Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes

Hamburg, Federal Republic of Germany, 16-20 October 1989

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In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of «El Niño» *(Also printed in Spanish)*
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping *(Also printed in French and Spanish)*
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica *(Spanish only)*
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources *(Also printed in French and Spanish)*
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities *(Also printed in Spanish)*
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of « El Niño » *(Also printed in Spanish)*
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN (OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes

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IOC-WMO/IGOSS-XBT-III/3
Paris, 22 December 1989
English only

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* For reports on national activities and technical reports presented at this Meeting, please see Document IOC/INF-804.

1. ORGANIZATION OF THE MEETING

1.1 OPENING OF THE MEETING

1 The Third Session of the Joint IOC-WMO Meeting for Implementation of the Integrated Global Ocean Services System (IGOSS) XBT Ship-of-Opportunity Programmes was opened by Dr. Yves Tourre, Chairman of the Joint IOC-WMO Committee for IGOSS, at 10:00 a.m., 16 October 1989, at the Deutsches Hydrographisches Institut, Hamburg, Federal Republic of Germany. Professor Dr. Koopmann, Vice-President of the DHI, welcomed the participants on behalf of the Institute and wished them a pleasant and productive stay in Hamburg.

2 Dr. Y. Tourre presented a brief summary of the accomplishments made within IGOSS over the intersessional period:

3 Dr. Y. Tourre emphasized the importance of the meeting as a forum for co-ordinating platforms which measure the sub-surface thermohaline structure of the oceans. Requirements are increasing as existing networks become operational and future research efforts are developed. The recently approved IGOSS Plan and Implementation Programme provides a comprehensive description of the means to meet these challenges through 1995.

4 Value-added applications derived from data transmitted in real-time are many. For example, global analysis of sub-surface conditions will permit : (i) rapid comparison with global circulation simulations; (ii) scientific analysis of different parameters from gridded values available on electronic networks; (iii) establishment of regional maps and indices for fisheries, weather, transportation, and shipping; (iv) improved weather and climate predictions with different temporal and spatial scales (one of the ultimate IGOSS goals).

5 Dr. Tourre noted that advancements in automated data acquisition systems together with the proposed IGOSS-IODE Global Temperature-Salinity Pilot Project, should stimulate the insertion of TESAC reports onto the GTS.

6 Many Member States are preparing products and analyses using IGOSS data and Dr. Tourre noted that an "IGOSS Products Bulletin" is in the planning stages. A Seminar/Workshop on IGOSS Products is being organized for 1991, prior to the Sixth Session of the Joint IOC-WMO Committee for IGOSS, when the first draft of this document should be ready for consideration. Dr. Tourre asked for the continued support of all the participants in expanding present IGOSS efforts and capabilities.

7 Dr. Carl Berman, IGOSS Operations Co-ordinator, on behalf of the IOC, and Dr. Michael Krasnoperov, Scientific Officer, on behalf of the WMO, welcomed the participants and thanked the Government of the Federal Republic of Germany for hosting the meeting and providing the excellent conference facilities.

8 The List of Participants is given in Annex II of this Report.

1.2 ELECTION OF THE CHAIRMAN

9 Prof. Dieter Kohnke of the Deutsches Hydrographisches Institut was nominated as Chairman by the Representative of Chile. The nomination was seconded by Representatives from Australia, Canada and France and the Meeting unanimously supported the nomination.

1.3 ADOPTION OF THE AGENDA

10 The Agenda, as adopted by the Meeting, is reproduced in Annex I.

1.4 WORKING ARRANGEMENTS

11 The Meeting adopted the work programme proposed by the local secretariat and agreed to adjust it as necessary, including the establishment of drafting groups to address specific questions. This meeting was held in conjunction with the WOCE VOS Committee.

2. REQUIREMENTS FOR SUB-SURFACE THERMAL DATA

12 The discussion on Agenda Item 2 was opened by Prof. Kohnke.

2.1 TROPICAL OCEAN GLOBAL ATMOSPHERE (TOGA) PROGRAMME

13 The Report of the First Session of the TOGA XBT ad hoc Panel of Experts (Document ITPO No.3), Noumea, New Caledonia, 31 May-1 June 1989, was presented by Ms. Valery Lee of the International TOGA Programme Office. The goals of the TOGA XBT Programme remained the same for the second half of TOGA as they were for the first half, namely to contribute to a basic monitoring network designed to provide:

(i) a description of the space and time variations of the tropical upper ocean;

(ii) inputs for testing and verification of tropical ocean models; and

(iii) data for timely initialization of predictive coupled ocean-atmosphere models.

The TOGA XBT sampling strategy for the second half of the programme should allow for both the continuation of time series analysis of transequatorial sections and also the broad-scale mapping of thermal structures. Recognizing that ocean models tend to have much higher spatial and temporal resolution than the sampling scales derived from optimal interpolation (OI) studies, the TOGA Numerical Experimentation Group will carry out simulations to determine if an alternate sampling plan would result in an improved ocean model analysis.

14 In support of time series analysis and mapping studies, the First Session of the TOGA XBT ad hoc Panel of Experts recommended two basic rates of sampling based on the decorrelation scales for the tropical Pacific and Indian Oceans identified by Meyers et al., (1989), which are: meridional scales of three degrees of latitude, zonal scales of fifteen degrees of

longitude, and temporal scales of two months. The Panel recommended that all lines in the network should be sampled at a minimum of two observations per decorrelation scale: once every degree and a half of latitude, once every five degrees of longitude, twelve times per year. The Panel identified a subset of the TOGA lines as priority 1, and recommended that these lines should be sampled at a rate of three observations per decorrelation scale: once every degree of latitude and once every five degrees of longitude, eighteen times per year. The Panel suggested some priorities for sampling in the Atlantic, but advised that the Atlantic strategy be revised upon completion of the study being carried out under the direction of R. Molinari at NOAA AOML in Miami. The Panel identified a subset of lines, particularly in the western part of the basins, which should be sampled to at least 750 metres.

15 The Panel estimated the number of observations required annually to sample the network, based on the OI strategy, to be: Pacific, 12,500, Indian Ocean, 6,070; Atlantic, 3,540, for a total of 22,110. Based on an average success rate of 75%, this would require 29,400 probes annually. The Panel noted that the "pool" of XBTs currently available to TOGA met less than 50% of this requirement, and urged the TOGA Operations and Management Committee to take action to increase the number of probes available.

2.2 WORLD OCEAN CIRCULATION EXPERIMENT (WOCE) PROGRAMME

16 The WOCE programme was presented by Dr. Robert Molinari, Chairman of the WOCE Voluntary Observing Ship Committee.

17 The World Ocean Circulation Experiment (WOCE) is an internationally co-ordinated study designed to observe the ocean circulation over a five-year period. Included in the WOCE objectives are the collection of data to improve numerical models of the ocean and to design long-term ocean monitoring arrays for climate studies. Observations to be taken during WOCE include those by satellite altimetry and scatterometer, CTD, chemical tracers, surface and subsurface floats and current meters. Volunteer observing ships are an important component of the WOCE observational strategy. The objectives of the VOS programme are listed in Annex III to this document. Two types of sampling have been proposed to meet the VOS objectives; a low-density and a high-density sampling mode. These modes are described in Annex III. A third sampling strategy, the broadcast mode, will be added to the first two modes to recognize sampling which may not be along repeat lines. This mode includes sampling from research vessels, fishing fleets, etc. and is implemented to acknowledge this important source of data. Design strategy studies have been completed in the tropical and northern sub-tropical Pacific to define the low-density VOS grid. The expected coverage is shown in figures 1 and 2 of Annex III, and represents an extension of the TOGA and TRANSPAC grids. The high density sampling lines are shown in figure 3. Additional effort is required to define the South Pacific sampling requirements. Design studies for WOCE are now underway in the Atlantic and Indian Oceans. Pending completion of these studies, tentative VOS tracklines have been proposed for each basin. The Atlantic Ocean lines are given in figure 4; the Indian Ocean lines are given in figure 5. The VOS goals of WOCE are closely linked to those of IGOSS and TOGA. It is important that these groups continue to co-ordinate their efforts in order to maximize the return from VOS resources.

2.3 OPERATIONAL ACTIVITIES

18 The IGOSS Operations Co-ordinator reported on the activities of this office during the intersessional period which saw Carl Berman replace John Withrow in the position.

19 These activities included missions to Chile, to assess the status of marine meteorology and oceanographic data exchange between organizations in that country, and to Kenya, to evaluate personnel and facilities available for a proposed long-term course in marine meteorology and physical oceanography to be presented at the Regional Meteorological Training Centre (RMTC), Nairobi.

20 Other missions involved travel to Leningrad for the International Meeting of Experts on Southern Ocean Hydrometeorology Information Collection and Distribution, the United States for the Joint IGOSS-IODE Meeting (US), and attendance, as an observer, at the Antarctic Treaty Meeting in Paris.

21 The IOC Secretariat continued its commitment to support the IGOSS ship-of-opportunity managers and is gradually assuming the role of global distribution centre for ideas, problems, and other items which require worldwide attention. To this end, the Co-ordinator's office assumed responsibility for pertinent activities in the Southern and Indian Oceans in order to be more fully informed on the status of these regions.

22 In addition to the climate-related requirements for IGOSS data for TOGA, WOCE, JGOFS, etc., many operational requirements for real-time data are being identified. In this regard, the Meeting noted that the upcoming International Symposium on Operational Fisheries Oceanography would be an important focuss for the identification of fisheries requirements for IGOSS type data.

23 See Agenda Item 3.6 for further information on the role of the IGOSS Operations Co-ordinator.

2.4 JOINT GLOBAL OCEAN FLUX STUDY (JGOFS)

24 Since there was no representative from this programme present, it was not possible to determine the exact nature of their future requirements regarding ocean thermal structure. However, when these prerequisites are formulated in detail, the present IGOSS Service and Ship-Management structure will be in place and has the capability to expand in order to serve their needs as has already been demonstrated in the case of TOGA and WOCE programmes. The IGOSS Coordinator will establish lines of communication with knowledgeable individuals participating in JGOFS so that the IGOSS community will have advance notice of their needs.

2.5 CURRENT SITUATION IN DATA SPARSE REGIONS (INDIAN AND SOUTHERN OCEANS, INCLUDING THE ANTARCTIC)

25 The lack of data from the Southern Oceans continues to be a problem within the IGOSS community. As noted elsewhere, this difficulty is due more to a lack of resources (notably XBT probes) than to a shortage of

willing participants. In spite of this situation, Mauritius, with assistance from France, has initiated a line in the Indian Ocean and has plans to occupy an additional line and deploy a series of drifting buoys in the Tropical Cyclone Belt.

26 The Meeting noted that the participation of representatives from Chile, Argentina, and the Soviet Union would help to open lines of communication encourage participation in IGOSS, not only through ships-of-opportunity, but also through the insertion onto the GTS system of data collected in Antarctic waters.

27 Member States wishing to provide platforms for observations in the Southern Oceans may find that gatherings such as the Ship-of-Opportunity Managers Meeting provide the person-to-person contact necessary to locate possible sources of equipment and an interested audience to which they can address their requests for assistance.

3. SHIP-OF-OPPORTUNITY ACTIVITIES; PRESENT AND FUTURE

3.1 STATUS OF EXISTING OPERATIONAL LINES

28 Prof. D. Kohnke introduced this Agenda Item and presented documents IOC-WMO/IGOSS-XBT-II/3 and IOC/INF-731 which included reports of existing ship-of-opportunity XBT programmes.

3.2 PLANNED AND PROPOSED LINES

29 Reports were submitted by Representatives of the following Member States: Argentina, Australia, Canada, Chile, France (ORSTOM Brest, ORSTOM Nouméa), Federal Republic of Germany, Japan, USSR, United Kingdom and the USA (NOAA, Navy Fleet Numerical Oceanography Center, Scripps Institution of Oceanography). The text of these reports appears in Document IOC/INF-804.

3.3 STANDARDIZATION OF VARIOUS LINE NUMBERING SCHEMES

30 A proposed XBT line numbering scheme was submitted by Ms. Valery Lee, International TOGA Project Office, that combined the present TOGA numbering of the Pacific, the WOCE numbering in the Atlantic, and the IGOSS numbering in the Indian Ocean.

31 The Meeting, which included members of the Committee for WOCE VOS, adopted the proposal, as shown in Annexes VII and VIII, and used an "X" in each new number to distinguish an XBT line from any other type of ocean measurement line. The IGOSS Operations Coordinator will develop a comprehensive list and an appropriate map showing these routes, for circulation to all managers. He will also serve as the focal point for assignments of new numbers. Note was made that ships may have multiple numbers if transitting more than one route. Those ships without a regular route -i.e., research vessels, tramp steamers, etc.- will have no number.

3.4 SAMPLING STRATEGIES

32 The participants agreed that the present Meeting was not a forum in which sampling strategies for scientific programmes could be formulated. However, the Meeting agreed that present and future efforts involving ships-of-opportunity should design their sampling schemes in ways that took advantage of every available platform and extracted the maximum amount of information from every probe expended.

33 It is well-known that resources, especially the XBT probes themselves, represent a static or, perhaps, dwindling equipment pool. Sampling strategies should take note of this situation and ensure that all those who have an interest in the data have access to information which is collected, avoiding wasteful duplication of effort.

3.5 POSSIBLE ADDITIONAL DATA SOURCES

34 The Meeting noted with interest the widening use of mini-CTD equipment which facilitates the collection of salinity data from vessels of opportunity. There is an increasing requirement throughout the oceanographic community for thermohaline structure information and the CTD provides a means of meeting this need. However, since it is sometimes necessary to calibrate this equipment at the end of each cruise, in order to ascertain the accuracy of the measurements, it is not always possible to enter appropriate TESAC messages onto the GTS in real-time.

35 The Meeting agreed that all participants should take steps to not only increase the amount of salinity data collected within their respective national systems but also to insure that observations presently being recorded on a regular basis become available once the appropriate quality control measures have been applied. To facilitate this process, Canada offered software capable of formatting a TESAC message from mini-CTD measurements to any interested party.

3.6 MANAGEMENT OF THE SHIP-OF-OPPORTUNITY PROGRAMME INCLUDING DATA FLOW MONITORING AND COMMUNICATIONS

36 The Meeting exercised its prerogatives in order to improve the flow of information and to facilitate its processing within the network of ship-of-opportunity managers and between this group and the IGOSS Operations Co-ordinator. The following practices were adopted.

(i) A standard format for the monthly ship visit report was proposed by J. P. Rebert (ORSTOM Brest). This format was endorsed by the participants and will be used to report on ships-of-opportunity which are visited each month by the managers or their representatives. This report will continue to be sent to the IGOSS Operations Co-Ordinator via electronic mail (the new format appears in this document as Annex IV).

(ii) In order to get a more accurate picture of monthly GTS activity, the Meeting decided that the present status report, which provides a listing of messages inserted onto and received from the GTS by the major communications centres, be transmitted by either electronic mail or

facsimile to the IGOSS Operations Co-ordinator in Paris. The IOC Secretariat will then combine the separate contributions into a single report and distribute the result, again, via electronic mail or facsimile, to the reporting centres and other interested parties. Back-up copies will continue to be distributed through the mail.

(iii) Due to the increasing importance of IGOSS to all international scientific programmes, the Meeting decided to change the title of the present IGOSS electronic mailing list from "IGOSS.TOGA.XBT" to "IGOSS.XBT" and include the International Programme Office for WOCE as a subscriber to the new listing.

(iv) Dr. Alexander Sy (DHI, FRG) created, for his own use, a Ship-of-Opportunity Logistic/Activity Inventory. This document, which was presented to the Meeting, contained all the pertinent information describing a particular ship participating in the ship-of-opportunity programme. Everything from ship's name, callsign, and equipment configuration to the name and phone number of the agent was included. This document is given as an example in Annex V to this Report.

37 The Meeting agreed that this type of inventory, if kept current, would be a valuable management tool and asked that each ship-of-opportunity manager create such an inventory for the vessels under his control and that a master volume of all the separate catalogs would be kept at the IOC Secretariat in Paris. The WOCE/VOS Committee agreed to utilize the information and inventory scheme described above.

38 Preliminary statistics concerning real-time data transmissions by ships-of-opportunity were presented by the TOGA sub-surface data centre.

39 The Meeting agreed that data centres which have easy access to VOS data should prepare and distribute statistics useful for VOS management on a global basis.

40 The Meeting recognized, in particular, the necessity to know how well the TOGA, IGOSS and WOCE standard lines are being sampled relative to the successful requirements expressed in the TOGA XBT ad hoc Panel of Experts Report or other such reports.

41 The subject of data communication losses provided a source of serious concern among the participants. It was recognized that unacceptable data losses were taking place throughout the IGOSS Telecommunication Arrangements (ITA). This problem could be described in two areas: (A) the individual national communications systems used to gather the data prior to insertion on the GTS and (B), within the GTS itself.

42 The Meeting agreed that previous data monitoring exercises had indicated instances of excessive data loss but had not provided information sufficient to determine the reasons for lost data. It was obvious, however, that the losses could be attributed to a variety of causes.

43 In order to help correct this situation, the Meeting agreed to conduct an additional monitoring experiment within the next six months (by the close of April, 1990) to: (i) determine national data transmission

problems as opposed to GTS data loss difficulties (see attached format, Annex VI), and (ii) to submit the results to national contacts responsible for communication integrity within the various national services and to international representatives responsible for GTS functions.

44 WMO telecommunication personnel will be asked to assist in this effort in order to apply their expertise to the solutions of problems which fall within their area of responsibility.

45 In view of its importance, it was agreed that future announcements and reminder of upcoming IGOSS data monitoring exercises would be provided to Members through telemail/facsimile by the IGOSS Operations Co-ordinator. Appropriate announcements of the results of such exercises, and the availability of other important IGOSS reports, would be made available via the same mechanism.

4. EQUIPMENT

4.1 DEFICIENCIES IN EXISTING SYSTEMS, INCLUDING COMMUNICATIONS

4.2 STANDARDIZATION

46 These Agenda Items were presented by Prof. D. Kohnke and he noted that many of the items discussed here had already been noted in conjunction with previous agenda items. They will be presented as a unit.

47 Mr. M. Szabados, Dr. A. Sy, Mr. P. Rual and Mr. R. Bailey made presentations regarding observed differences between simultaneous XBT and CTD observations. Three possibilities were discussed regarding this discrepancy.

(i) An error in the coefficients in the fall rate equation published by Sippican.

(ii) An error caused by the inability to properly calibrate the thermistors in the XBT probes.

(iii) No acclimitization of the XBT probes prior to launch.

Copies of these presentations are attached in Document IOC/INF-804.

48 Noting that extensive co-ordination will be required to conduct a scientifically rigorous examination of the problem, and that the NOAA National Ocean Service of the United States was assigned the task of preparing a comprehensive report of the problem by the TOGA Ad Hoc Panel of Experts, the Meeting asked the IGOSS Task Team on Quality Control for Automated Systems to assist in the formulation of procedures and implementation of the tests. The Meeting also recommended that the tests be conducted as soon as possible in as many locations as possible, especially in cold water regions and the Indian Ocean. The Meeting recommended that no changes be made to the fall rate equation prior to resolution of the differences and internationally accepted solution adopted.

49 The "bowing" problem was discussed and it was noted that this problem is limited to one particular system of which there are approximately 30 units in operation. Mr. R. Bailey (CSIRO) tabled results of his study of the problem. Several possibilities were discussed and the focus of concern was the controller board. This problem was also referred to the Task Team on Quality Control for Automated Systems for examination.

50 The Meeting expressed concern over the low success rate of XBTs launched from the bridge wings that are high above the surface of the water.

4.3 INFORMATION ABOUT NEW DEVELOPMENTS (XCTD, etc.)

51 A total of five vendors presented information on products available or under development:

52 Mr. J. Hannon of Sippican, Inc. (USA) described the status of development of the expendable conductivity, temperature and depth (XCTD) profiling system by Sippican Corporation. A series of 250 at-sea comparisons have been made between cable-lowered CTDs and XCTDs. Sippican requested assistance from Meeting participants in further testing. A need exists for testing the XCTD in deep water with dynamic structure. Sippican will provide XCTDs and XBTs for a limited number of ships going to sea with CTD systems on board. The Meeting expressed interest in participating and expressed gratitude to Sippican Corp. for its assistance in these test and evaluation activities. Australia, Canada, France (ORSTOM-Nouméa) and the Federal Republic of Germany will co-operate in the testing and will make results available to Sippican Corp. Commercial production of XCTDs is to begin in November 1989.

53 Sippican is also preparing for testing a single-purpose card for insertion into a personal computer that would replace the XBT controller. They are also considering the use of remote launchers, telemetering the data from the stern to the bridge. Lastly, they are replacing the present styrofoam XBT containers with containers made of a biodegradable material.

54 Mr. J. Keogh of Sparton, Inc., Canada, indicated that they have been producing XBTs for two and a half years, including air-launched bathythermographs, T-4 probes and T-7 probes. They are also developing an XCTD, XBT processor, and a fiberoptics salinometer.

55 The latest information on the continuing development of the Sippican XCTD was presented by a representative of that organization. The company offered to supply XCTD probes and deck equipment without charge to any of the Member States, represented at the meeting, for the purposes of conducting CTD-XCTD comparisons in the different oceanic regions in which they operate. The company requested that all results be sent to them once the experiments were completed so that modifications to hardware and software, if any, could be designed and implemented.

56 Mr. T. Ueltzen of the Republic Group, USA, presented the products of three firms: STI, GSC and Sutron.

57 Mr. M. Stender of Nautilus Marine Services in Bremen, FRG, demonstrated an XBT controller programme now in use in the Federal Republic of Germany which transmits data via both GOES and METEOSAT.

58 Mr. C. Ortega of CLS/Service Argos, France, demonstrated the Argos version of XBT software and controller using the Argos satellite based communication link. This version is now in use on 22 vessels.

59 Prof. D. Kohnke informed the Meeting about the success aboard a number of vessels with a contact thermometer inside the ship's hull. The readouts of sea-surface temperature on the bridge are transmitted as TRACKOB messages on GTS. On board the "KOELN ATLANTIC", the readout of the contact thermometer is used as a reference value for XBTs and for marine meteorological reports.

4.4 PROPOSED SPECIFICATIONS FOR HARDWARE INNOVATION OR MODIFICATION

60 Mr. J. Withrow presented the Agenda Item noting that the Task Team on Quality Control for Automated Systems had addressed the setting of specifications on hardware. The decision of the Task Team was that it was not possible to set specifications on equipment as it inhibited the use of present equipment and the development of new equipment.

61 The Meeting considered the present development of XBT recording equipment and made the following recommendation for equipment innovation and modification:

(i) Development of a multiple XBT launcher to be located on the stern and controlled from the bridge. Efforts in this area by Japan, US Scripps Institute and US Sippican Corporation were noted.

(ii) VHF or other radio link between the deck on the bridge unit and the multiple launcher near the stern.

(iii) Development of an inexpensive acoustic doppler current profiling system that can be installed in conjunction with existing doppler speed systems to produce TESAC messages from current information.

5. DATA QUALITY

62 Mr. J. Withrow introduced this Agenda Item and presented the Report of the IGOSS Task Team on Quality Control for Automated Systems.

5.1 QUALITY CONTROL; AUTOMATED SYSTEMS ABOARD SHIP

63 Dr. A. Sy and Mr. P. Rual presented automatic quality control and filtering techniques to be used for processing XBT and CTD data prior to encoding for transmission. Concern was expressed by some participants that the data was being altered without the knowledge of the end user. The Task Team on Quality Control for Automated Systems was asked to examine this problem and present a report to the GE/OTA (see paper by Dr. A. Sy in Document IOC/INF-804).

5.2 QUALITY CONTROL: QUIPS SYSTEM AND OTHER SHOREBASED EQUIPMENT

64 Mr. P. Stevens opened this Agenda Item and presented the Report of the IGOSS Group of Experts on Operations and Technical Applications (GE/OTA). He briefed the Meeting on the QUIPS system and how it is integrated into the data processing system at FNOC. In response to query's from the participants, he pointed out that the QUIPS programme was available and had already been distributed to many countries. Unfortunately the programme was written in the "C" programming language that may make it difficult to install on some computers. Again the implementation of checks prior to insertion of data onto the GTS was questioned by some members of the meeting. The development of flags to mark data that had been modified was referred to the GE/OTA which is already considering the matter. The implementation of the BUFR code form with which QUIPS is compatible will permit the insertion of those flags.

5.3 QUALITY CONTROL PRIOR TO GTS INSERTION, MINIMUM REQUIREMENTS

65 Prof. D. Kohnke opened this Agenda Item and presented the second revised edition of IOC Manuals and Guides No. 3. He pointed out that a major revision was made in the quality procedures before data insertion onto the GTS. He asked the Member States to report on the status of implementation of these new procedures. The following countries reported that they were conforming with the minimum quality control standards: Australia (6 months), France, Federal Republic of Germany (6 months), USSR and USA. The Meeting urged that all Member States make every effort to conform with the new quality control procedures.

6. TEMA RELATED ACTIVITIES

6.1 PROVISION OF EQUIPMENT AND SPARE PARTS

66 The Meeting noted that the Southern and Indian Oceans continue to be areas in which data is difficult to obtain. This scarcity of information is not due to a shortage of willing participants but to a lack of appropriate equipment. As noted by the representative of Argentina (see Argentina's National Report), his country has two ships available for transits across the Southern Atlantic and Indian Oceans but is unable to take the necessary measurements. This is the case with many Member States.

67 Prof. D. Kohnke described his experiences at the Seminar on Partnership in Ocean Sciences and Services for Sustainable Development (Bremerhaven, FRG, 19-22 September 1989), in which the creation of international partnerships in scientific endeavours were proposed as a solution to situations such as the one faced by the IGOSS programme in the Southern Oceans. A nation or programme with a vital interest in data from the Southern Ocean would establish contact with authorities within Member States whose ships operate in these areas and provide them with the necessary equipment in return for the data from these platforms.

68 The Meeting suggested that a Joint IOC-WMO Circular Letter be prepared asking Members States to assist in the solution of this problem and that all other avenues of assistance be explored.

6.2 TRAINING ACTIVITIES

69 The Member States which contribute equipment to developing countries provide training together with this equipment. It was noted that such instruction was necessary for, once the invited expert has left the area, the local technician is left on his own to repair and maintain the equipment for which he is responsible. In addition, a statement was made that without a national "advocate" (i.e., a scientist or government official who is the driving force behind the IGOSS programme), interest often decreases after the first few months or the first serious equipment malfunction. It was suggested, therefore, that such persons be identified as a first step in augmenting Ship-of-Opportunity Programtme participation in a new region.

7. CLOSURE OF THE MEETING

70 Considering that ships-of-opportunity are only one type of platform now available and in use to collect ocean temperature and salinity data, the Meeting agreed that future sessions of this group will include co-ordination of not only ships-of-opportunity but other shipboard oceanographic observation activities.

71 The Meeting agreed that the next meeting will be held prior to the Sixth Session of the Joint IOC-WMO Committee for IGOSS in 1991.

72 Following the review and adoption of the Draft Summary Report, the Chairman thanked the participants for their contribution and co-operation.

73 The Meeting closed at 12.30 on Friday, 20 October 1989.

ANNEX I

AGENDA

1. **ORGANIZATION OF THE MEETING**

   1.1 OPENING OF THE MEETING
   1.2 ADOPTION OF THE AGENDA
   1.3 WORKING ARRANGEMENTS

2. **REQUIREMENTS FOR SUB-SURFACE THERMAL DATA**

   2.1 TOGA
   2.2 WOCE
   2.3 OPERATIONAL ACTIVITIES
   2.4 JGOFS
   2.5 CURRENT SITUATION IN DATA SPARSE REGIONS (INDIAN AND SOUTHERN OCEANS, INCLUDING THE ANTARCTIC)

3. **SHIP-OF-OPPORTUNITY ACTIVITIES; PRESENT AND FUTURE**

   3.1 STATUS OF EXISTING OPERATIONAL LINES
   3.2 PLANNED AND PROPOSED LINES
   3.3 STANDARDIZATION OF THE VARIOUS LINE IDENTIFICATION SCHEMES
   3.4 SAMPLING STRATEGIES
   3.5 POSSIBLE ADDITIONAL DATA SOURCES
   3.6 MANAGEMENT OF THE SHIP-OF OPPORTUNITY PROGRAMME INCLUDING DATA FLOW MONITORING AND COMMUNICATIONS

4. **EQUIPMENT**

   4.1 DEFICIENCIES IN EXISTING SYSTEMS, INCLUDING COMMUNICATIONS
   4.2 STANDARDIZATION
   4.3 INFORMATION ABOUT NEW DEVELOPMENTS (XCTD, etc.)
   4.4 PROPOSED SPECIFICATIONS FOR HARDWARE INNOVATION OR MODIFICATION

5. **DATA QUALITY**

   5.1 QUALITY CONTROL: AUTOMATED SYSTEMS ABOARD SHIP
   5.2 QUALITY CONTROL: QUIPS SYSTEMS AND OTHER SHOREBASED EQUIPMENT
   5.3 QUALITY CONTROL PRIOR TO GTS INSERTION, MINIMUM REQUIREMENTS

6. **TEMA RELATED COMPONENTS**

   6.1 PROVISION OF EQUIPMENT AND SPARE PARTS
   6.2 TRAINING ACTIVITIES

7. **CLOSURE OF THE MEETING**

ANNEX II

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ANNEX III

WOCE/VOS PROGRAMME

Dr. R. Molinari, Chairman of the WOCE/VOS Committee

The scientific objectives for the VOS programme are:

(i) to measure changes in the heat and salt content of the upper ocean on basin scales;

(ii) to estimate the statistics of the thermal field in the upper kilometre. In order to carry out unbiased sampling of the large-scale field and to assess the possible contribution of eddy processes in the general circulation, it is necessary to know the variance of the eddy field and the spatial and temporal covariances;

(iii) to observe the variations of large-scale geostrophic velocity in the upper kilometre and of the zonal and meridional fluxes of heat and salt on time-scales of seasons to years. This objective includes the observations of changes in the subtropical and subpolar gyre interior circulations, the boundary currents, the location of the gyre centres, and the tropical current systems.

There will be two modes of sampling from commercial ships. The first is an extension of the present TOGA and TRANSPAC-type XBT networks. The low density sampling of such networks will be extended to the middle and high latitude oceans. XCTDs should be included where T/S variability is large and the sampling depth should extend as nearly as possible to the base of the thermocline. This expansion will primarily be aimed at the measurement of heat and salt storage in conjunction with the TOGA heat storage measurement programme in the tropics.

In the second mode, sampling will be by high density (eddy-resolving) XBT/XCTD measurements along a subset of ship tracks. The high density sections will be used to determine spatial statistics of the temperature, salinity, and geostrophic velocity fields and to measure temporal changes in large-scale geostrophic velocity without aliasing effects from meso-scale features. The tracks will include:

(i) zonal tracks from coastline to coastline near the centre of the subtropical gyres and if possible near the centre of the subpolar gyres;

(ii) two or three meridional tracks crossing the equator and terminating at high latitudes;

(iii) a few additional tracks in the western oceans across the western boundary currents.

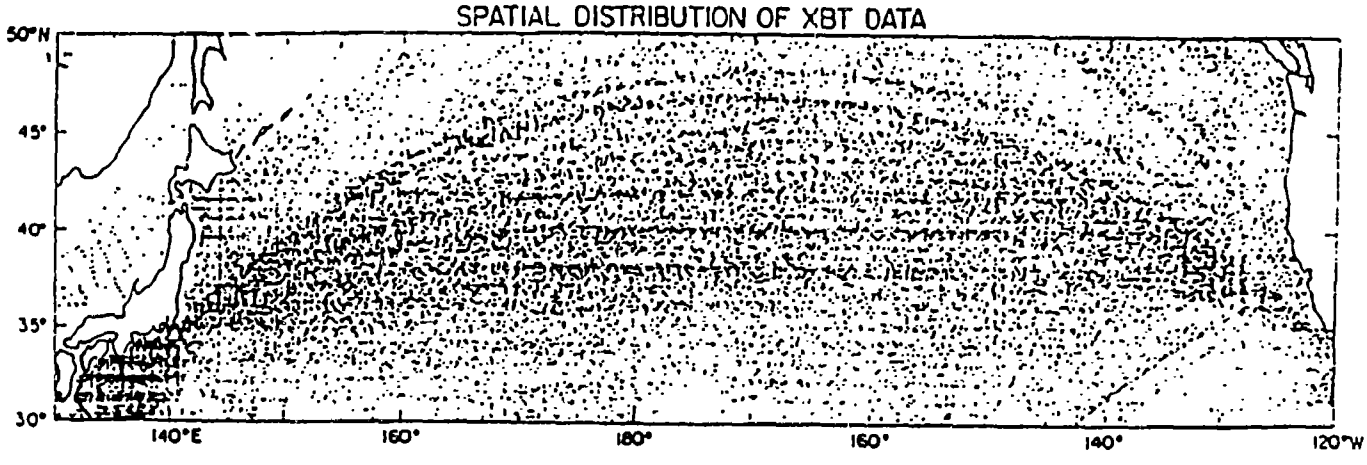


Fig. 1 The TRANSPAC Network in the Northern Pacific Ocean

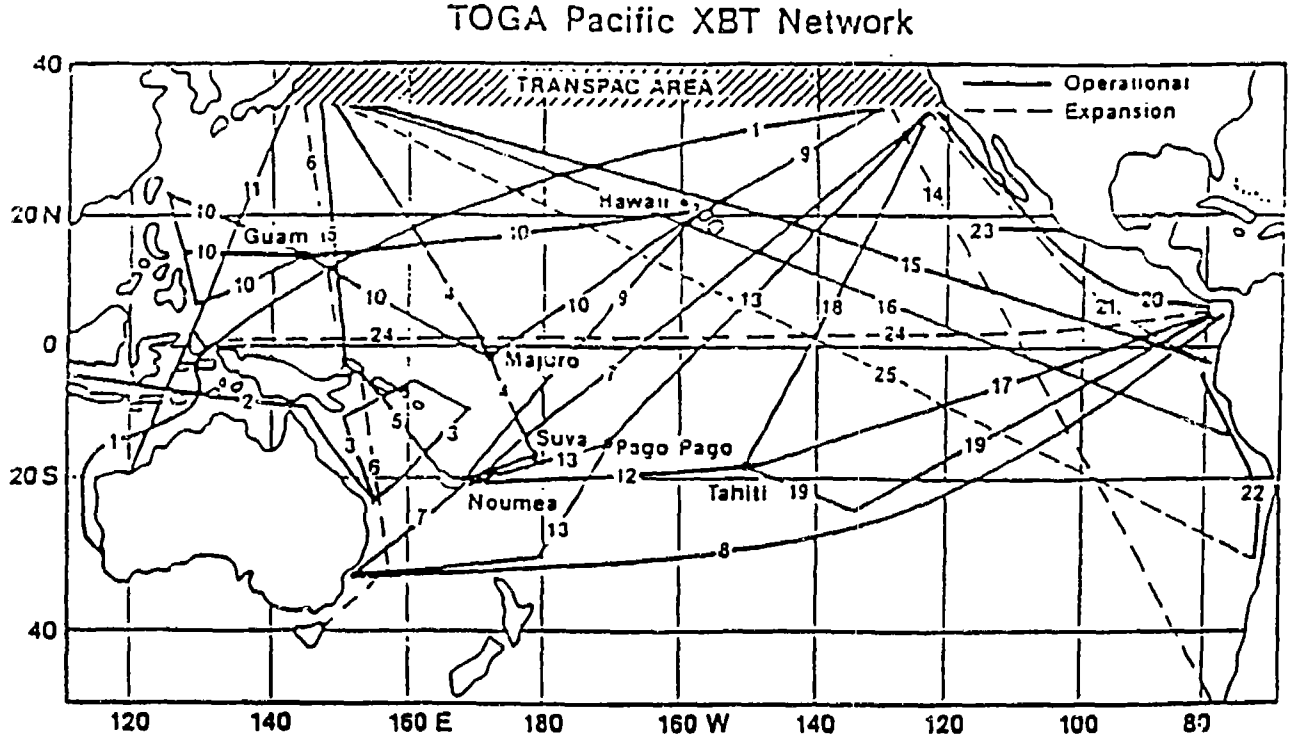


Fig. 2 The TOGA Pacific XBT Network

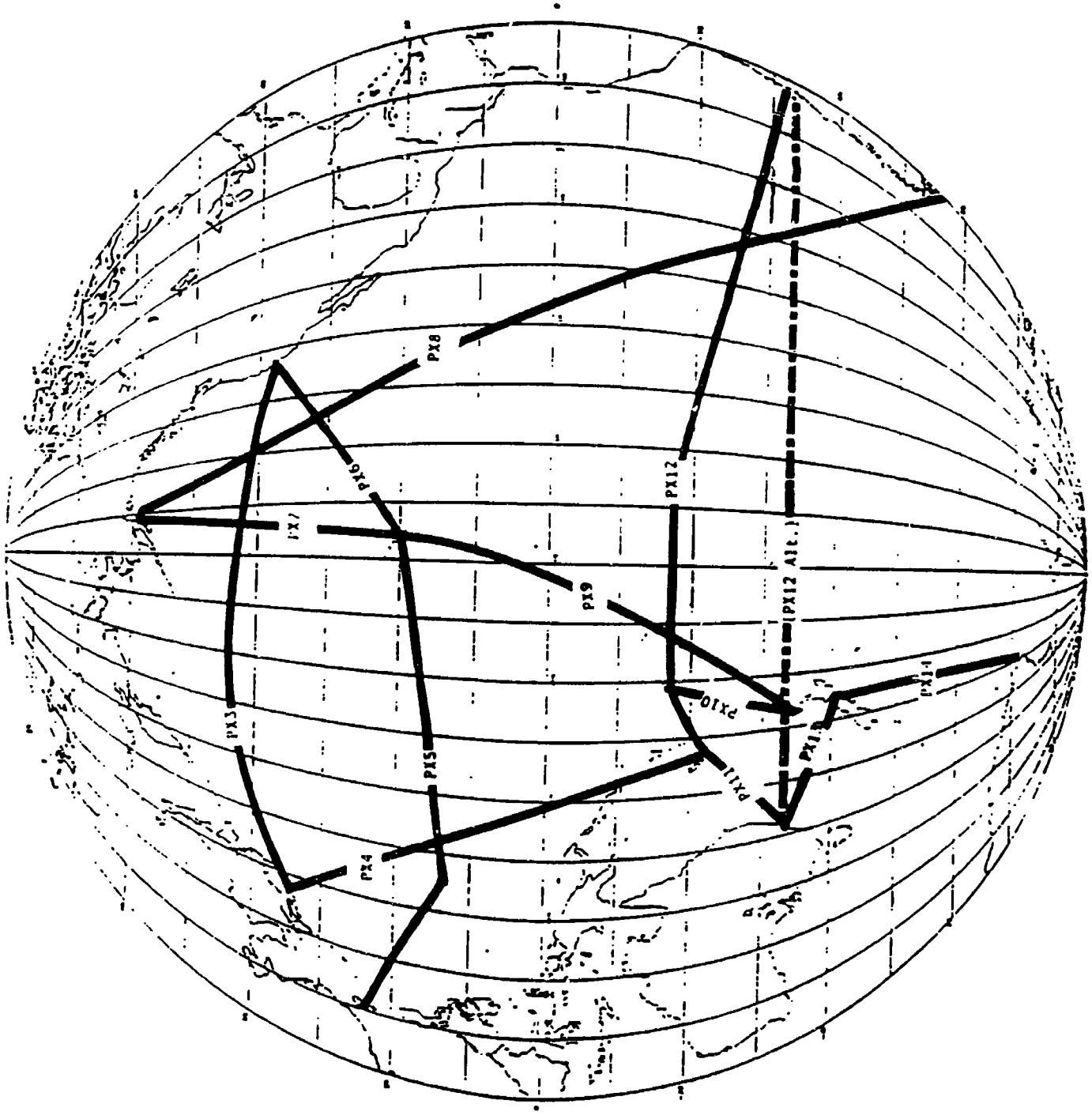


Fig. 3 VOS high-density Network in the Pacific Ocean
b VOS TRANSPAC Network PX1
c VOS TOGA Network PX2

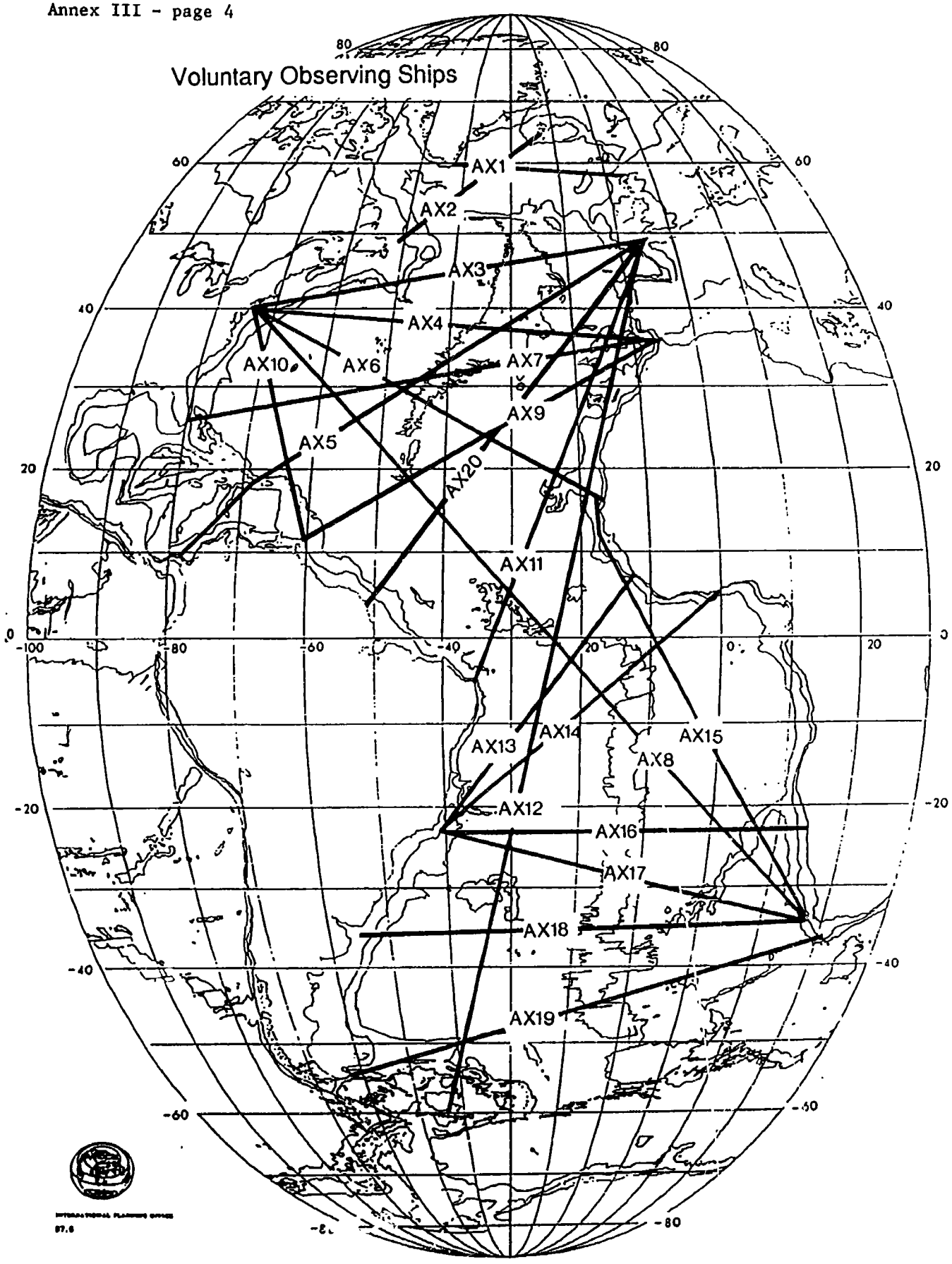


Fig. 4 VOS Network in the Atlantic Ocean

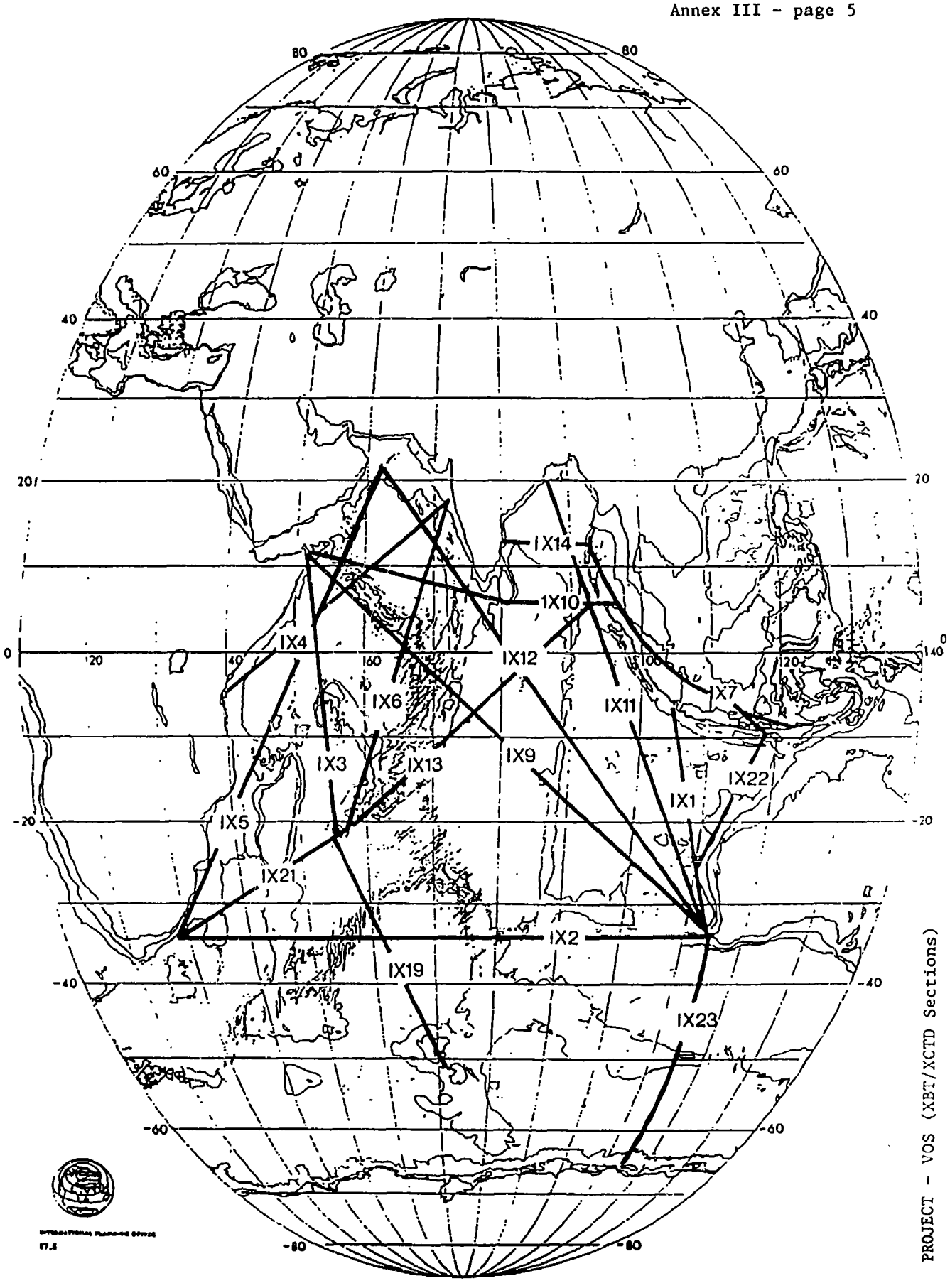


Fig. 5 VOS Network in the Indian Ocean

ANNEX IV

FORMAT ADOPTED FOR
MONTHLY SHIP VISIT REPORT

FOR TRANSMISSION VIA ELECTRONIC MAIL

SHIP NAME CALL SIGN	YR/MO	LINE(S)#	OP	VST/DAY	USED	GOOD	LOADED	ABOARD
ALCAZAR AXLM	89/11	PX10	CS	TD/12	34	33	20	50
St. HELENA TDSC	89/11	IX4	OB	LN/01	34	?	40	45
HAMBURG ARROW MNST	89/11	AX3	DH	AM/05	0	0	0	60
LIBERTY TSTD	89/11	PX3	SI	DC/10	40	38	24	50
PETREL I WXTG	89/11	AX1	NO	MS/25	50	50	48	48
VICTORY CDNP	89/11	PX6	ON	TD/26	36	34	20	50

There are 6 boxes of T4's and 4 boxes of T7's remaining at this facility which is equal to two month's work at the usual rate. "ALCAZAR" is former "HARVESTER," Callsign AXTS.

Comments on Format:

Operators are identified as follows:

- CS = CSIRO, Australia
- OB = ORSTOM.BREST, France
- DH = DHI.HAMBURG, FRG
- SI = SIO, Scripps Institute of Oceanography, USA
- NO = NOS (NOAA), USA
- ON = ORSTOM.NOUMEA, France

"0" is used to note that no probes were expended or loaded. A "?" indicates that probes were expended but the number launched and the number good were not known at the time the ship was visited.

The long field for the ship name enables the complete name to be entered to ensure that accurate cross referencing is possible between ship names and call signs.

Other fields may be included at a later date. Messages may be added to the end of the report such as the level of probe supply at a given facility or changes in ship status.

ANNEX V

PROPOSED FORMAT FOR
SHIP INVENTORY REPORT

Example

Ship-of-Opportuntiy Logistic/Activity Inventory

Dr. A. Sy, DHI, FRG

1. ATLANTIC OCEAN

line #:	AX 3
Status:	operational
Date started:	May 1988
Duration planned:	1994
Respons. scientist	A. Sy (DHI)
Resp. organization	Deutsches Hydrographisches Institut Bernhard-Nocht-Str. 78 D-2000 Hamburg 36 F.R.Germany Phone: 40 3190 440 Telex: 21 54 48 hydro d Telefax: 40 3190 5150 Telemail: DHI.HAMBURG
Scientific objectives:	WOCE VOS programme and spatial & temporal variability of North Atlantic Current system, eddy field, frontal zone Labrador C./NAC, wintertime convection North-East A.
Ship's name:	CMS "Köln Atlantic"
Call sign:	DAKE
Size:	39 000 GRT
Speed:	21 - 22 kn
Port of registry:	Hamburg (FRG)
Owner:	Hapag-LLoyd AG Ballindamm 25 D-2000 Hamburg 1 F.R.Germany
Contact person:	--
Regular ports of call:	Bremerhaven (FRG), Rotterdam (Ned.), Antwerpen (Bel.), Le Havre (Fr.), Halifax (Can.), New York (USA), Boston (USA), Philadelphia (USA)
Agents (address):	--

Equipment (type):	SEAS II (Bathy SA-810 Contr., HP85B Comp., Synergetics 3400 DCP, Bathy Software)
Owned by:	DHI
Probes (type):	T7
Purchased by:	DHI
Regular Greeting port:	Bremerhaven (FRG)
Greeter:	A. Sy (DHI)
Greeting frequency:	monthly
Collaborative Greeters:	--
Duration of round trip:	28 days
Temporal resolution:	1 section per round trip (homebound)
Spatial resolution:	12 per day (30 - 40 nm)
XBT per section needed:	50 - 60
Position of launcher:	Bridge
Hight of launcher:	30 m
No. probes launched:	1988: 549 1989:
Real-time Data transm.:	METEOSAT (Eumetsat)
No. BATHY reported:	1988: 396 1989:
GTS insertion delay:	less 3 days
QC before GTS insertion?	limited (manually)
Delayed mode data flow:	DHI: Data processing as scientific data after ship visit as soon as possible, duration of processing approx. 1 month, printed data report available on yearly basis, submission to Deutsches Ozeanographisches Datenzentrum (DOD)
No. profiles processed:	1988: 468 1989:
Probe failure rate:	1988: 15 % 1989:
Problems occured:	decrease of data quality when wind from ahead > Bf 5 (nominal ship's speed = Bf 5)
Help needed:	--
Comments:	1990: replacement of SEAS II by SEAS III, T7 complemented by T5, new software for QC prior to GTS insertion

(should be complemented)

Grounds for this proposed inventory:

* It is useful to know what is going on in IGOSS SOO and WOCE VOS and helpful for practical management. It is necessary to have all information concerning the lines at hand.

* It is usual that ships change their ports of call or even their lines suddenly, which must not necessarily mean that vessels are lost for IGOSS/WOCE. Good SOO/VOS should be kept in the IGOSS/WOCE family.

* In case of running short in probes or changes of port of call looking for help is easier.

* Many of us have access to GTS, and it is often difficult to identify SOO/VOS and assign them to particular programmes.

* The availability of technical information can be helpful for investigators localizing specific data problems and estimating data quality.

* It is easier and faster to identify problem areas.

* Data centers and investigators can check completeness of final data sets.

* I know this is bureaucratic but should be done for each ocean separately!

ANNEX VI

ADOPTED IGOSS INTERNAL MONITORING REPORT FORM

SHIP NAME AND CALL SIGN	Number of BATHY/ TESAC reports transmitted from the ship	Number of reports received at national Centers

SHIP NAME AND CALL SIGN	Number of reports entered on GTS	Number of reports received on GTS at various centers			

ANNEX VII

SHIP-OF-OPPORTUNITY LIST

The participants at the Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes agreed to a new line numbering scheme. This new system uses the designations "AX" for Atlantic, "PX" for Pacific and "IX" for Indian Ocean lines. The scheme was verified as closely as possible before publication but, as with any new arrangement, corrections, additions and deletions will be required before everyone is content with the result. With this final product in mind, all recipients of this Report, especially the TOGA and WOCE communities and ship-of-opportunity managers, are urged to examine Annexes VII and VIII closely and submit corrections to the IGOSS Operations Co-ordinator so that we can publish a complete and correct list and chart package. We would like your comments no later than 15 June 1990.

Ships-of-Opportunity

ATLANTIC OCEAN

Operational

Line No.	Route/Ship Name	Frequency	Country/Sponsoring Organization
AX-2	Newfoundland - Iceland		
	Skokafoss	4	Canada
AX-1	Denmark - Greenland		
	Nivi Ittuk	12	United Kingdom
	R/V Sagcek - Cape Farewell	2-3	Canada
AX-22	Argentina - Antarctica		
	Amirante Irizar	1	Argentina
AX-11	Europe -E. Coast S. America		
	La Fayette	14	France/ORSTOM
	Monte Rosa	8	FRG/DHI/FNOC
	Seas Eiffel	14	France/ORSTOM

AX-11	Europe - S. tip of Africa		
	Ango	10	France/ORSTOM
	Rabelais	10	France/ORSTOM
AX-5	Europe - Panama Canal		
	Libreville	24	France/ORSTOM
	Los Angeles	6	US/FNOC
	Falstria	6	US/FNOC
	(Temporarily Inactive)		
AX-10	New York - Burmuda		
	Oleander	52	US
AX-3	Europe - E. Coast N. America		
	KÖLN ATLANTIC	12	FRG/DHI
AX-17	Gulf of Mexico		
	Edgar M. Queeny	24	US/NWS/NOS
	Senator	24	US/NWS/NOS
AX-17/5	Gulf of Mexico - Panama Canal		
	Exxon Jamestown	12	US/SIO
AX-4	East Coast US - Portugal		
	Damaio de Grois	6	US-NOS-PORTUGAL
AX-17	Brazil - S. tip of Africa		
	Nedlloyd Kimberly	6	US/FNOC
	Nedlloyd Katwick	6	US/FNOC
	Tilly	3	FRG/IFM
	Paul	3	FRG/IFM

<u>Planned</u>

?	France - French Guyana		
	Ariana	24	France/ORSTOM
	Nedlloyd Kingston	6	US/FNOC/DHI
	Nedlloyd Kyoto	6	US/FNOC/DHI
AX-20	Europe - E. Coast N. America		
	TBN	12	FNOC/UK
A-ø	Iceland - Rotterdam Extension		UK/Canada

Proposed

AX-5	Europe - Panama Canal		
	Rimbaud	4	ORSTOM/SIO
	Racine	4	ORSTOM/SIO
	Ronsard	4	ORSTOM/SIO
	Forth Bank	2.5	ORSTOM/SIO
	Ivi Bank	2.5	ORSTOM/SIO
AX-18	Brazil - S. tip Africa		
	Anakena	6	Chile
	Angol	6	Chile
AX-13	Uruguay - Nigeria		
	Angol	6	Chile
	Ankena	6	Chile
	Europe - E. Coast S. America		
	M.V. Kraljevica	3	Yugoslavia
AX-14	Rio - Lagos	4	US-NOAA/BRAZIL
	Nigeria - Europe		
	M.V. River Oshun	4	Nigeria
	M.V. Oli	4	Nigeria
AX-10	E. Coast N. America - Venezuela		
	TBN	UNK	NOAA/NOS
	Panama Canal - S. tip Africa		
	UNK	UNK	FNOC
AX-19	S. tip S. America - S. tip Africa		
	Vina Del Mar	4	Chile
	E. Coast N. America - Brazil		
	TBN (2 ships)	UNK	NOAA/NOS
AX-24/25	S. tip of Africa - Antarctica - S. tip of S. America		
	Polarstern	1	FRG/AWI

INDIAN OCEAN

Operational

IX-1	Fremantle - Java/Arafura Sea		
	ANRO Australia	8	Australia/CSIRO
	ANRO Asia	8	Australia/CSIRO
IX-2	S. tip of Africa - Australia		
	Nedlloyd Kembla	3	US/FNOC
	Nedlloyd Katwyk	3	US/FNOC
IX-3	Red Sea - La Reunion		
	Marion Dufresne	4	France/TAAF
	Renoir	6	France/ORSTOM
	Ile Maurice	12	France/ORSTOM
	Ville de Rouen	Irr	France/ORSTOM
IX-9	Fremantle - Red Sea		
	Flinders Bay	4	Australia/CSIRO
	Nedlloyd Tasman	4	Australia/CSIRO
	Encounter Bay	4	Australia/CSIRO
IX-12	Fremantle - Dubai		
	Mahsuri	6	Australia/CSIRO
IX-10	Red Sea - Singapore		
	Korrigan	10	France/ORSTOM
IX-22	Fremantle - Sunda Strait		
	Swan Reefer	24	Australia/CSIRO
IX-21	Mauritius - Durban		
IX-10	Somalia - Singapore		
	Racine	4	ORSTOM
	Rimbaud	4	ORSTOM
	Ronsard	4	ORSTOM
	Forthbank	2.5	ORSTOM
	Ivi Bank	2.5	

Planned

IX-14	Bangkok - Colombo		
	R.V. Fishery No. 4	2	Thailand
IX-23	Australia - Antarctica		
IX-2	Aurora Australis	1	Australia/CSIRO
	Cape of Good Hope - Australia Ship ?	1	Australia/CSIRO

Proposed

IX-7	Mombasa - Pakistan		
	Various	UNK	Kenya
IX-6	Mauritius - India		
	TBN	4	Mauritius
IX-12	Red Sea - Australia		
	M.V. Admiral Rurisic	4	Yugoslavia
	M.V. Heroj Paic	4	Yugoslavia
IX-18	Mombasa - Bombay		
	Various	UNK	Kenya
IX-16	Mombasa - Singapore		
	Various	UNK	Kenya
IX-8	Mombasa - La Reunion		
	Various	UNK	Kenya
IX-6	La Reunion - Singapore	2	France/Japan (ORSTOM/JMA)
IX-19	La Reunion - Kerguelan		
	Marion Dufresne	4	MNHN/TAAF
IX-20	Mauritius - Rodriguez		
	M.V. Mauritius	12	Mauritius

PACIFIC OCEAN

Operational

PX-1	Noumea - Japan		
PX-5			
	Zuryu Maru	6	ORSTOM/SIO
	Pacific Islander	8	ORSTOM/SIO
	Hakuryu Maru	6	ORSTOM/SIO
PX-42	Noumea - Hawai - W. Coast US		
PX-37	ACT 9	12	ORSTOM/SIO
	ACT 12	12	FNOC
PX-18	Tahiti - W. Coast US		
	Polynesia	12	ORSTOM/SIO
	Moana Pacific	12	ORSTOM/SIO
PX-17	Noumea - Tahiti - Panama		
PX-19			
PX-12	Rimbaud	4	ORSTOM/SIO
	Racine	4	ORSTOM/SIO
	Ronsard	4	ORSTOM/SIO
	Forth Bank	2.5	ORSTOM/SIO
	Ivi Bank	2.5	ORSTOM/SIO
PX-26	W. Coast US - Japan (TRANSPAC)		
	Hakone Maru	12	US/SIO
	Tokyo Maru	12	US/SIO
	Pacbaroness	6	US/FNOC
	Pacmerchant	6	US/FNOC
	Hira Maru	12	US/SIO
	Shinkashu Maru	12	US/SIO
	Hikawa Maru	12	US/SIO
	Yamahsin Maru	12	US/SIO
	America Maru	12	US/SIO
	Pacprincess	8	US/FNOC
	Pacmonarch	8	US/FNOC
	Lars Maersk	8	US/SIO
	Lexa Maersk	8	US/SIO
	Hiyoshi Maru	8	US/SIO
	Pacprince	8	US/FNOC
	Ambassador Bridge	12	US/SIO
	McKinney Maersk	8	US/SIO
	W. Coast US - Indonesia		
	Nedlloyd Kembla	6	US/FNOC
	Nedlloyd Katwyk	6	US/FNOC

PX-15	Ecuador - Japan		
	Isla Floreana (?)	12	INOCAR/AOML
	Japan - Hong Kong		
	Pacbaroness	6	US/FNOC
	Pacmerchant	6	US/FNOC
	Pacprincess	6	US/FNOC
	Pacmonarch	8	US/FNOC
PX-10	Hawaii - New Guinea - Guam - Hawaii		
	Micronesian Independence	4	US/SIO
	Micronesian Commerce	4	US/SIO
	Cap Anamur	4	US/SIO
PX-27	Ecuador - Galapagos		
	Bucanero (?)	24	INOCAR/AOML
PX-38	ALASKA - Hawaii		
	Chevron California	3	US/SIO
	Chevron Mississippi	3	US/SIO
PX-14	Alaska - S. tip S. America		
	Sea Island	6	US/SIO/IOS
	Mt. Cabrite	6	US/SIO/IOS
	Santa Lucia	6	US/SIO/IOS
	Sealift Arctic	6	US/FNOC
PX-20	W. Coast US - Panama Canal		
	Exxon Jamestown	12	US/SIO
	Falstria	12	US/FNOC
	Packing	6	US/FNOC
PX-31	W. Coast US - Australia		
	Columbus Canada	12	US/FNOC
	Columbus Victoria	12	US/FNOC
	Columbus Virginia	12	US/FNOC
	Columbus Wellington	12	US/FNOC
	Columbus California	12	US/FNOC
PX-11	Port Hedland - Japan		
	Australian Progress	24	Australia/CSIRO
PX-25	Peru - Japan		
	Scrim	6	Peru/AOML

PX-17/19	Sidney - Panama		
PX-28	Act III	4	AOML
	Act IV	4	AOML
	Act VI	4	AOML
PX-3	Coral Sea		
	Nimos	12	Australia/CSIRO
	Rimbaud	4	ORSTOM/SIO
	Racine	4	ORSTOM/SIO
	Ronsard	4	ORSTOM/SIO
	Forth Bank	2.5	ORSTOM/SIO
	Ivi Bank	2.5	ORSTOM/SIO
?	Sydney - Wellington		
(new line)			
	Nedlloyd Tasman	4	Australia/CSIRO
	Encounter Bay	4	
	Flinders Bay	4	

Planned

PX-6	W. Coast US - Japan		
	Pac Emporer	8	US/FNOC
	Japan - Hong Kong		
	Pac Emporer	8	US/FNOC
PX-6	R/V Japan - North America	2	USSR/Canada/USA
PX-38/9	Vancouver - New Zealand		Canada
?	Australia - Cape Horn		
	Ship ?	1	Australia/CSIRO
?	Brisbane - Auckland		
	Mahsuri	6	Australia/CSIRO
?	Melbourne - Dunedin		
	Mahsuri	6	Australia/CSIRO
	Nedlloyd Tasman	4	Australia/CSIRO
	Encounter Bay	4	Australia/CSIRO
	Flinders Bay	4	Australia/CSIRO

Proposed

	Bangkok - Japan		
	Nakon Thon (HSGG)	8	Thailand
	Chile - Peru		
	Malleco	4	Chile
	South Diamond	4	Chile
	Chile - W. Coast US		
	Anakena	3	Chile
	Angol	3	Chile
	Maipo	4	Chile
	Rubens	4	Chile
	Malleco	4	Chile
	South Diamond	4	Chile
	Valparaiso	4	Chile
	Presidente Ibanez	4	Chile
	Presidenta Gontalez Videla	4	Chile
165°E 20S-10°N:			
	Rg. Vessels	4	ORSTOM/MEL
PX-29	Tahiti - Chile	8	ORSTOM/SIO

ANNEX VIII

NEW LINE NUMBER SCHEME AND CHARTS

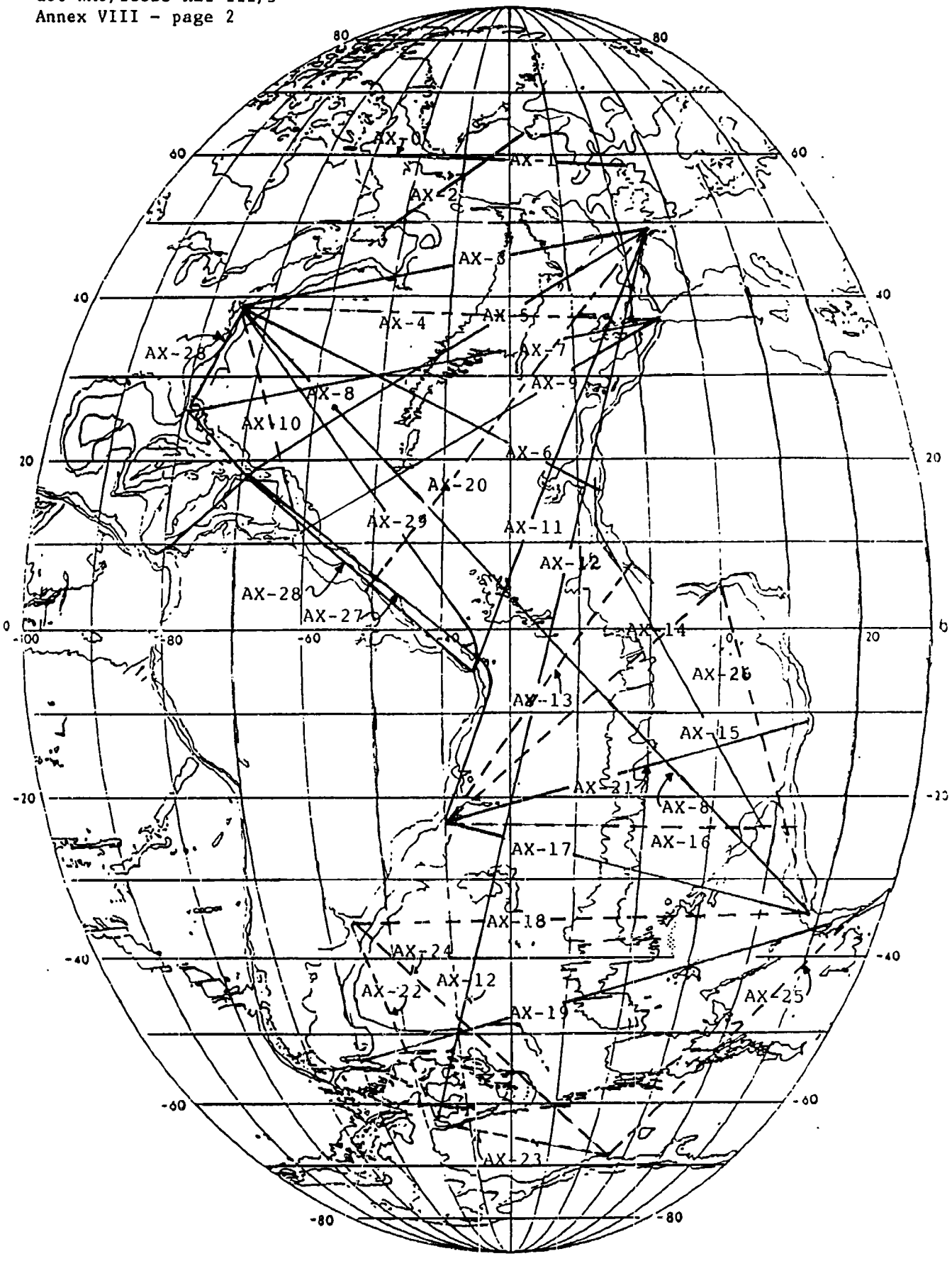
For the purposes of interpretation, lines are identified as follows:

Operational line: solid line _____

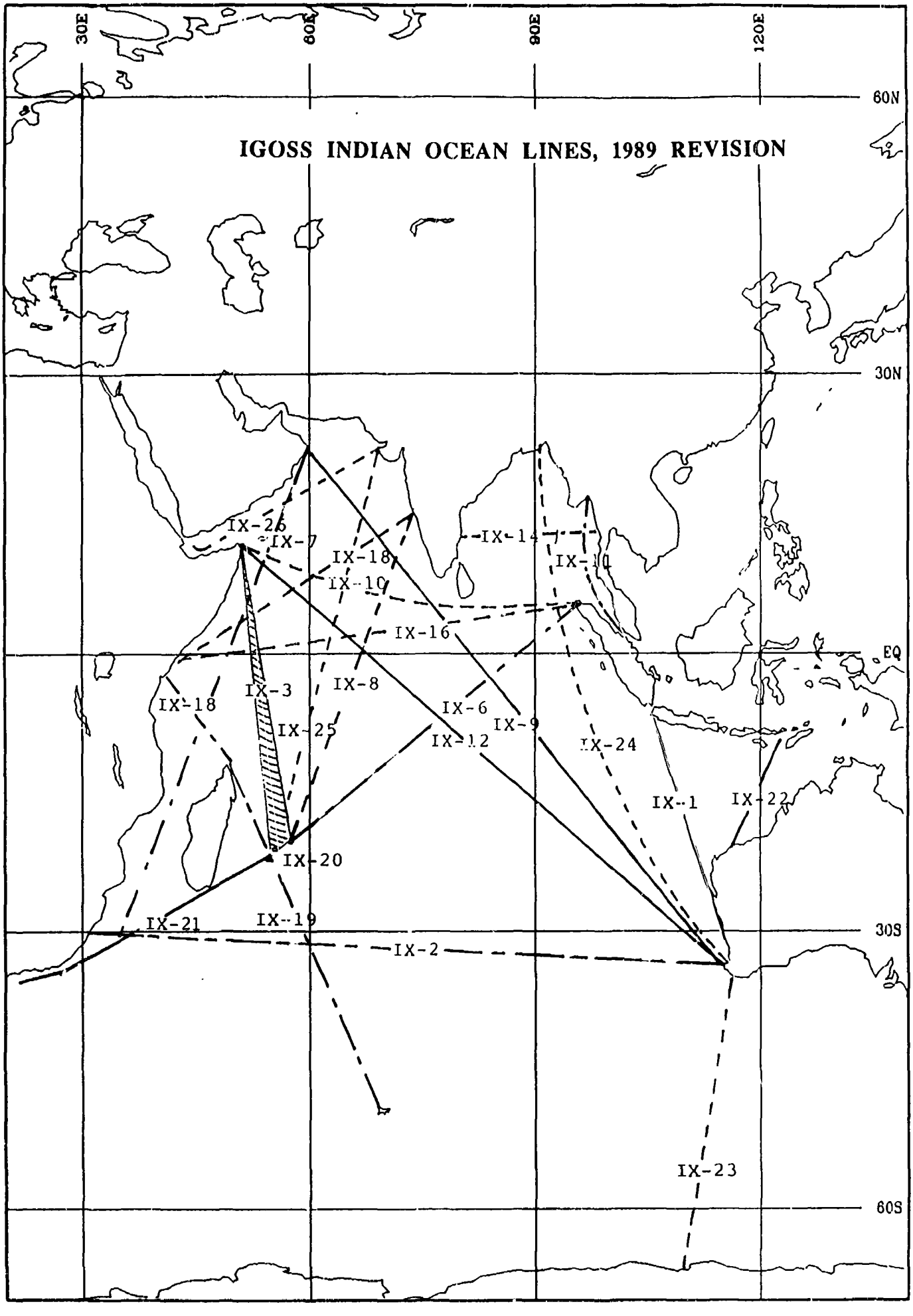
Proposed line: dot-dash-line . _ . _ . _ . _

Planned line: dashed line ----------

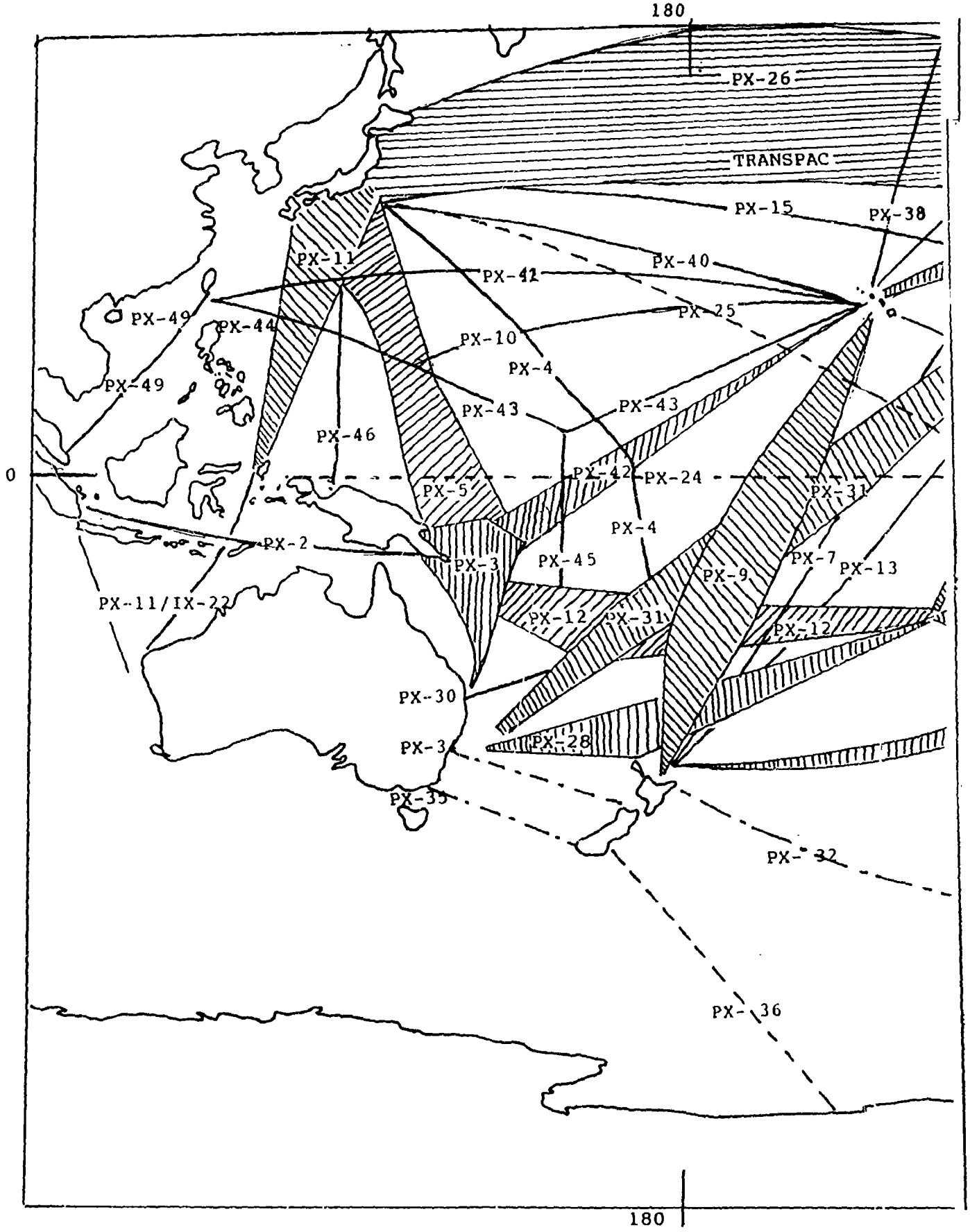
Note: As mentioned in Annex VII, these charts may be subject to revision. When this process is complete, a new set of charts will be issued.



IGOSS ATLANTIC LINES, 1989 REVISION
NORTH AND SOUTH ATLANTIC


IGOSS INDIAN OCEAN LINES, 1989 REVISION
30E
60E
90E
120E
60N
30N
EQ
30S
60S
IX-26
IX-7
IX-18
IX-10
IX-14
IX-16
IX-3
IX-8
IX-18
IX-25
IX-6
IX-9
IX-12
IX-24
IX-1
IX-22
IX-20
IX-21
IX-19
IX-2
IX-23

IGOSS PACIFIC CORRIDORS AND LINES, 1989 REVISION
WESTERN PACIFIC



IGOSS PACIFIC CORRIDORS AND LINES, 1989 REVISION
EASTERN PACIFIC