continental Shelf "with a view to exchanging scientific and technical information which might be of assistance in discharging the Commission's responsibilities". This sub-committee is also required to evaluate and provide advice on the training and education facilities that might be made available to coastal states from the expertise that has been built up for the GEBCO project.

In more general terms the Guiding Committee wishes to place on record its willingness at all times to identify and provide advice to the IOC and IHO on the kind of scientific and technical experience and expertise needed in the field of marine geology and geophysics and hydrographic surveying, in order that they may be able to respond to any requests that may be addressed to them by or through the UN Law of the Sea Secretariat. Depending on the origin and nature of such requests, and the amount of work involved, such tasks may be beyond the resources of the Guiding Committee. If consultants have to be employed, this would have to be under the normal terms of UN contracts.

8. PREPARATION AND PUBLICATION OF THE GEBCO FIFTH EDITION

The preparation and publication of the GEBCO Fifth Edition is the major task for which the Joint IOC-IHO Guiding Committee for GEBCO was formed in 1974.

As with earlier editions, world coverage between 72°N and 72°S is on Mercator Projection, scale 1:10 million at the equator. This requires 16 sheets (see Annexure III, Assembly Diagram), some of which have been given overlap strips to ensure that prominent morphological features are shown in their entirety on one sheet and are not cut by an arbitrary geographical border. For the same reason, limits of sheets in the southern hemisphere have been shifted 20° to the east in order to give more satisfactory cover to the main ocean basins. For the polar regions, an Arctic and an Antarctic sheet have been produced on Polar Stereographic Projection on a scale of 1:6 million at 75° latitude, and extend to 64°N and S which provides considerable overlap with the Mercator sheets.

The Guiding Committee is working on a deadline of April 1982 for publication of all 18 sheets comprising the GEBCO Fifth Edition. In this event they can be mounted for display at the XII International Hydrographic Conference, 20-30 April 1982, and at the twelfth session of the IOC Assembly in November 1982. A supporting book containing historical information, introduction to the Fifth Edition, credits, legends, references, GEBCO Specifications, etc, is being prepared by the Permanent Secretary GEBCO: it is intended that the 18 sheets of the series will be folded to approximately A4 size, packed in a box together with the book and sold as a unit suitable for library cataloguing procedures and bookshelf storage. The charts will of course also be available in unfolded form.

At the outset, in 1974, the Guiding Committee faced two fundamental problems since no funds were available for creation of the GEBCO international Marine Geoscience Unit whose task was to have been compilation of the GEBCO Fifth Edition charts from the mass of new data available, nor for printing and publication.

The breakthrough came when the Canadian government, with remarkable foresight, agreed to scribe, print and publish initially the first four sheets of the series, but later all 18 sheets, of the Fifth Edition subject only to receiving the proceeds of sales. This agreement has been honoured by the Canadian Hydrographic Service and has ensured that the various sheets have a consistency of style and presentation which would have been impossible if they had been produced in different establishments as was at one time contemplated.

With this agreement in hand the Guiding Committee was able to offer marine geoscientists in many countries the possibility of publishing their work, with full acknowledgement, in a prestigious chart series of high quality and thus gain strong support from the leaders of the world marine geoscientific community. It could not assist them however with project funding, and it is a measure of the high regard in which the GEBCO is now held that so many eminent marine geoscientists have been willing to give their time and energy to the preparation of one or more sheets of the series (see Annexure II, para 5) and to obtain institutional or national funding for their in-house work.

For each sheet, one or more Scientific Coordinators were appointed who were responsible for co-ordinating and compiling the best possible contour plots for the area of the sheet. They were also responsible for working closely with the Scientific Co-ordinators of adjacent sheets to ensure continuity at borders and on overlaps. Independent scientific and nomenclatorial review procedures were set up through which all sheets had to pass before being cleared for production by the Canadian Hydrographic Service.

This arrangement has led to differences in style of interpretation between sheets and also to different contours being shown in overlap areas on adjacent charts where these have been produced some years apart and new data have become available in the interval. This was recognised by the Guiding Committee at an early stage and it was agreed that it was inevitable if, as was considered right and proper, accuracy was being sought rather than elegance.

All land topography on the Mercator sheets has been provided by the French Institut géographique national and is the same as that used on their Carte générale du monde though the GEBCO has its own colour scheme. The Antarctic continent was taken from maps supplied by the Scott Polar Research Institute in Cambridge, England.

An important innovation with the Fifth Edition of GEBCO has been the inclusion of sounding control on the face of each sheet. Discrete soundings appear as grey dots and echo-sounding tracks as subdued grey lines. Saturated areas

and areas of high quality surveys are shown in boxes or brackets and cross-referenced to a note in the border. This has enabled far fewer spot depths to be shown in numerals; indeed these are now virtually confined to maximum and minimum depths of significant features. An even greater advantage is that the chart user can assess for himself the degree of confidence with which the compiler has drawn contours in relation to the density of data available.

In order to ensure standardization of style between different sheets, even though prepared by geoscientists of different nationality and language, and to avoid as far as possible political differences of opinion in regard to geographic names, all such names shown and the nomenclature used for bottom features are carefully scrutinized for each sheet by the Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features (see Annexure IV). In brief, the GEBCO Specifications (Annexure III) call for national versions of geographical names for land features (transliterated to the Roman alphabet where appropriate) and English names in the waterwork. This conforms to the system used by the IHO for its International Nautical Chart series.

Publicity and Sales

Publicity for the GEBCO Fifth Edition has been achieved by displays at international scientific and other conferences; articles, advertisements, reviews and flyers in appropriate journals. It is further considered that the educational field is one in which the GEBCO is likely to make a very significant impact. The Guiding Committee is satisfied that sales for the partially-completed series, as follows, are satisfactory:

	Sheets available	Copies sold
1975	1	175
1976	1	75
1977	1	50
1978	4	1188
1979	7	4211
1980	9	3985

It is reasonable to expect that sales will increase substantially when the full set of 18 sheets is available, particularly with a supporting book in a library-compatible box as described above. At this stage (mid-1982) a major publicity campaign will be mounted. Meanwhile copies can be purchased (5 Canadian dollars per sheet) from the Canadian Hydrographic Chart Distribution Office in Ottawa, IHB Monaco and UNIPUB (at a higher cost) in addition to several regional outlets.

Acknowledgements

The continued interest of His Serene Highness Prince Rainier III of Monaco is acknowledged with sincere appreciation.

The following have rendered indispensable service without which the Fifth Edition of the GEBCO would not have approached completion (see Annexure II):

Members of the Joint IOC-IHO Guiding Committee for GEBCO
Scientific Co-ordinators of individual sheets and their assistants
The Chairmen and members of GEBCO Sub-Committees
The Assistant Deputy Minister, Ocean Science and Surveys, Canada
The Dominion Hydrographer, Canadian Hydrographic Service
The Chief of Geoscience Mapping and GEBCO and his staff, Canadian Hydrographic Service

The scale of the task involved is illustrated by the results of an overall cost estimate of between seven and eight million dollars for the production of the GEBCO Fifth Edition; this does not take into account the considerably larger unseen costs for the provision of ship time for the collection of bathymetric data, provided by numerous member states of IHO and IOC.

9. GEBCO INTERNATIONAL MARINE GEOSCIENCE UNIT

In order to ensure a steady production of GEBCO charts to uniformly high standards it was foreseen at an early stage (by SCOR Working Group 41) and accepted by the Guiding Committee that a GEBCO International Marine Geoscience Unit, under strong leadership and adequately funded, would be essential. It was agreed that the Geoscience Unit should consist of three geoscientists comprising a Director, a Deputy and a Trainee from a developing country. The estimated cost of such a Unit was US$174 000 per annum when a detailed submission was made in 1976 to UNDP for financial support. That and all other efforts to secure sound support for the Geoscience Unit have failed, in spite of the generous offer by the Government of Canada to house the Unit and to cover all costs, including overheads, with the exception of salaries and travel.

10. FUTURE ACTIVITIES AND TERMS OF REFERENCE FOR THE GEBCO GUIDING COMMITTEE. RECOMMENDATIONS

The Guiding Committee has reviewed its 1974 terms of reference (Annexure I) now that the major task for which it was formed - compilation and publication of the GEBCO Fifth Edition - is approaching completion. Certain items will require further attention and some will need to be continued indefinitely. It is moreover now possible to identify new problems and tasks which require the attention of a joint IOC-IHO subsidiary body.

In addition, there are a number of important tasks that the Guiding Committee will have to undertake during the interim period in order to minimize delays when work on the Sixth Edition is activated. These include:

(i) Identification of logistic and financial arrangements for compilation and publication of the Sixth Edition. The GEBCO Fifth Edition is a most valuable asset and resource, representing the concentration into an 18-sheet world coverage of the most modern scientific interpretation of the most comprehensive available data base. The Guiding Committee should watch its impact upon the marine community and devise ways and means of capitalizing on it. This will be a vital task if sufficient funding is to be found for the Sixth Edition.

(ii) Meeting requests for special charts of specific regions or for special purposes. The possibility of using the Fifth Edition as a base for overlays or overprints of other parameters should be fully investigated and their preparation supervised by small planning or working groups sponsored together with other appropriate agencies.

(iii) Supervision of certain existing activities which need to continue, such as the continuing rôle of the IHO in maintaining the 1:1 million series of master sounding sheets without interruption; implementation of computer-based procedures for acquisition, storage and retrieval of bathymetric data; the use of the digitized Fifth Edition contours; maintenance of the advisory Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features; close liaison with agencies concerned with implementation of the International Convention on the Law of the Sea; publicity and sales; etc.

A more detailed list of presently identifiable tasks to be undertaken by the Guiding Committee after 1982 is attached as Annexure VII. It is emphasized that the main thrust of the Guiding Committee should be directed towards planning the production of a new Sixth Edition of the GEBCO not later than 1995. IOC resolution EC-XIV.16 (Annexure VIII) is also relevant.

Recommendations, including revised Terms of Reference for the Joint IOC-IHO Guiding Committee for GEBCO

It is therefore recommended that the Joint IOC-IHO Guiding Committee for GEBCO remain in existence with revised terms of reference (see below) and that it should continue to be co-sponsored jointly by IOC and IHO.

It is further recommended that the Chairmen of the three existing Sub-Committees be co-opted as necessary to the Guiding Committee to assist with its task.

It is proposed that the revised terms of reference read as follows :

The Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO) shall :

1. identify the needs of the various users of a world series of bathymetric charts, study the means whereby the needs can be met, and take all necessary action toward this end ;

2. draw up administrative plans for, and actively pursue, the formation and continued operation of a full-time GEBCO Ocean Mapping Unit :

   (i) to provide advice and facilities for the compilation of bathymetry and other oceanographic parameters for the GEBCO series of charts and overlays (overprints);

   (ii) to provide education and training facilities identified by the GEBCO Sub-Committee on Technical Problems relating to the proposed Convention on the Law of the Sea;

3. after analysing the impact of the GEBCO 5th Edition on the world community over a number of years after issue of full world cover, draw up plans for a next edition which should reflect the new technologies and data available, and subsequently, draw up specifications and a timetable for the production of a 6th Edition of GEBCO ;

4. investigate and develop new logistic and financial arrangements necessary for the production of a 6th Edition of GEBCO;

5. advise the International Hydrographic Organization (in its capacity as the World Data Centre for Bathymetry) on matters connected with the collection and exchange of high-quality bathymetric data; including both the compilation and updating of the 1:1 million plotting sheets and the development of automatic data generating, archiving and retrieval, soliciting the advice and assistance of the IOC Working Committee on International Oceanographic Data Exchange (IODE), as necessary;

6. identify new sources of data with the object of ensuring that maximum available data are submitted to the World Data Centre for Bathymetry ;

7. recommend and develop measures for optimum publicity, distribution and sales of charts produced under the aegis of the Guiding Committee ;

8. maintain as necessary, advisory Sub-Committees on :

   (i) Geographical Names and Nomenclature of Ocean Bottom Features ;
   (ii) Digital Bathymetry ;
   (iii) Technical Problems relating to the proposed Convention on the Law of the Sea ;

   and create others as required from time to time ;

9. be prepared to act, when requested, as the representative subsidiary body of the IOC and IHO for the co-sponsorship, with other appropriate bodies, of disciplinary groups for the preparation of overlays (or overprints) of various oceanographic parameters (biological, physical and chemical as well as geological/geophysical) ;

10. collaborate, when requested, with regional bodies affiliated to IOC and/or IHO in the preparation of bathymetric charts and overlays (overprints) at scales suitable for regional projects, e.g. the International Bathymetric Chart of the Mediterranean (IBCM) ;

11. provide advice on ocean mapping, as requested by intergovernmental and non-governmental organizations.

TERMS OF REFERENCE FOR THE JOINT IOC-IHO GUIDING COMMITTEE FOR THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

(As recommended by the Committee and approved by IOC Resolution EC-IV.14, June 1974)

The Joint IOC-IHO Guiding Committee for GEBCO is:

1. To determine and respond to the needs of the various users of a world series of bathymetric charts.
2. To draw up specifications for a revision of the GEBCO series of charts including the scale to be adopted, projection to be used, sheet limits, contour intervals, indication of density of data, representation of topography, etc.
3. To lay down priorities for the production programme, to make periodic reviews in keeping with the availability of new data, and to formulate policy for updating and revision of charts.
4. To advise the IHO on matters connected with collection and exchange of bathymetric data, and the compilation and updating of 1:1M plotting sheets, taking into account the chart production programme.
5. To identify new data sources with the object of ensuring that maximum available data are included in the updated 1:1M plotting sheets.
6. To recommend measures for fair-drawing, printing, distribution and sales of the GEBCO charts.
7. To draw up administrative plans for the formation and continued supervision of a full time geoscience unit for the preparation and compilation of bathymetry for the GEBCO charts. These plans to include budgetary estimates, procedures for recruitment of personnel, and administrative/technical facilities required for the project.
8. To make recommendations for the establishment of ad hoc regional consultative groups to assist the geoscience unit when deemed necessary.
9. To establish an advisory sub-committee on the identification, description, nomenclature and the names of ocean bottom features, for the GEBCO (5th edition).
10. To investigate methods of automatic data archiving and retrieval as a future extension of the 1:1M sounding collection system.
11. To collaborate with regional co-operative investigation groups in the preparation of bathymetric charts at scales suitable for regional projects eg the Co-operative Investigations in the Mediterranean (CIM).
12. To provide advice, as requested by Intergovernmental Organizations and Non-governmental Organizations, on the bathymetry of the oceans, eg the Commission for the Geological Map of the World.

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GEBCO PERSONALITY LISTS (1974-1981)

1. MEMBERSHIP OF THE JOINT IOC-IHO GUIDING COMMITTEE FOR GEBCO

(a) Nominated by IOC

Professor B C Heezen (IAPSO), Lamont-Doherty Geological Observatory, USA (1974-77)
Dr A S Laughton (SCOR), Institute of Oceanographic Sciences, UK
Professor E S W Simpson (CMG) (Chairman 1974-77 and 1978-81), University of Cape Town, RSA
Dr G B Udintsev, Institute of Physics of the Earth, USSR
Professor W Langeraar, Netherlands Maritime Institute (1974-76)
Dr R L Fisher (IAPSO), Scripps Institution of Oceanography, USA (from 1978)
Dr A Lonardi, Department of Scientific Affairs, Organization of American States (1977-79)
Lic F Mouzo, Servicio de Hidrografía Naval, Argentina (from 1980)

(b) Nominated by IHO

Captain J H S Osborn RAN, Hydrographer, Australia (1974-76)
Ing A Roubertou, Service Hydrographique et Océanographique de la Marine, France
Mr G N Ewing, Dominion Hydrographer, Canada (now Assistant Deputy Minister, Ocean Science and Surveys)
Dr T Sato, Hydrographic Office, Japan (1974-76)
Dr W Bettac, Deutsches Hydrographisches Institut, Federal Republic of Germany (1974-79)
Dr Y Iwabuchi, Hydrographic Service, Japan (1976-79)
Captain M Calder RAN, Hydrographer, Australia (from 1977)
Mr Henri Rombach, Dienst der Hydrographie, Netherlands (from 1979)
Shri Satya Prakash, Naval Hydrographic Office, India (from 1980)

(c) Representatives of the IOC and IHO Secretariats

Mr D P D Scott (IOC) (Permanent Secretary)
Rear-Admiral D C Kapoor, Indian Navy (ret)(IHO)

2. SUB-COMMITTEE ON DIGITAL BATHYMETRY

Mr G N Ewing, Canada (Chairman)
Mr Neil Anderson, Canadian Hydrographic Service
Mr John Warren, Canadian Hydrographic Service
Rear Admiral D C Kapoor, IHO (Secretary)

3. SUB-COMMITTEE ON GEOGRAPHICAL NAMES AND NOMENCLATURE OF OCEAN BOTTOM FEATURES

Mr G N Ewing, Canada (Chairman)
Dr R L Fisher, USA
Ing A Roubertou, France
Dr G B Udintsev, USSR
Rear-Admiral D C Kapoor, IHO (Secretary)

4. SUB-COMMITTEE ON TECHNICAL PROBLEMS RELATING TO THE DRAFT CONVENTION OF THE LAW OF THE SEA

Dr A S Laughton, UK (Chairman)
Mr D P D Scott, UK

5. SCIENTIFIC CO-ORDINATORS FOR 5th EDITION GEBCO SHEETS

5.01 J Ulrich (FRG)
5.02 G B Udintsev (USSR)
5.03 G L Johnson (USA), D Monahan (Canada)
5.04 A S Laughton (UK), D Monahan (Canada)
5.05 A S Laughton (UK)
5.06 Y Iwabuchi (Japan)
5.07 Jacqueline Mammerickx (USA)
5.08 G L Johnson (USA), R Searle (UK), D Monahan (Canada)
5.09 R L Fisher (USA)
5.10 R K H Falconer (NZ), Marie Tharp (USA), D Monahan (Canada), Jacqueline Mammerickx (USA), R L Fisher (USA) and others
5.11 Jacqueline Mammerickx (USA), S M Smith (USA)
5.12 B C Heezen (USA), Marie Tharp (USA)
5.13 D E Hayes (USA)
5.14 R K H Falconer (NZ), Marie Tharp (USA)
5.15 Jacqueline Mammerickx (USA), S Cande (USA)
5.16 J La Brecque (USA), P D Rabinowitz (USA), C Brenner (USA)
5.17 G L Johnson (USA), D Monahan (Canada), G Grønlie (Norway) L Sobczak (Canada)
5.18 G L Johnson (USA), J-R Vanney (France)

SPECIFICATIONS FOR THE GEBCO (5th Edition)

SECTION 100 - GENERAL

101 - Introduction

A. The General Bathymetric Chart of the Oceans (GEBCO) established in 1903 by H.S.H. Prince Albert I of Monaco, is now published under the authority of the International Hydrographic Organization and the Intergovernmental Oceanographic Commission with the assistance of a Guiding Committee whose members have been nominated by the IHO and the IOC after consultation with SCOR, IAPSO and the CMG.

The GEBCO (5th Edition) aims to place at the disposal of the user community the best available bathymetry interpretation for the oceans of the world.

B. An Assembly Diagram showing the basic sheet limits of the GEBCO 5th Edition for world coverage is attached as an Annex.

102 - Scope

A. These specifications provide basic guidance for the production of the 18 sheets of the GEBCO.

SECTION 200 - BASIC SPECIFICATIONS

201 - Projection

A. Sheets between latitudes 72°N and 72°S shall be on Mercator projection as used in the IGN "Carte générale du monde".

B. The polar sheets shall be prepared on polar stereographic projection.

C. International Ellipsoid (Hayford).

202 - Scale of the sheets

A. The scale of the sheets on Mercator projection shall be 1/10M at the Equator.

B. The scale of the polar sheets on polar stereographic projection shall be 1/6M at latitude 75°.

C. A scaled border shall be shown subdivided into 30-minute increments of latitude and longitude for the Mercator sheets.

203 - Graticule

A. Meridians and parallels shall be drawn every 10° on sheets on Mercator projection. On the polar sheets, meridians shall be drawn every 10° and parallels every 5°.

B. Labelling of the graticule shall be as shown on Sheet 5.05.

C. The tropics of Capricorn and Cancer and the Polar Circles shall be shown.

204 - Size

The neat line size of the 5th Edition sheets shall be the same as that of previous editions (585mm x 1000mm) except in the case of extended sheets and the polar sheets.

205 - Numbering

A. The sheets of the GEBCO shall be numbered 1-18 as shown in the Assembly Diagram (see Annex). 3-digit numbers shall be allotted to each, the first digit referring to the edition and the other two being the number of the sheet (e.g. 5.15).

B. Sheet numbers shall be printed in 8mm Arabic figures.

C. The sheet number shall be printed in the lower right-hand corner of each sheet and in the opposite corner.

206 - Dating

The date of publication shown for each sheet shall be the date of going to press.

207 - Units of measure

Depths and topographic heights shall be shown in metres.

208 - Marginal information (for layout see Chart 5.05)

A. All marginal information shall be bilingual (English/French)

B. This shall include :

1. The general title GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO), series established by H.S.H. Prince Albert I of Monaco in 1903. / CARTE GENERALE BATHYMETRIQUE DES OCEANS (GEBCO), Série créée par S.A.S. le Prince Albert Ier de Monaco en 1903.
2. Sheet number (see 205).
3. Projection, ellipsoid and scale (see 201, 202).
4. Unit of measure used for depths and heights (see 207).
5. Code of colours used on the sheet to portray bathymetry (see 403).
6. Code of colours used on the sheet to portray hypsometry (see 301).
7. An index of areas and names of countries whose Hydrographic Offices prepared plotting sheets for the sheet, and other sources of data used.
8. The names of the scientific co-ordinator and principal geoscientists responsible for the scientific content of the sheet.
9. Seals of the IHO and the IOC.
10. Edition number and date of publication (see 206) followed by the statement :
"Published by the ... (name of printer) .... under the authority of the IHO and the IOC (of UNESCO)"
11. Source of data for numbered boxes.

SECTION 300 - TOPOGRAPHY

301 -

For the land part, the current edition of the 1/10M "Carte générale du monde" published by the French "Institut Géographique National" shall be used where applicable with the GEBCO code of colours as shown on Sheet 5.05.

302 -

The shore line shall be shown as a firm line in blue.

303 -

Contours on land shall be at 200, 500, 1000, 2000, etc., metres.

SECTION 400 - BATHYMETRY

401 -

A. The 1/1 million plotting sheets prepared by certain Member States of the IHO, together with any other reliable sounding data that can be obtained, shall form the basic bathymetric data to be used for the compilation of GEBCO charts.

B. The IHB shall inform volunteering Hydrographic Offices of the GEBCO production schedules and obtain updated copies of 1/1M plotting sheets for supply to the respective scientific co-ordinators.

402 - Soundings

A. In order to indicate contour reliability, all soundings used shall be shown as dots representing discrete soundings or lines representing continuously sounded traverses. Areas of detailed surveys where soundings are denser than can be conveniently shown shall be indicated by numbered boxes referenced in the margin.

B. A sparse pattern of numerical soundings shall be shown to indicate maximum and minimum (and other significant) depths, where known, over major undersea features in such a way as not to detract from the paramount objective of indicating the sea floor relief by means of contours.

C. The exact position of all numerical soundings shown shall be indicated by a dot. The depth shall be written as cartographically convenient against the dot, using 1.5mm sans-serif figures. Where space does not permit the juxtaposition of the figures they may be offset and linked by a fine line to the dot placed in the exact position.

403 - Depth Contours and Colours

A. Contours shall be derived from the best available larger scale charts which have been prepared or are approved by marine scientists in the light of current geological and geophysical knowledge, or taken from surveys of such details that there is no room for interpretation. Where such data is not available, contouring from soundings must be done by experienced geoscientists.

B. Basic contours which shall separate the depth colours shall be at 200m, 500m, 1000m, and thence at 1000m intervals.

C. Additional contours which may be required by the data must be shown at regular intervals.

D. Contours that are multiples of 500m shall be shown as firm continuous blue lines.

E. The contour at 200m depth and any additional contours that are not multiples of 500m shall be shown as subdued continuous blue lines.

F. At the discretion of the Scientific Co-ordinator large areas of sea floor shallower than 200 metres may be represented by contours spaced at not less than 50-metre depth intervals.

G. The resultant patchiness of the final chart will reflect the quality and quantity of the input data and indicate the need for more surveys. No attempt should be made to generalize down to the lowest quality data.

H. The code of blue depth shades used for Sheet 5.05 shall be used.

SECTION 500 - NOMENCLATURE AND GEOGRAPHICAL NAMES

501 -

A. The Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features shall lay down guide-lines to be followed for showing names on GEBCO sheets. The Sub-Committee shall also develop definitions of undersea features for adoption on an international basis.

B. The Sub-Committee shall be guided by the relevant decisions of the United Nations Conferences on Geographical Names as well as IHO resolutions on this subject.

C. The nomenclature for undersea features shall be shown on GEBCO sheets in the English language.

D. The Scientific Co-ordinator, in each case, shall forward to the Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features a proposed list of names for inclusion on the sheet. This list will be reviewed by the members of the Sub-Committee and a final version approved.

SECTION 600 - SCIENTIFIC AND CARTOGRAPHIC REVIEW

601 - Scientific Review

The Scientific Co-ordinator shall be responsible for obtaining a scientific review (to include comments from co-ordinators of adjacent sheets) of the bathymetric content of the chart, prior to submission to the printing authority. The Joint IOC-IHO Guiding Committee for GEBCO should be notified by letter of the names of the reviewers and of the date of submission to the printing authority and should, if necessary, advise further review. The printing authority should be given at least one month's notice of the submission of documents. Documents shall include bathymetry, names, tracks, source material and references. The printing authority will not consider the chart to be in its possession until <u>all</u> documents are supplied.

602 - Cartographic Review

At a suitable stage of production, the printing authority will convene a meeting (or communicate by mail) with the Scientific Co-ordinator, the Chairman of the Guiding Committee for GEBCO and representatives of the IOC and the IHO, to review technical aspects (style, nomenclature, cartographic standards, etc.) before final publication.

A N N E X

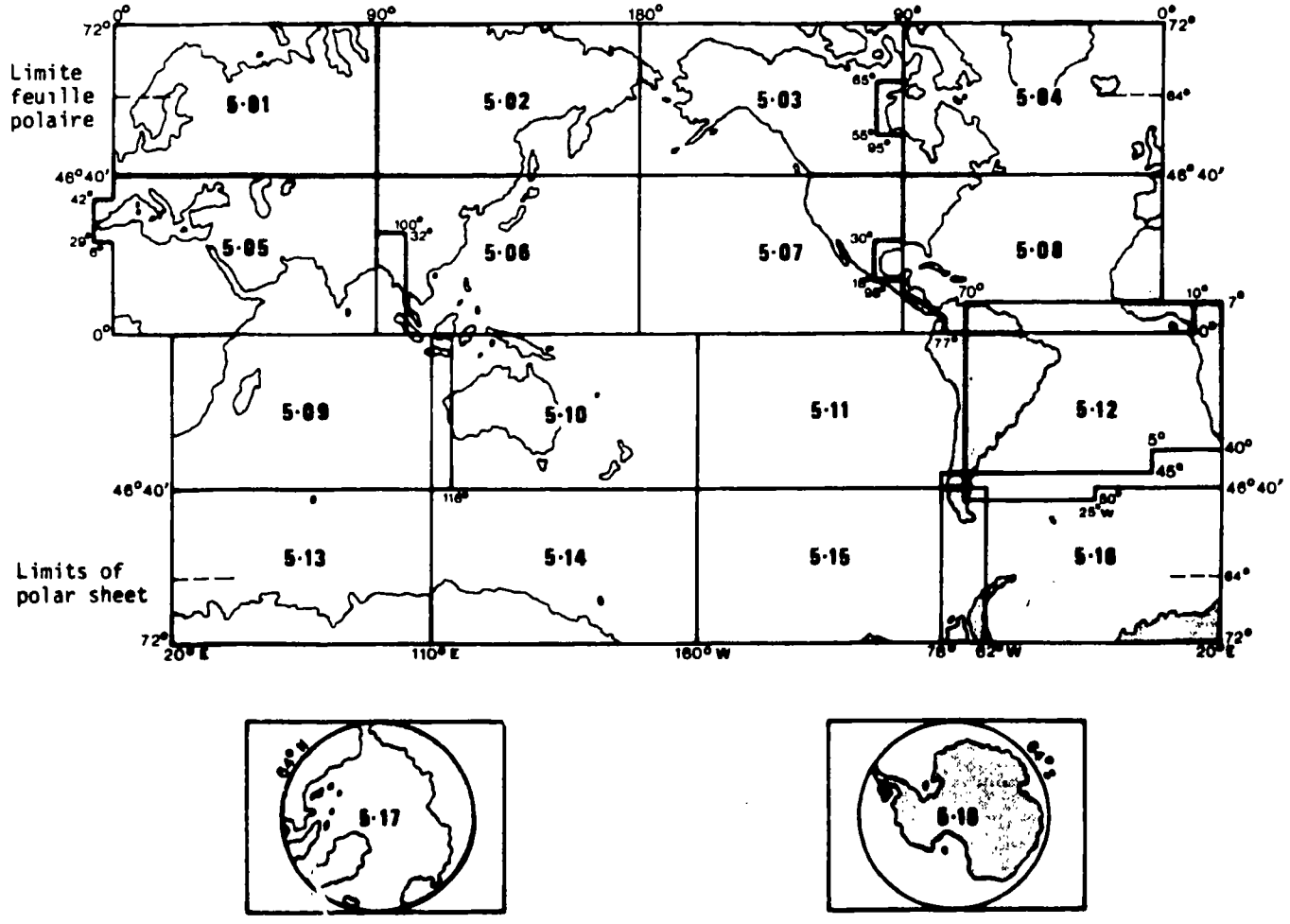
to the SPECIFICATIONS
for the GEBCO
(5th Edition)

A N N E X E

aux SPECIFICATIONS
pour la GEBCO
(5ème édition)

ASSEMBLY DIAGRAM FOR GEBCO SHEETS (5th EDITION)

TABLEAU D'ASSEMBLAGE DES FEUILLES DE LA GEBCO (5ème EDITION)



ANNEXURE IV
ANNEXE

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

ORGANISATION HYDROGRAPHIQUE INTERNATIONALE

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

COMMISSION OCEANOGRAPHIQUE INTERGOUVERNEMENTALE

This technical document exists in English and French. It is being translated into Spanish and Russian and will be issued as a separate document.

STANDARDIZATION OF UNDERSEA FEATURE NAMES

GUIDELINES
PROPOSAL FORM
TERMINOLOGY

NORMALISATION DES NOMS DES FORMES DU RELIEF SOUS-MARIN

DIRECTIVES
FORMULAIRE DE PROPOSITION
TERMINOLOGIE

Published by the
INTERNATIONAL HYDROGRAPHIC BUREAU

Publié par le
BUREAU HYDROGRAPHIQUE INTERNATIONAL

MONACO - 1981

SUB-COMMITTEE ON DIGITAL BATHYMETRY

RESULTS OF SURVEY ON DIGITAL BATHYMETRY

Introduction

The International Hydrographic Organization (IHO) is the World Data Centre for bathymetry, and is supported by the Hydrographic Offices of the member states. The IHO receives lists of newly acquired hydrographic data from the member hydrographic offices on an annual basis. Certain member states as well, maintain (1:1 million scale) Mercator collector sheets, which collectively cover all the world's oceans, on which are posted water depths.

More and more organizations are depending on computers to assist in data collection, data storage, and data retrieval, operations previously done manually. Maintaining an up-to-date data bank of bathymetry data becomes more difficult when the data exist in both graphical and digital form. In this case we are concerned with data that exists in one or both forms. This report summarizes the results of the survey undertaken by the Dr. Loncarevic sub-Committee, in order that the IHO can assess the impact of computers on the role of the IHO, and the member Hydrographic Offices, to maintain a world-wide bathymetry data base.

A Sub-Committee on Digital Bathymetry was formed in 1977 at the Fourth Session of the GEBCO Guiding Committee. Dr. B.D. Loncarevic was the sole member of the original Sub-Committee.

In February 1979, Dr. Loncarevic circulated a questionnaire to the Hydrographic Offices of the IHO members, and also to a number of Oceanographic Research Institutes, to survey the policy, status and direction toward automated digital bathymetry.

Terms of Reference (Sub-Committee on Digital Bathymetry)

In August, 1980, a new Sub-Committee was formed to analyze and report on the results of the questionnaire. (Attached as Appendix 1.)

The Sub-Committee is to:

1) Analyze and prepare a consolidated report on the responses to the questionnaires sent out to the IHO Volunteering Hydrographic Offices (IHO Circular Letter 4/1979 dated 15 February 1979) and to selected Oceanographic Institutions;
2) Study and report on the desirability and the ways and means of digitizing the contours of the GEBCO (5th Edition); and
3) Study and report on the desirability and the ways and means of achieving an international system of storage and retrieval by an automatic digital system of the data at present stored by the International Hydrographic Bureau (as the World Data Centre for Bathymetry) on 1/1 million plotting sheets, and any further data to be collected in the future.

The Sub-Committee is required to report (if necessary in separate documents) to the GEBCO Officers at their meeting scheduled for April 1981, so that a final report can be prepared for consideration by the XIIth I.H. Conference and the twelfth session of the IOC Assembly (scheduled for April 1982).

Term of Reference #1

Summary of Responses

Responses were received from 25 organizations, 23 of which are members of the IHO, 17 of the 19 Hydrographic Offices having responsibility for bathymetric plotting sheets replied to the questionnaire. The following is a list of the countries that replied to Dr. Loncarevic's questionnaire:

Argentina; Australia; Canada; Chile; Denmark; Finland; France; Germany; India; Indonesia; Japan; Monaco; Netherlands; New Zealand; Pakistan; Portugal; Republic of South Africa; Sweden; Spain; Turkey; U.S.S.R.; United Kingdom; U.S.A. Table 1 summarizes the responses. The following questions do not appear in Table 1; Section I, question 8, Section II, questions 1 (part b), 3, 6; Section II,

question 2; and Section V.

As of the date of the responses (1979); the Hydrographic Offices of the following IHO members have Automated Digital Bathymetry (A.D.B.) Systems in place; Canada; Denmark; Finland; France; Federal Republic of Germany; United States of America (USA) and United Kingdom of Great Britain and Northern Ireland (U.K.). The two research institutions; Scripps Institution of Oceanography, and Woods Hole Oceanographic Institute appear to have digital data systems in place as well. The following Hydrographic Offices use or are about to use digital bathymetry in automated cartography: Australia; Canada; Chile; Denmark; France; The Federal Republic of Germany; Spain; USA; and U.K.

The following is a summary of the responses (per Table 1).

Section 1 - concerns questions of a general nature regarding the philosophy of each organization toward Automated Digital Bathymetry (ADB). Most organizations favoured ADB as a long-term goal; they have identified section responsible for ADB; and they are expanding their involvement in it in the near future.

Section II - concerns questions regarding acquisition of ADB; either in real-time, or by conversion of existing analog records and digitizing of graphical documents.

18 out of 25 respondents indicate that they acquire digital bathymetry and/or convert existing analog data into digital form. The most common medium for data storage is magnetic tape. About 2/3 of the respondents co-operate with other organizations on matters concerning digital bathymetry.

Section III - concerns storage of digital data. 8 of the 12 organizations with ADB experience sort their data on the basis of geographical coordinates.

Section IV - The questions in this section concern retrieval and display of digital data. It is useful to consider the responses from organizations with the most experience in ADB, in assessing the impact of ADB on the problems of maintaining an up-to-date bathymetry data base.

These organizations with experience in digital bathymetry can retrieve their data on the basis of geographical area. These organizations are able to provide listings of their data as well as geographic postings.

Summary

There is a genuine interest in ADB, even on the part of organizations which are presently not involved. The majority of IHO members favour a continuation of the role of IHO. The Hydrographic Offices should be responsible for maintenance of hydrographic data within their area of responsibility and the IHO should coordinate the individual efforts.

Term of Reference #2

Digitization of Contours

Several individuals and organizations have approached the GEBCO organization in an attempt to obtain the contours of the Fifth Edition in Digital form. To date we have been unable to meet these requests since we do not have contours in a digital form. (Some organizations have digitized part of the series; the DHI, for example, has digitized parts of 501, 504 and 508). Digitizing the entire Fifth Edition would obviously be a fairly expensive and protracted exercise, for which no funds are available.

We are fortunate, therefore, that the International Gravity Bureau has asked to use the Fifth Edition as a base in their gravity mapping of the world. Part of their process will involve digitizing the contours of GEBCO and they will provide a copy of the magnetic tape containing information sufficient to replot the contours. The Canadian Hydrographic Service will keep this tape and copy it at the request and expense of the scientific community. This tape should be available by mid-1983.

Term of Reference #3

Out of 25 responses, 13 favour handling ADB in a manner similar to the 1:1 million scale bathymetric plotting sheets through the Volunteering Hydrographic

Offices (H.O.), while 5 responses favour establishment of an International Data Centre (I.D.C.). There were several organizations that did not reply to this question. There are 12 organizations experienced in ADB (Australia, Canada, Chile, Denmark, Finland, France, Federal Republic of Germany, Spain, U.S.A., U.K., Scripps Institute of Oceanography, Woods Hole Oceanographic Institute), 10 are in favour with handling ADB through the Volunteering H.O.'s, 1 favours the establishment of an I.D.C. and 1 did not comment.

Some argumentsin favour of handling digital data through the Volunteering H.O.'s are; that the resources devoted to the establishment of an international data centre might better be spent on strengthening already existing national data centres; also, the funding of an international data centre could be difficult, and the great differences in technological resources of the potential supporting countries would probably result in compromises of data handling procedures that were satisfactory to no one.

The information service, which indexes what data is available, where, and from whom, is a valuable service presently provided by the IHB. This service should be augmented to include the data available in digital form. For some time into the future, both graphical data and digital data will be part of the world-wide data base for bathymetry. The concerns of those states that may never get involved in digital bathymetry might be allayed provided that the organizations involved in digital bathymetry would make graphical plots of digital data on request as one source of data exchange. (Data exchange between organizations involved in digital bathymetry could take the form of magnetic tapes and/or graphical plots.)

At the same time, expanding co-operation and communication between all of the nations interested in an up-to-date directory of bathymetry data, could lead to improvements in; the maintenance procedures; the quality control process;

and the methods of data display, given the increased potential of computer processes. There is a vast amount of data which lie outside the Hydrographic Offices and it should be incumbent upon them to seek and incorporate this data into their area of responsibility.

Recommendation

It is recommended that the existing catalogue of bathymetric data maintained by the IHO be expanded to include a central directory of bathymetric data which is in digital format.

24.09.81

	ARGENTINA	AUSTRALIA	CANADA	CHILE	DENMARK	FINLAND	FRANCE	GERMANY (FED REP.)	INDIA	INDONESIA	JAPAN	MONACO	NETHERLANDS	NEW ZEALAND	PAKISTAN	PORTUGAL	SOUTH AFRICA (REP OF)	SPAIN	SWEDEN	TURKEY	U S S R	U K	U S A	SCRIPPS INSTIT OF OCEANOGRAPHY	WOODS HOLE OCEANOGR INST
Is your organization interested in ADB ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Is ADB practical as a long term aim ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	No	Yes	Yes	Yes		Yes	Yes	Yes	No
Have you made policy decisions regarding the introduction of ADB ?	No	Yes Hobart	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Not yet		Yes	Yes	Not yet	Yes	No	Yes		Yes		Yes	Yes		
Is there an identified section responsible for ADB ?	Yes	Yes	Yes C.H.S.	Yes CENDOC	Yes Hydrog. Depart.	Yes EPSHOM	Yes	Yes	Yes	Yes	No		Yes	Yes	No	Yes	No	Yes	Yes	Yes		Yes	Yes DMAHTC		
Do you intend to expand ADB activities in near/distant future ?	Near future	Near future	Near future	Distant future	Yes	Near future	Near future	Near future	Near future	Near future	Near future		Not certain	Near future	Near future	Near future	No	Near future		Near future		Near future	Near future		
Should ADB be handled by volunteering H.O.'s or an International Data Center ?	H O	H.O.	H.O.	H O		H O	H.O.	IDC withheld	H O	H.O.	H O		IDC	IDC	IDC	IDC	IDC	H O		H O		H O	H O		H.O.
Would an IDC cause duplication with national organizations ?	Yes	Yes initially	Yes	Yes		Yes	Yes	No	Yes	Yes	No comment		No	No	No	No	Yes			No		Yes	Yes		
Are you now acquiring ADB data ?	No	Yes in future	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes Experimental		No	Yes	No	Beginning		Yes	No	No		Yes	Yes External sources		Yes
On what medium is the data stored ?		Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape & disk	Magnetic tape	Magnetic tape	Cards, magnetic and punched tapes					Magnetic tape						Punched cards	Magnetic tape		N/A Log
What is the annual acquisition rate ?		3000	3000	15 K	250 h	400 K	None yet	500 K	None yet	Very little												Test data 250 K	1 million		
Do you convert analog records into computer processible in digital bathymetry ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not yet	Yes						Yes						No	Yes		Yes
Is there much delay between acquisition and recording into computer processible medium?	Little	No delay	Little	Yes	1 week	1 year	Little	No delay		Yes													1 month		
Do you cooperate in ADB with other national or international organizations ?	No	Yes National	Yes Both	No	Yes International	Yes	Yes National	Yes National		No						Yes International						No	Yes Both		Yes
What is the primary medium for storage of your ADB ?		Magnetic tape	Magnetic tape	Cards & magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape & disk	Magnetic tape							Magnetic tape						Magnetic tape	Magnetic tape		Magnetic tape
What is the system of file identification ?		Project, ship, date	Data base and files	UTM	Depth and geog. coord.	Area, year ship	Area, ship, time, country	Ship, area data	Not developed							Ship, area						Ship, year, days, time	Chart No.		
Are the data sorted into geographical areas ?	Yes	Yes	Yes	Yes UTM	Yes	Yes	Yes	No								No						No	Yes		
What data is now available for exchange ?	None	None	Limited areas	None	None	None	None	None								None						None	25 multibeam p.s.		
Is auxiliary information stored in each file ?	Yes	Yes	Yes	No	No	No	Yes	No								Yes						No	Yes		
Is there provision for editing and updating the stored data files ?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes								Yes						Yes	Yes		
Specify system of quality control .	Manual comparison	Manual comparison	Quality PBS and manual	Manual process	Complicated	Computer and manual	Manual comparison of lines	Manual process								Manual comparison						Manual and computer comparison	Manual comparison		
How long to search your complete file ?	Don't know	Don't know	Seconds at times		Don't know	1 minute 2 hours	Seconds at time	1 hour								Don't know						Don't know	4-8 hours		
Is it possible to search soundings within a specified geographical area ?	Yes	Yes	Yes	Yes UTM	Yes	Yes	Yes	Yes								Yes						Yes	Yes		
How many persons can search files simultaneously ?	One	One	Multi	One	One	One	One	Two								One						One	One		
Is the output available as : a/ Hard-copy listings ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes								Yes						Yes	Yes		
b/ Profiles along track ?	Yes	Yes	Not yet	No	Yes	Yes	Yes	No								No						No	No		
c/ Areal posting of soundings ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No								No						Not yet	Not yet		
d/ Machine contoured plots ?	No	Yes	Not yet	Not yet	Yes indirectly	Not yet	Not yet	Yes								Not yet						Yes	No		
Is the output used directly in automatic cartography ?	No	Yes	Not yet	Not yet	Yes	Not yet	Not yet	Yes								Not yet						Yes	No		

No BATHYMETRIC SERVICE

No Experience

No experience yet

No Experience

JOINT IOH-IOC GUIDING COMMITTEE FOR GEBCO

Sub-committee on Digital Bathymetry

QUESTIONNAIRE

To be returned by 30 April 1979 direct to Dr Loncarevic, with copy to IHB (see addresses at end of questionnaire).

Note: In this questionnaire automatic digital acquisition, storage, retrieval and display of bathymetric information is shortened to Automatic Digital Bathymetry (ADB).

Member State: _____

Date of Reply: _____

Reference No: _____

Section I - General

1. Is your o_ganization at the present time interested in ADB?

2. Do you consider that ADB is practical as a long term aim?

3. Have you made any policy decisions yet with regard to the introduction of ADB?

4. Is there an identified section in your organization responsible for ADB?

5. Do you consider that ADB should be handled in a manner similar to the 1:1 million bathymetric plotting sheets (through the volunteering H.Os) or should ADB be the responsibility of an international data centre?

7. Would the establishment of an international Data Centre lead to duplication of effort with national organisations?

8. Comments:

Section II - Acquisition

1. Are you now acquiring ADB data? Please specify format.

2. In what medium is the data recorded?

3. Please specify equipment used.

4. What is the annual acquisition rate? (number of data records)

5. Do you convert data acquired (now or in the past) on conventional echo-sounder records into computer processible digital bathymetry?

6. Please briefly describe procedures and equipment used.

7. Is there much delay between acquisition and recording in computer processible medium?

8. Are you cooperating in ADB with other national or international organizations (or groups) : please specify.

Section III - Storage

1. What is the primary medium for storage of your ADB (cards, punched tape, magnetic tape, microfilm, disc, etc)?

2. What is the format of data storage? (please give an example of data record)

3. What is the system of file identification? (by ship, by project, by area, year, etc)

4. Are the data sorted into geographical areas?

5. What data is now available for exchange?

6. Is auxiliary information stored in each file (eg instruments, reduction velocity, accuracy, etc)?

7. Is there any facility for editing and updating the stored data files?

8. Please specify system of quality control.

Section IV - Retrieval and Display

1. How long does it take to search your complete file?

2. Is it possible to search for soundings in a specified geographical area?

3. How many users can search the files simultaneously?

4. Is the output available as:
   a) Hard-copy listings
   b) Profiles along the track
   c) Areal posting of soundings for hand contouring
   d) Machine contoured plots

5. Is the output used directly in automatic cartography?

Section V - General Comments (use extra sheet if necessary) (please include any comments or suggestions on future GEBCO policy with respect to ADB)

One copy each to:

a) Dr B D LONCAREVIC
Chairman
Sub-Committee on Digital Bathymetry
(GEBCC)
Bedford Institute of Oceanography
P O Box 1006
DARTMOUTH NS
Canada B2Y 4A2

b) International Hydrographic Bureau
7 avenue President J F Kennedy
MC MONTE CARLO
(Principality of Monaco)

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of Unesco)

REPORT BY A SUB-COMMITTEE OF THE JOINT IOC-IHO GUIDING COMMITTEE FOR THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO) ON THE TECHNICAL ASPECTS RELATING TO THE IMPLEMENTATION OF THE DRAFT CONVENTION ON THE LAW OF THE SEA (ARTICLE 76)

80-81/WS/41

TECHNICAL ASPECTS RELATING TO THE IMPLEMENTATION OF THE DRAFT CONVENTION ON THE LAW OF THE SEA (ARTICLE 76)

A report by a Sub-Committee of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO)

Introduction

At its seventh session (6-8 October 1980)(1), the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO) formed a Sub-Committee on Technical Problems relating to the Draft Convention on the Law of the Sea (2), with the following terms of reference -

The Sub-Committee is to :

1. Identify technical problems which may arise in the application of Article 76 of the Draft Convention;
2. Evaluate and provide advice on the training and education facilities needed in order to enable coastal States to build up a cadre of marine geologists and geophysicists, and hydrographic surveyors, of high calibre, who will be able to provide the expertise needed in this field;
3. Report to the GEBCO Officers meeting scheduled for April 1981.

The extension of the rights of coastal States to the resources of the seabed and its subsoil beyond the outer limit of the Exclusive Economic Zone (EEZ) to include the natural prolongation of its land territory requires a definition of the outer edge of the legal Continental Shelf. Article 76 of the Draft Convention (see Annex I) defines the Continental Shelf in terms of both geodetic and geologic concepts.

The procedure by which a coastal State establishes the limits of its continental shelf beyond the 200 n.m. EEZ is laid down in paragraphs 8 and 9 of Article 76, in which reference is made to a Commission on the Limits of the Continental Shelf to be set up in accordance with the provisions of Annex II of the Draft Convention (see Annex II of this report). Article 3, paragraph 2 of this Annex authorises the Commission to co-operate 'to the extent considered necessary and useful, with the Intergovernmental Oceanographic Commission of Unesco, the International Hydrographic Organization and other competent international organizations with a view to exchanging scientific and technical information which might be of assistance in discharging the Commission's responsibilities.'

In April 1980, the United Nations Under Secretary-General, Special Representative of the Secretary-General to the Third United Nations Conference on the Law of the Sea, wrote to both a Director of IHO and the Secretary IOC as follows : "it would ... be helpful if the IOC and IHO Secretariats could begin to identify potential key elements in the co-operation and assistance they might be able to provide such a Commission (the Commission on the Limits of the Continental Shelf) and its Secretariat. It would seem relevant, for example, to take account of the technical expertise and methods adopted for the development of the General Bathymetric Chart of the Oceans. I make special mention of this joint IOC/IHO programme in view of the valuable services already rendered to the Conference by GEBCO experts. Any examination of future needs may also have to take account of the situation with respect to available specialized training in the marine geosciences and hydrography." (see Annex III).

In response to this approach and after considerable discussion during which it was decided that it was inappropriate for the GEBCO Guiding Committee to assume any role in the interpretation of Articles in a legal document, this Sub-Committee was appointed with the terms of reference given above. In referring to 'technical problems', these are viewed not as problems relating to the text itself but to hydrographic and geological aspects which will arise in coastal States in obtaining the technical data and other material needed for submission to the Commission on the Limits of the Continental Shelf, and in the interpretation of such technical data and other material by that Commission (ref: Draft Convention Annex II, Article 3 - Annex II of this report).

The necessary expertise to address these problems lies in the links with national hydrographic services maintained by the International Hydrographic Organization, and with the marine geoscience community maintained by the Intergovernmental Oceanographic Commission. The collaboration of these two intergovernmental bodies in the preparation of a world bathymetric chart (GEBCO) provides a suitable forum for consideration of these problems.

In addition to this GEBCO Sub-Committee, an ad hoc Task Team has been created by the Intergovernmental Oceanographic Commission 'to study the present or any future text developed by the Third UN Conference on the Law of the Sea, with a view to identifying the functions set forth in that text which the IOC is competent to perform or which may be the subject of a possible future request.' (ref: IOC resolution EC-XIII.16 - in Annex IV).

The Sub-Committee recommends that this report be placed before the above ad hoc Task Team as a working document, for use as it sees fit and incorporation as considered desirable in any report it may make to the Executive Council of the IOC at its fourteenth session.

I TECHNICAL PROBLEMS IN THE IMPLEMENTATION OF ARTICLE 76 OF THE DRAFT CONVENTION ON THE LAW OF THE SEA

Each coastal State which intends to establish the seaward boundary of its continental shelf beyond the 200 n.m. exclusive economic zone is required to submit particulars of such boundary to the Commission (on the Limits of the Continental Shelf) along with supporting scientific and technical data (ref : Draft Convention Annex II, Article 4 - Annex II of this report).

Most elements required for the establishment of this seaward boundary will require the application of the standard techniques of hydrographic surveying. Some will require additional interpretation of data obtained by such standard surveying techniques. A few will require the use of geophysical techniques not commonly used by hydrographers but extensively used by geophysical surveyors in the search for hydrocarbons, and also possibly of deep sea drilling.

In general, it is considered that provision of advice to coastal States and to the Commission on the Limits of the Continental Shelf, on the delimitation and identification of the following limits and seabed features, fall within the competence of the International Hydrographic Organization and the Intergovernmental Oceanographic Commission, and in particular, the expertise of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO).

Several criteria for the establishment of the outer limits of their continental shelves by coastal States are given in Article 76 of the Draft Convention (2). Certain of these are distance criteria which can be determined either

cartographically or computationally from the boundaries from which they are to be measured. In this exercise, attention must be paid to the delineation of 'straight lines' on the curved surface of the earth, especially when these may be long as 100 n.m., and the appropriate chart projections used, if they are established cartographically. This problem is discussed in more detail in IHO document 'Commentary on Technical Provisions in Section 1 of Part II, and some related Articles, of the Informal Text of the Draft Convention' (3).

1. Baselines Although the establishment of baselines is not discussed in Article 76, they are an essential starting point for the definition of the continental shelf. They shall be determined according to Articles 5, 6, 7, 9, 10, 11, 13 and 14 in Section 2 of Part II and Article 47 in Part IV of the Draft Convention.

   A prerequisite for such determination is firstly the establishment to a sufficient degree of accuracy of the absolute geographical position of the coastline, and secondly, an adequate quantitative description of the tidal regime. These will enable the baselines to be delineated on the appropriate large-scale charts, using standard nautical surveying techniques.

2. The foot of the continental slope (Art. 76, para. 4(b))

   If the continental margin extends beyond 200 n.m., the outer limit of the continental shelf is referred to the 'foot of the continental slope', which can consist of straight line segments connecting points not more than 60 n.m. apart. The sub-paragraph referred to above states 'In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change in gradient at its base.' A coastal State will therefore have to acquire, by the use of precision deep echo-sounding equipment, profiles of the continental slope approximately orthogonal to the regional trend of the continental margin.

   Bearing in mind the small-scale features of the continental slope (submarine canyons, sediment drifts, fault blocks, slumps, etc.), the average of a number of slope profiles will be required in order to establish the regional position of the foot of the continental slope. Procedures will need to be developed to determine from these smoothed profiles 'the point of maximum change of gradient at its base'.

3. The 1% sediment thickness line (Art. 76, para. 4(a)(i))

   The coastal State can choose to determine the outer edge of its continental margin 'by reference to the outermost fixed points at each of which the thickness of sedimentary rocks is at least one per cent of the shortest distance from such point to the foot of the continental slope'. Profiles of sediment thickness can be determined by the technique of seismic reflection profiling combined with seismic refraction data. Reflection profiling determines the time for sound to penetrate the sediments and be reflected back by basement rocks. To convert the time interval to a true thickness of sediments, the velocity of sound at all depths in the sediment has to be determined and this is commonly done by the seismic refraction method.

   However there are many difficulties with these techniques especially in the interpretation of the basement, or base of the sediments. Layers of hard (lithified) sediment, intrusions of sills into the sediments or lava extrusions on top of the older sediments, and inversions of velocity gradients within the sediments, can complicate the interpretation of seismic data.

The nature of the basement rocks themselves may be massive volcanic basalt, fractured volcanic debris (breccia) or ash (tephra), or they may be fractured, subsided or altered blocks of continental rocks resulting from the initial rifting of continents and thus containing older sedimentary rocks. The thickness of sedimentary rocks at a point can only be established unequivocally by drilling through them. To date, only about 700 such holes have been drilled in oceanic depths throughout the world.

As the formula in paragraph 4(a)(i) refers to sediment thickness as a percentage of distance from the foot of the continental slope, it follows that the greater this distance, the greater the sediment thickness needed to qualify for inclusion in the continental margin. Thus sediment thickness profiles orthogonal to the regional trend of the continental margin will be necessary in order to maximise a claim.

4. The 2,500 metre isobath (Art. 76, para. 5)

To determine this isobath, it will be necessary to survey the region using precision echo-sounding techniques. In establishing the depth from the time interval recorded on the echo-sounder, the variations of sound velocity in sea water will have to be taken into account.

5. Submarine ridges (Art. 76, para. 6)

The identification of those submarine ridges to which the provisions of this clause will apply will require a full understanding of the usage, by hydrographers and marine geoscientists, of the terms for 'submarine elevations that are natural components of the continental margin, such as its plateaux, rises, caps, banks and spurs'.

II TRAINING AND EDUCATION FACILITIES NEEDED

Background

The Secretariat of the Third UN Conference on the Law of the Sea, following up on a suggestion made by the Chairman of the First Committee of the Conference and a brief discussion that ensued in that Committee, prepared a document entitled 'Manpower Requirements of the Authority and related Training Needs'(4) which was submitted to the resumed eighth session of the Conference, New York, 19 July - 24 August 1979.

The document states inter alia : 'According to the provisions of part XIV of the ICNT (now the Draft Convention on the Law of the Sea), the Authority will be required to furnish technical assistance to developing countries, to promote and conduct marine scientific research, and to facilitate information exchange on marine science and technology', and also : 'While the requirements of the Authority and enterprise call for special focus on education and training in deep sea mineral development, the Authority would also become involved with more general training programmes in marine science and technology and marine affairs.'

The document recalls that 'A report to the United Nations Sea Bed Committee, entitled 'Study on international machinery'(5), listed training as one of the five main functions for the future body, noting that ocean-based industries would require a variety of specialists in a wide range of basic scientific disciplines as well as in many engineering fields and that there was a world-wide weakness in most of these professions, particularly in deve-

loping countries.', and continues 'Organizations of the United Nations system continue to stress that scarcity of manpower resources is the chief limiting factor to the development of national efforts and international co-operation as regards the study of the oceans and the rational use of their resources, and to urge that marine education and training programmes be strengthened, whether by increasing allocations for study grants, fellowships and training courses, or by increasing the assistance States provide for the development of national and regional programmes and facilities. Emphasis is increasingly placed on the importance of national commitment to peaceful marine science and technology training and on efforts which create or promote public awareness of the oceans and their resources.'

More recently, the United Nations General Assembly adopted resolution A/RES/35/116 (dated 19 January 1981) which inter alia requests the Secretary-General

> 'in his capacity as Secretary-General of the Conference, to prepare and submit to the Conference (on the Law of the Sea) at its tenth session, for such consideration as it deems appropriate, a study identifying :
>
> (a) the future functions of the Secretary-General under the draft Convention; and
>
> (b) the needs of countries, especially developing countries, for information, advice and assistance under the new legal regime.'

The study is being prepared with the participation of the different departments of the United Nations Secretariat which have contributed to the substantive Secretariat of the Conference.

The Special Representative of the Secretary-General (to the Third U.N. Conference on the Law of the Sea) has stated on more than one occasion that the practical implementation of many aspects of the future Convention on law of the sea will require the close co-operation of every agency and intergovernmental body within the UN system that has within its terms of reference any of the different aspects of the uses of the sea and the rational management of its resources.

It is likely that the demands from Governments for information and assistance will increase substantially and that the different members of the UN family will have to make great efforts to meet this new challenge (6).

Transfer of knowledge and information exchange

Most aspects within the competence of the Intergovernmental Oceanographic Commission and the International Hydrographic Organization of transfer of knowledge and information exchange, particularly those in the field of marine science and technology, including hydrography, have been covered in two documents :

i) The IHO. These may be found in 'Training and Technical Assistance in Hydrography'(7);

ii) The IOC. These have been remarked upon in the document 'Outline of a Comprehensive Plan of Major Assistance to enhance Marine Science Capabilities of Developing Countries' (in preparation).

The Sub-Committee has therefore confined itself in this report to those aspects of this problem which fall within the competence of the GEBCO Guiding

Committee and which can possibly be solved, or to which a contribution can be made to their solution, by the expertise which has been built up over the years by the present joint IOC-IHO project.

Coastal States having limited expertise in these fields will have to reach early decision on the ways and means whereby they might implement the provisions of the Draft Convention on the Law of the Sea to their optimum benefit.

Each coastal State which intends to establish the seaward boundary of its continental shelf beyond the 200 n.m. exclusive economic zone, will have to take into account the provisions of Annex II, Article 4 of the Draft Convention (see Annex II of this report) which states that the 'coastal State concerned shall submit particulars of such boundary to the Commission (on the Limits of the Continental Shelf) along with supporting scientific and technical data as soon as possible but in any case within 10 years of the entry into force of this Convention for that State.'

Initially, depending on numerous factors, in particular the cost of such undertakings and the availability of existing national structures and trained manpower, each such coastal State will have to decide whether it intends to : i) undertake the work itself; or ii) place contracts for the work to be carried out either by commercial undertakings or by countries which do have the necessary skills.

In either case, there will be a requirement in each such coastal State for a cadre of marine geologists and geophysicists, and hydrographic surveyors, of high calibre, who will have sufficient qualifications and expertise to enable them to have a full understanding of the technical problems involved in obtaining the supporting scientific and technical data needed for its submission to the Commission, quite apart from any subsequent exploitation of the resources which may exist on its continental shelf.

Training for marine geoscientists and hydrographic surveyors is currently available in a wide variety of organizations, academic, commercial and government, throughout the world (8), although none at present, so far as is known, is dedicated solely to the purpose of the implementation of the technical content of the proposed Convention on the Law of the Sea.

GEBCO International Geoscience Unit

In 1975, the Secretary IOC, acting on the recommendation of the GEBCO Guiding Committee, prepared an application to the United Nations Development Programme (UNDP) for support for a GEBCO International Geoscience Unit, to be colocated in Ottawa with the Canadian national geoscience mapping division of the Canadian Hydrographic Service. The reason for this choice of location was that the sheets of the GEBCO (5th Edition) are scribed, printed and published by the Canadian Hydrographic Service (at Canadian government expense), and the Canadian government had offered to host a GEBCO International Geoscience Unit and bear all administrative support and overhead costs on condition that the unit was so colocated. The proposed unit had a training component which had been designed to meet certain of the stated needs of the UN Conference on the Law of the Sea (as then foreseen); it was supported fully by the Conference Secretariat.

It may be worthwhile to recall at this stage, in view of its relevance to the recommendations of this Sub-Committee, that the proposed GEBCO International Geoscience Unit was described in the application as an integral part of the

GEBCO project as a whole. The request was for a sum of $130,000 per year for five years (1976-80), whilst counterpart contributions in kind were assessed as 'well over three quarters of a million dollars per annum, plus considerably larger unseen costs for the provision of ship time for the collection of bathymetric data, provided by numerous member states of both the IHO and IOC.' These contributions were (and still are) made by 19 member States and a number of international Agencies. The application was rejected. A number of other attempts to raise funds for this purpose also proved unsuccessful.

The Sub-Committee considers that failure tc find the necessary funding for the GEBCO International Geoscience Unit has resulted in a great loss of opportunity and consequent lack of preparedness by many countries for the tasks that they will wish to undertake for their own benefit once the Convention on the Law of the Sea has come into force.

It should be reiterated once again that within the framework of the Guiding Committee for GEBCO, there rests a specific competence that is highly relevant to the scientific needs that have become of increasing importance to coastal States as a result of the Third U.N. Conference on the Law of the Sea, and that this and another similar project sponsored by IOC (the International Bathymetric Chart of the Mediterranean) are unique within the United Nations system.

Because of this competence, the Guiding Committee is considered to be the most appropriate existing group to supervise either a unit similar to the proposed GEBCO International Geoscience Unit or any small geoscience units that may be established as components of any overall training structure that may be developed. Such units constituted within the overall structure could also provide all the necessary technical servicing support that will be needed by the Commission on the Limits of the Continental Shelf.

Courses at such units could initially be specifically tailored to meet the requirements of the small number of coastal States wishing to establish the seaward boundary of their continental shelves beyond the 200 n.m. exclusive economic zone, and would cover inter alia the topics discussed in Section I of this report. The content of such training courseswould depend on the basic qualifications of the participants but, to be of any value, each course would have to last at least 2-3 months and consist of no more than 10-12 participants. These particular courses will be a limited requirement. They could be followed by (or be coincident with) courses with a wider scope providing training in basic geological and geophysical survey methods and techniques falling within the competence of the Guiding Committee for GEBCO.

The staff proposed for the GEBCO International Geoscience Unit would allow some 60-70 persons to be given this limited training per year. It is stressed that such courses would be supplementary to, and would in no way replace, longer qualifying courses leading to degrees in marine science, and qualifications in hydrographic surveying, at universities and at the various establishments listed in IHO Special Publication no. 47.

Funding

Whilst it is not considered to be the task of the Sub-Committee to assess the detailed costs of the proposed GEBCO International Geoscience Unit, it has been estimated that there would be three main cost headings, for which funds would have to be guaranteed before such a unit could be established. Staff (6 professionals and supporting staff); Overheads and administrative support; and Trainigg awards for course participants. At present day prices such a unit would cost about $1 million a year.

During the Third UN Conference on the Law of the Sea, the delegation of the United Kingdom suggested that, immediately following signature of the Convention, a provisional training fund should be established, financed by voluntary contributions, to provide training awards for qualified students in disciplines identified as being relevant to the needs of the Authority and the Enterprise.(9)

References

1. Summary Report of the seventh session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), Monaco, 6-8 October 1980 (doc. IOC-IHO/GEBCO-VII/3), item 7 Provision of Technical Support in response to the requirements of the Third UN Conference on the Law of the Sea, including training and education activities.

2. Draft Convention on the Law of the Sea (Informal Text) - (doc. A/CONF.62/WP.10/Rev.3* dated 22 September 1980).

3. Commentary on Technical Provisions in Section 1 of Part II, and some related Articles, of the Informal Text of the Draft Convention (on the Law of the Sea)-(IHO ref: S1/4011).

4. Manpower Requirements of the Authority and related Training Needs. Preliminary report of the Secretary-General (doc.A/CONF.62/82 dated 17 August 1979).

5. Study on international machinery (doc. A/AC.138/23) - also issued as Annex III to 'A report to the United Nations Sea-Bed Committee' (doc. A/8021).

6. Extract from a 'Statement by Mr J.P. Lévy, on behalf of Mr Bernardo Zuleta, Under-Secretary-General, Special Representative of the Secretary-General, to the first session of the IOC Scientific Review Board (doc. IOC/SRB-I/3 Annex IV).

7. Training and Technical Assistance in Hydrography (IHO Special Publication No. 47 dated January 1980).

8. Marine Affairs : Register of Courses and Training Programmes (UN publication no. ST/ESA/54).

9. Reports of the 115th and 116th plenary meetings of the Third UN Conference on the Law of the Sea (docs. A/CONF.62/SR.115 and 116).

Extract from the Draft Convention on the Law of the Sea (Informal Text)
(doc. A/CONF.62/WP.10/Rev.3* dated 22 September 1980)

PART VI. CONTINENTAL SHELF

Article 76
Definition of the continental shelf

1. The continental shelf of a coastal State comprises the sea-bed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.

2. The continental shelf of a coastal State shall not extend beyond the limits provided for in paragraphs 4 to 6.

3. The continental margin comprises the submerged prolongation of the land mass of the coastal State, and consists of the sea-bed and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof.

4.(a) For the purposes of this Convention, the coastal State shall establish the outer edge of the continental margin wherever the margin extends beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured by either :

(i) A line delineated in accordance with paragraph 7 by reference to the outermost fixed points at each of which the thickness of sedimentary rocks is at least 1 per cent of the shortest distance from such point to the foot of the continental slope; or

(ii) A line delineated in accordance with paragraph 7 by reference to fixed points not more than 60 nautical miles from the foot of the continental slope.

(b) In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change in the gradient at its base.

5. The fixed points comprising the line of the outer limits of the continental shelf on the sea-bed, drawn in accordance with paragraph 4(a)(i) and (ii), either shall not exceed 350 nautical miles from the baselines from which the breadth of the territorial sea is measured or shall not exceed 100 nautical miles from the 2,500 metre isobath, which is a line connecting the depth of 2,500 metres.

6. Notwithstanding the provisions of paragraph 5, on submarine ridges, the outer limit of the continental shelf shall not exceed 350 nautical miles from the baselines from which the breadth of the territorial sea is measured. This paragraph does not apply to submarine elevations that are natural components of the continental margin, such as its plateaux, rises, caps, banks and spurs.

7. The coastal State shall delineate the seaward boundary of its continental shelf where that shelf extends beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured by straight lines

not exceeding 60 nautical miles in length, connecting fixed points, such points to be defined by co-ordinates of latitude and longitude.

8. Information on the limits of the continental shelf beyond the 200 nautical mile exclusive economic zone shall be submitted by the coastal State to the Commission on the Limits of the Continental Shelf set up under Annex II on the basis of equitable geographical representation. The Commission shall make recommendations to coastal States on matters related to the establishment of the outer limits of their continental shelf. The limits of the shelf established by a coastal State on the basis of these recommendations shall be final and binding.

9. The coastal State shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data, permanently describing the outer limits of its continental shelf. The Secretary-General shall give due publicity thereto.

10. The provisions of this article are without prejudice to the question of delimitation of the continental shelf between adjacent or opposite States.

Annex II

Extract from the Draft Convention on the Law of the Sea (Informal Text)
(doc. A/CONF.62/WP.10/Rev.3* dated 22 September 1980)

ANNEX II

Commission on the Limits of the Continental Shelf

Article 1

In accordance with the provisions of article 76 of Part VI of this Convention, a Commission on the Limits of the Continental Shelf beyond 200 nautical miles shall be established in conformity with the following articles.

Article 2

1. The Commission shall consist of 21 members who shall be experts in the field of geology, geophysics or hydrography, elected by States Parties to this Convention from among their nationals, having due regard to the need to ensure equitable geographical representation, who shall serve in their personal capacities.

2. The initial election shall be held as soon as possible but in any case within 18 months after the date of entry into force of this Convention. At least three months before the date of each election, the Secretary-General of the United Nations shall address a letter to the States Parties, inviting the submission of nominations after appropriate regional consultations, within three months. The Secretary-General shall prepare a list in alphabetical order of all persons thus nominated, and shall submit it to all the States Parties.

3. Elections of the members of the Commission shall be held at a meeting of States Parties convened by the Secretary-General at United Nations Headquarters. At that meeting, for which two thirds of the States Parties shall constitute a quorum, the persons elected to the Commission shall be those nominees who obtain a two-thirds majority of the votes of the representatives of States Parties present and voting. Not less than three members shall be elected from each geographical region.

4. The members of the Commission shall be elected for a term of five years. They shall be eligible for re-election.

5. The State Party which submitted the nomination of the member shall defray the expenses of a member of the Commission while such member is in performance of Commission duties. The relevant coastal State shall defray the expenses incurred in respect of the advice referred to in article 3, paragraph 1(b). The secretariat of the Commission shall be provided by the Secretary-General of the United Nations.

Article 3

1. The functions of the Commission shall be:

(a) to consider the data and other material submitted by coastal States concerning the outer limits of the continental shelf in areas where those limits extend beyond 200 nautical miles, and to make recommendations in accordance with article 76 of Part VI of this Convention;

(b) to provide scientific and technical advice, if requested by the coastal State concerned, during the preparation of the data referred to in sub-paragraph (a).

2. The Commission may co-operate, to the extent considered necessary and useful, with the Intergovernmental Oceanographic Commission of UNESCO, the International Hydrographic Organization and other competent international organizations with a view to exchanging scientific and technical information which might be of assistance in discharging the Commission's responsibilities.

Article 4

Where a coastal State intends to establish, in accordance with article 76 of Part VI of this Convention, the seaward boundary of its continental shelf beyond 200 nautical miles, the coastal State concerned shall submit particulars of such boundary to the Commission along with supporting scientific and technical data as soon as possible but in any case within 10 years of the entry into force of this Convention for that State. The coastal State shall at the same time give the names of any Commission members who have provided it with scientific and techical advice.

Article 5

Unless the Commission decides otherwise, the Commission shall function by way of sub-commissions composed of seven members, appointed in a balanced manner taking into account the specific elements of each submission by a coastal State. Nationals of the coastal State making the submission who are members of the Commission and any Commission member who has assisted a coastal State by providing scientific and technical advice with respect to the delineation shall not be a member of the sub-commission dealing with that submission but has the right to participate as a member in the proceedings of the Commission concerning said submission. The coastal State which has made a submission to the Commission may send its representatives to participate in the relevant proceedings without the right to vote.

Article 6

1 The sub-commission shall submit its recommendations to the Commission.

2. Approval by the Commission of the recommendations of the sub-commission shall be by a majority of two thirds of the Commission members present and voting.

3. The recommendations of the Commission shall be submitted in writing to the coastal State which made the submission and to the Secretary-General of the United Nations.

Article 7

Coastal States shall establish the seaward limits of the continental shelf in conformity with the provisions of article 76, paragraph 8, of Part VI of this Convention and in accordance with the appropriate national procedures.

Article 8

In the case of disagreement by the coastal State with the recommendations of the Commission, the coastal State shall, within a reasonable time, make a revised or new submission to the Commission.

Article 9

The actions of the Commission shall not prejudice matters relating to delimitation of boundaries between States with adjacent or opposite coasts.

IOC/INF-460
Annex III

UNITED NATIONS NATIONS UNIES

THIRD CONFERENCE ON THE LAW OF THE SEA

TROISIEME CONFERENCE SUR LE DROIT DE LA MER

15 April 1980

Dear Mario,

The Law of the Sea Conference has introduced some changes and additions to its Informal Composite Negotiating Text which hold particular importance for the joint activities of the IOC and the IHO. I refer to Article 76 and Annex II of the ICNT/Rev. 2 establishing a Commission on the Limits of the Continental Shelf. The Plenary debate held towards the end of the first part of the Ninth Session on the question of effecting this second revision of the ICNT clearly showed broad support for the establishment of such a Commission of experts.

Since the new Annex II provides for cooperative arrangements between the IOC and the IHO and the Commission, and since such specific reference to international organizations has not been the practice of the Conference in the ICNT, it is most appropriate that this new development is brought to the attention of the bodies concerned. At the same time, it should be noted that Annex II requests the Secretary-General of the United Nations to provide the Secretariat for this Commission. Servicing arrangements also would therefore be expected to take account of the co-operation and assistance that could be provided by the IOC and the IHO.

As you are aware, the Secretary-General attaches great importance to the contribution the United Nations system should be able to make to the effective implementation of the Convention in the future, and thus to the need for a careful examination of the institutional implications of the provisions the Conference has drafted. Although, as you will have noted, the provisions of Annex II would not begin to take effect until at least 10 years after entry into force, it would nonetheless be helpful if the IOC and IHO Secretariats could begin to identify potential key elements in the cooperation and assistance they might be able to provide such a Commission and its Secretariat. It would seem relevant, for example, to take account of the technical expertise and methods adopted for the development of the General Bathymetric Chart for the Oceans. I make special mention of this joint IOC/IHO programme in view of the valuable services already rendered to the Conference by GEBCO experts. Any examination of future needs may also have to take account of the situation with respect to available specialized training in the marine geosciences and hydrography.

I would like to suggest also that the marine geosciences and hydrographic communities, through IOC and IHO be encouraged to examine the other provisions of the Conference that call for extensive charting of marine areas. The development of the necessary expertise in hydrography, including nautical charting and baseline delimitation, will be a major undertaking for many developing countries and may require new efforts in education, training and institution-building by the IOC and the IHO. All such questions will clearly need to be included in an examination of the institutional implications of the future Convention for the United Nations system.

The IOC Executive Council meeting will give us the opportunity to examine some of these questions more closely and I look forward to a most interesting exchange of views.

Yours sincerely,

Sd/-

Bernardo Zuleta
Under Secretary-General
Special Representative of the Secretary-General
Third UN Conference on the Law of the Sea

(Note by the GEBCO Sub-Committee on Technical Problems relating to the Draft Convention on the Law of the Sea:
The letter sent to Rear Admiral D.C. Kapoor, Director IHO is identical but dated 16 April 1980).

Mr. Mario Ruivo
Secretary, Intergovernmental Oceanographic Commission
c/o UNESCO
Place de Fontenoy
F75700 PARIS
France

IOC Resolution EC-XIII.16

THIRD UN CONFERENCE ON THE LAW OF THE SEA

The Executive Council,

Noting the progress that the Third UN Conference on the Law of the Sea has made in developing a comprehensive Convention on the Law of the Sea,

Recognizing that the present Informal Composite Negotiating Text (Rev.2) developed by the Third UN Conference on the Law of the Sea proposes that the Intergovernmental Oceanographic Commission, in co-operation with IHO, provide assistance in the identification of the outer limits of the continental shelf,

Further recognizing that the present informal text contains several functions that the IOC is competent to perform,

Noting also that the scientific terminology used in the present informal texts of the Law of the Sea treaty merits close examination,

Decides that the Chairman, Secretary and appropriate officers of the IOC should represent the Commission at future sessions of the Conference with the same mandate as set forth in Annex III of document IOC/EC-VIII/3;

Accepts, in principle, the possible responsibility of providing assistance in the identification of the outer limits of the continental shelf as set forth in the present Informal Composite Negotiating Text developed by the Third UN Conference on the Law of the Sea, and directs the Secretary to undertake an examination of the implications of such possible assistance and, in co-operation with IHO, to start examining how this could best be accomplished;

Requests the Secretary to examine the scientific terminology used in the Informal Composite Negotiating Text (Rev.2) of the Law of the Sea, to assist the Drafting Committee of the Third UN Committee on the Law of the Sea in the drafting of the various language texts and to convey his views to the Chairman of that Committee;

Decides to create an ad hoc Task Team to meet in the future, if necessary, to study the present or any future text developed by the Third UN Conference on the Law of the Sea with a view to identifying the functions set forth in that text which the IOC is competent to perform or which may be the subject of a possible future request;

Instructs the Task Team to complete this study prior to the fourteenth session of the Executive Council.

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RECOMMENDED FUTURE ACTIVITIES OF THE JOINT IOC-IHO GUIDING COMMITTEE FOR GEBCO AFTER 1982

1. CONTINUATION ACTIVITIES

(a) Revision of the GEBCO Fifth Edition

It should be noted that further support from the Canadian Hydrographic Service, after April 1982, will be confined to amendments to the black plate (ie names, spot depths, etc) when sheets are taken in hand for reprinting.

Although highly desirable, it is not considered practicable that contours on sheets of the Fifth Edition be updated by the incorporation by "patching in" of newly contoured areas based upon new data. Apart from the very real considerations of cost involved, the major objection lies in the fact that each sheet of the Fifth Edition is a highly personalised product, representing the subjective attitude of the compiler towards interpretation of the data available in relation to his/her ideas on the structure and tectonic evolution of a particular area of ocean floor. This consideration is bound to present any other geoscientist with problems which extend beyond the area for which revised contours have been compiled.

(b) Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features

It is strongly recommended that this Sub-Committee be invited to continue with membership unchanged to assist and advise the Guiding Committee and GEBCO sheet compilers.

(c) Sub-Committee on Digital Bathymetry

It is recommended that this Sub-Committee be retained in order to provide expert advice to the IHO-IOC community on matters relating to automated digital bathymetry.

(d) Sub-Committee on Technical Problems Relating to the Draft Convention of the Law of the Sea

This sub-committee will undoubtedly be called upon in the future for expert advice and it should be retained for an indefinite period.

(e) Advice on Bathymetry of the Oceans

Requests for advice on the bathymetry of the oceans will continue to be requested by Intergovernmental and Non-Governmental Organizations since the GEBCO Fifth Edition is recognised as being the most modern and reliable contoured representation of bathymetric data available for the foreseeable future. Users already identified are the Commission for the Geological Map of the World, Circum-Pacific Map Project, IOC International Geological/Geophysical Atlases of the Atlantic and Pacific Oceans. The digitized contours on magnetic tape will be particularly useful for response to scientists who require bathymetric charts with scales, projections or sheet limits which differ from those of the GEBCO. One identified example is a bathymetric chart of sectors of the Southern Oceans extending from Antarctica to Latitude 30°S.

In addition, IOC has proposed that the Joint Guiding Committee assume responsibility for preparation of special bathymetric charts on larger scales, such as the International Bathymetric Chart of the Mediterranean (1 : 1 million) or areas of special interest or study (eg western Indian Ocean, Caribbean, etc).

2. NEW ACTIVITIES

(a) GEBCO Sixth Edition

Production of the GEBCO Sixth Edition must remain the top priority objective of the Joint Guiding Committee. The new logistic and financial arrangements necessary for commencement of this project should be attainable after about five years of concerted effort. Compilation, review, production and publication will occupy a further five years at least. A final deadline for completion of the Sixth Edition should be set not later than 1995.

Essential prerequisites will be (i) the creation of the GEBCO International Marine Geoscience Unit and (ii) reliable arrangements for draughting, printing and publication of each sheet. The alternative to (i) is to follow the GEBCO Fifth Edition example of inviting carefully chosen marine geoscientists to accept responsibility (and a deadline!) for compilation of individual sheets according to GEBCO specifications and procedures. The alternative to (ii) is to find an organization as competent as the Canadian Hydrographic Service, supported by a generous government.

(b) GEBCO International Marine Geoscience Unit

As originally conceived, the GEBCO International Marine Geoscience Unit was intended to be the vehicle for compilation of bathymetric contours for each sheet of the GEBCO under the overall supervision and control of the Guiding Committee. Its other important function was to serve as a training facility for marine geoscientists from developing countries.

Using Annexure VI (Part II, Training and Education Facilities needed) as a guide to formulation of updated proposals, and in close consultation with the UN Secretariat for the Law of the Sea, the Guiding Committee should assign top priority to securing the necessary funds to establish and maintain a GEBCO International Marine Geoscience Unit as an effectively viable group. It is important that the Unit be housed in an organization where considerable expertise and activity relating to morphological charting of the ocean floor is at hand.

(c) Smaller Scale Bathymetric Charts

It is recommended that the Joint Guiding Committee give attention to the desirability of publishing smaller scale reductions of the 1 : 10 million series, the costs being recovered from sales. Two such proposals have been made in the past; one for a single wall map (eg 3m x 2m) covering the whole world, the other for three sheets covering the Atlantic, Indian and Pacific Oceans on a scale of 1 : 25 million.

The Joint Guiding Committee should also investigate ways and means of introducing the GEBCO Fifth Edition into educational publications such as wall maps, as above, and atlases, with the added advantage of greatly enhanced publicity and sales income.

(d) Preparation of Overlays

As is the case with topographic maps on land, the GEBCO Fifth Edition provides an excellent base chart which will lend greater significance to charts showing parameters which are directly or indirectly related to sea-floor morphology or vice versa. This can be achieved by the construction of transparent overlays to be used in conjunction with (or overprints on) the GEBCO sheets (or vice versa). It is noted that the IOC-sponsored IBCM Disciplinary Group on Overlay Sheets in Marine Geology and Geophysics is already preparing overlay sheets showing gravity, magnetics, top Messinian, thickness of post-Messinian, geological parameters, earthquake epicentres, etc, on the same scale and projection as the International Bathymetric Chart of the Mediterranean (1 : 1 million).

These and many other parameters (biological, physical, chemical as well as geological/geophysical) are candidates for the preparation of GEBCO overlay sheets. It is however recommended that the preparation of such overlay series be supervised by small planning or working groups co-sponsored by the GEBCO Guiding Committee and other appropriate agencies.

IOC resolution EC-XIV.16

GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

The Executive Council,

Having received the report of the Seventh Session of the Joint IOC/IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO) held in the headquarters of the International Hydrographic Organization, Monaco, 6-8 October 1980, and

Having heard the verbal report of the Permanent Secretary GEBCO on the second meeting of the GEBCO Officers, Ottawa, 13-15 April 1981,

Accepts the above-mentioned reports and expresses its pleasure on learning that the main task of the Guiding Committee - publication of a full world cover of bathymetric charts, the GEBCO 5th Edition, in eighteen sheets - will reach completion in 1982.

Noting, however, that there are a number of continuing tasks for which a joint guiding committee will be necessary: e.g., the preparation of overlays (or overprints) of other parameters; maintenance of the master sounding sheets; provision of expert advice on hydrographic, geological and geophysical matters; the use of the digitized tapes of the GEBCO 5th Edition contours; publicity and sales,

Decides, subject to the concurrence of the International Hydrographic Organization, to transfer responsibility for all the Commission's activities in the field of "Morphological Charting of the Sea-Floor" to a reconstituted GEBCO Guiding Committee;

Invites the GEBCO Guiding Committee to prepare proposals for amending the composition of the Guiding Committee to meet these tasks, and Revised Terms of Reference, for consideration by the Executive Council at its Fifteenth Session;

Instructs the Secretary to collaborate closely with the International Hydrographic Bureau on the preparation of proposals for a new structure for the Joint Guiding Committee and revised Terms of Reference for the Committee with a view to placing these before the Twelfth Session of the Assembly (November 1982) for adoption.