Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications

Second Session

Paris, 12-16 November 1990

Unesco

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)*
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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
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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
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50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
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56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping
59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications

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1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION

1 The Second Session of the IGOSS Group of Experts on Operations and Technical Applications, in which experts of the IODE Group of Experts on Technical Aspects of Data Exchange were invited to participate, was opened by the Chairman of the Group, Dr. Douglas McLain, at 10.00 a.m., on Monday 12 November 1990 at Unesco headquarters, Paris. Dr. McLain called on the Secretary IOC, Dr. Gunnar Kullenberg, to address the session.

2 On behalf of IOC and WMO, Dr. Kullenberg welcomed the participants in the session to the IOC Secretariat and to Paris. In his opening remarks, he emphasized the important role the Group had to play for IGOSS purposes in particular, in scrutinizing all technical problems encountered in the day-to-day running of the system and endeavouring to find solutions therefor, and, more generally, for the development of the emerging so-called Global Ocean-Observing System, the concept of which had been given a strong support at the recent Second World Climate Conference. IGOSS is obviously one of the building blocks of the future Ocean-Observing System since it is already a successful joint IOC-WMO undertaking in the field of operational oceanography. The achievements of the present session will undoubtedly benefit all future efforts in the field of systematic ocean observation within, inter alia, the framework of climate studies and environment management.

3 Dr. Kullenberg stressed that the challenges were two-fold: on the one hand, one has to both strengthen IGOSS and make it better known worldwide. The work of experts, such as those attending the session, is of course relevant to the former, but they should not forget that their own national positions give them the possibility of having some potential influence on the latter. On the other hand, one definite condition of success of any undertakings such as IGOSS and GOOS lies with international requirements meeting national interests. Here again all individual experts have a role to play at the national level. It may be worth recalling that nothing can be done at the international level without deep national involvements.

4 Dr. Kullenberg reminded the participants that a milestone in this whole undertaking would be the 1992 UN Conference on Environment and Development. The effects of national policies on the global environment, including the earth's climate, can be measured only with adequate information, a great deal more information than we have now. Recognizing this, the leaders of the world will be called upon to endorse a global climate monitoring system, of which an ocean monitoring system is, of course, a substantial component. The tasks placed before the present session of the Group fit well in with this general concern.

5 In closing his remarks, Dr. Kullenberg assured the session of the full support of IOC and WMO Secretariats in its work and wished all participants much success and a pleasant stay in Paris.

6 The Group was informed that the IGOSS Chairman, Dr. Yves Tourre, had expressed a deep regret not to be able to participate in the session and had wished the session every success from overseas.

7 The List of Participants is given in Annex II.

1.2 ADOPTION OF THE AGENDA

8 The Group adopted the Provisional Agenda as its agenda for the session. The session agenda is given in Annex I.

1.3 WORKING ARRANGEMENTS

9 The Group decided on its hours of work and other necessary arrangements for the smooth conduct of the session. The documentation for the session was also presented under this agenda item.

2. REVIEW OF THE STATE OF IMPLEMENTATION OF IGOSS-V DECISIONS RELATED TO THE WORK OF THE GROUP, AND OF OTHER RELEVANT INTERSESSIONAL EVENTS

10 The Chairman introduced this agenda item in noting that with the increasing interest in global climate change, pollution, fisheries and other marine problems, the need for timely monitoring of ocean conditions is increasing. IGOSS is advancing rapidly in its ability to respond to these needs. By applying modern technological advances, such as microcomputers and satellite communications, to IGOSS problems, the number, accuracy and timeliness of reporting of observations are increasing. In co-operation with the CBS of WMO, IGOSS is starting to adopt new binary communication formats and techniques that will allow to increase its data flow by ten to one hundred times. These advances will allow much greater spatial and temporal resolution of the ocean monitoring schemes.

11 Recent specific examples of progress are:

(i) installation of automated systems on over 100 vessels for ocean and atmospheric observations and timely reporting by satellite,

(ii) development of a flexible code for reporting oceanographic data over the GTS,

(iii) description of quality control procedures in a concise manner,

(iv) better understanding of the "bowing" and fall rate problems with XBT observations, and

(v) rapidly advancing communications globally among oceanographers via electronic mail.

12 But many problems still face the IGOSS community. A glaring example is the lack of salinity reports from CTD casts on research vessels. Another is the continuing inability to reliably communicate all data to all interested parties over the GTS. These problems must be dealt with in an effective way.

13 If these institutionally related problems can be solved, the future of IGOSS is bright. In the future, automated systems on buoys and ships will make large numbers of observations accurately and at low cost. Satellite communication systems, such as INMARSAT-C, will allow low cost digital communications to any location globally. Personal microcomputers will be available to all for display and analysis of the data. These systems will allow to meet IGOSS goals and the challenges of climate and ecological change.

14 The IGOSS Operations Co-ordinator then reviewed other OTA-related events. The Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes (XBT-III) (Hamburg, Germany, 16 - 20 October 1989) finalized the numbering scheme used for all programmes using ship-of-opportunity lines. Numbers previously used by TOGA, WOCE and IGOSS were combined into a single identification system which was adopted by all three programmes. The presence of representatives of both TOGA and WOCE at the meeting facilitated this process. New charts of the ship-of-opportunity lines were also produced as a result of this effort and were distributed to the community. Other results from XBT-III included a standardized form for monthly ship visit reports and a proposal for a ship-of-opportunity inventory system.

15 The International Symposium on Operational Fisheries Oceanography (ISOFO) (St. John's Newfoundland, Canada, 23 - 27 October 1989) was co-sponsored by IOC. The IGOSS Operations Co-ordinator attended as the Secretariat's representative and presented a paper on "The Applications of IGOSS Data to Operational Fisheries Oceanography." The speakers highlighted the developments in the field, many of which had their basis in temperature and salinity observations, and discussed new methods of interactive data exchange which allowed fishermen at sea to realize immediate benefits from data provided to analysis centres ashore. Valuable contacts were made in St. John's, including one which enabled IOC to obtain Southern Ocean SST analysis from the USSR Agency VNIRO.

16 The Group thanked the Chairman and the IGOSS Operations Co-ordinator for their reports. It noted in particular that the success of XBT-III was mainly due to the concurrence of a WOCE-related meeting. It therefore recommended that further ship-of-opportunity meetings be held, as far as possible, with a good representation of the joint WOCE-TOGA Panel on XBT's.

3. OBSERVATION TECHNIQUES

3.1 RECOMMENDED TECHNIQUES TO INCREASE THE NUMBER OF SALINITY DATA EXCHANGED WITHIN IGOSS

17 The Group recalled that many recommendations and/or resolutions had already been adopted within IOC or WMO intended to increase the number of salinity data exchanged within IGOSS, with very little practical results up to now. USSR is almost the only country that proved successful in distributing salinity data over the GTS in the form of TESAC reports and USSR experts expressed some doubts that this situation could be secured in future.

18 The Group first recommended that the Seminar/Workshop on IGOSS Products (Tokyo, April 1991) be taken as an opportunity to demonstrate the usefulness of operational exchange of salinity data through well chosen case studies. It considered indeed that such a demonstration might exert a pressure on the scientists who gathered salinity data and were reluctant to authorize their circulation onto the GTS, for various reasons. Scientists, in general, seek data of very high resolution (both in space and time) and accuracy. In contrast, IGOSS seeks global coverage and can cope with lower resolution data, and without taking into account the post-cruise calibration of the instruments.

19 The Group then agreed it had to devise some technical solutions to the question of increasing the number of salinity data circulating onto the GTS. It therefore decided on a set of demonstration projects, to be

implemented, at the latest, before its next session. The projects are listed in Annex III, items 1 to 5.

3.2 ALONG-THE-TRACK MEASUREMENTS

20 The Group was presented with statistics regarding the exchange of TRACKOB reports onto the GTS. For the time being, only Germany and Japan exchange such reports which contain hourly observations of sea-surface temperature and sometimes surface currents, encoded manually.

21 The Group considered that the number of TRACKOB reports exchanged over the GTS would likely increase significantly if the process of encoding and transmitting the data was automated. If therefore again decided on a set of demonstration projects, which are listed in Annex III, items 6 to 9.

4. CODE MATTERS

4.1 CHARACTER-BASED CODE FORMS

22 The Group recalled that, at its previous meeting (Geneva, December 1987), it had identified a general requirement for the future transmission on the GTS, in character code form, of new types of oceanographic data for which code forms do not presently exist. It had suggested that a single flexible character code would be the most appropriate means for dealing with any future requirements for real-time transmission of oceanographic data, and had requested Mr. J.R. Keeley (Canada) to develop a specific proposal to this effect.

23 The proposal of Mr. Keeley, the IGOSS Flexible Code (IFC), after review and some revision and with the general endorsement of both IGOSS-V (Paris, November 1988) and CMM-X (Paris, February 1989), was submitted to the appropriate expert working groups of CBS for their consideration and eventual approval. Within CBS, however, the 1FC proposal met with some resistance, essentially based on:

(i) a general reluctance to consider new character codes following the introduction of BUFR;

(ii) another related proposal for a character form of BUFR, BTABS;

(iii) concern about the length, and hence cost, of both IFC and BTABS;

(iv) the complexity of, and possibility of errors in, IFC.

24 At the request of the CBS Working Groups, attempts had been made to reconcile IFC and BTABS, but without success. At the time of the present session, neither code form had met with the approval of CBS.

25 The Group noted a strong continuing requirement for the GTS transmission, in character form, of new types of oceanographic data, in particular those now being identified in the context of the Global Ocean-Observing System (GOOS). It also noted the support being given by WMO to the GOOS, and the expressed desire to use and strengthen the World Weather Watch, and in particular the GTS, as part of this support. Finally, the Group agreed that, while real-time transmission is not strictly necessary for most oceanographic data, nevertheless their exchange via the GTS remains the most viable method for ensuring that these data are received by the data processing and archival centres, on the time scales which are appropriate, viz from days to a few months.

26 The Group expressed its belief that the IFC, in its present form, as well as satisfying the basic requirement for enabling the international GTS exchange of new oceanographic data in character form, is also appropriate to IGOSS needs in two other ways, viz it can be easily encoded on ships at sea and also it is compatible with the oceanographic data archival format GF-3.

27 The Group therefore agreed that CBS, through its appropriate working groups, should again be addressed:

(i) with the detailed requirements for the GTS transmission, in character form, of new oceanographic variables as are now being specified in the context of the GOOS;

(ii) with the additional requirements of the oceanographic community as noted above, viz encoding at sea and compatibility with GF-3;

(iii) with the belief of the IGOSS community that IFC satisfies all these requirements.

28 It requested its Chairman, together with Mr. Keeley and with the help of the Secretariats, to prepare the necessary documentation on this matter and submit this to the CBS Working Group on Data Management, Sub-group on Codes, as a matter of urgency. In the event that CBS continues to reject the IFC proposal, the Group requested CBS itself to develop a proposal which would satisfy all the oceanographic requirements, bearing in mind the expressed need to develop and expand the World Weather Watch in support of GOOS.

4.2 USE OF BUFR FOR IGOSS DATA (INCLUDING QC FLAGS))
4.3 RELATIONSHIP BETWEEN BUFR AND GF-3)

29 The presentation of, and discussions on, these two sub-items were very much interconnected during the session, and the Group therefore agreed that they should be treated together in the summary report.

30 The Group was first presented with a report by its Chairman on BUFR in general and on the present status of its implementation and further development, in particular for oceanographic purposes. It was recalled that BUFR is a binary data transmission format which is intended to eventually replace all the existing GTS character codes. The format is compact and designed for high-speed transmission of data on error checking and correcting transmission lines. Its implementation for the GTS is thus dependent on the existence both of the appropriate transmission protocols and also, of course, of encoding/decoding software in the GTS centres concerned. At present, BUFR is only being used for data transmission between major GTS/data processing centres. It is probable that the use of the standard character codes will continue to be required, at least on parts of the GTS, for the foreseeable future.

31 The Group noted further that both BUFR and GF-3 are table-driven formats designed for international data exchange: BUFR for real-time meteorological data and GF-3 for non real-time oceanographic data. If BUFR is to be used also for IGOSS data exchange, it is therefore essential that there should be compatibility between it and GF-3, in particular through the use of common data descriptor tables.

32 With regard to the use of BUFR for IGOSS purposes, the Group agreed that there were three specific questions which needed to be addressed, viz:

(i) When will oceanographic data be required to be transmitted on the GTS in BUFR format?

(ii) What can the GE/OTA do to facilitate the use of BUFR?

(iii) What should be done about ensuring compatibility of GF-3 and BUFR?

33 BUFR is likely to be implemented progressively on the Main Telecommunications Network of the GTS over the next 5 years. However, the Group agreed that, because of the complexity of BUFR and the nature of the transmission lines required to carry it, a much longer period (over 10 years) may be required before BUFR is implemented on the more outlying segments of the GTS, including in particular those from a number of centres where oceanographic data may be first inserted. In addition, it was felt that the use of BUFR for ship-to-shore transmission of oceanographic data will probably not occur in the foreseeable future. In view of this, the Group agreed that the role of the GE/OTA regarding the use of BUFR is essentially:

(i) at the present time, to maintain a close watch on its development and implementation, and to interact as appropriate with the CBS Sub-group on Data Representation;

(ii) eventually, to assist in the development and distribution of software for the encoding of oceanographic data into BUFR, for use in particular at the GTS terminal centres at which such data are first inserted;

(iii) eventually, also, to provide assistance to smaller institutes and data processing centres, where necessary, to decode BUFR messages.

34 Finally, the Group agreed that, since IGOSS data will eventually be transmitted in BUFR, it is essential that some form of compatibility be ensured between BUFR and GF-3. The Group therefore accepted with appreciation the kind offer of Mr. J.R. Keeley (Canada) to work, as a designated IGOSS/IODE expert, directly with the Chairman of the CBS Sub-group on Data Representation, Dr. J. Stackpole, to ensure that all the appropriate GF-3 data descriptor tables are included in BUFR. This would then allow the easy transfer of oceanographic data from one transmission format to another.

5. COMMUNICATION SYSTEMS AND PROCEDURES

5.1 SATELLITE-BASED DATA COLLECTION SYSTEMS

35 The Group noted with interest a presentation by Mr. W. Woodward (USA) on the variety of satellite-based systems currently available (or expected in the near future) for the collection of oceanographic data from platforms at sea (and sometime for the location of the platform). Details of this presentation, which include approximate cost estimates, are given in Annex IV. Following this presentation, some additional information on developments with the INMARSAT system was provided by the WMO Secretariat. In particular, it was noted that:

(i) as a direct result of the implementation of the Global Maritime Distress and Safety System of IMO, virtually all ocean-going ships (including IGOSS ships-of-opportunity and oceanographic research vessels) will be equipped with INMARSAT communication equipment (INMARSAT-C or INMARSAT-A) by the end of the decade;

(ii) the number of INMARSAT Coast Earth Stations (CES) was growing rapidly, with most being equipped with INMARSAT-C within five years, and major efforts were being made within WMO to ensure that as many as possible of these are available for the receipt of ships' meteorological and oceanographic reports, free of charge to the ships. At the present time, some 10-12 are collecting meteorological reports, using the Code 41 direct routing procedure, with about 6 of these, covering all ocean basins, also collecting BATHY/TESAC reports;

(iii) following a proposal by INMARSAT, a joint WMO-INMARSAT study group was being established to develop all the technical details of a special compressed format for the transmission of the met/ocean reports through INMARSAT. Although the configuration of the system will allow only 32 bytes (256 bits) for each data message, the use of the format will substantially reduce the transmission time, and hence cost, for each message. A figure of around 10 US cents per meteorological report has been suggested.

36 The Group was next presented with a report by Mr. C. Ortega of CLS/Service Argos on the present status and future developments of the Argos system for oceanographic data collection and location. The report covered in particular the Argos XBT and tide gauge systems and the development of links between Argos and EUMETSAT. Details are given in Annex V.

37 The Group expressed its appreciation for these various reports. It agreed that the availability of a variety of operational satellite-based systems for the collection of oceanographic data from platforms at sea is important to provide the maximum potential and flexibility for such data collection, thus hopefully ensuring that appropriate facilities are continuously in place. In particular, the International Data Collection System (IDCS) for the use of the network of geostationary meteorological satellites and the INMARSAT system provide appropriate global facilities for data collection only from fully automated or manned fixed or mobile stations, while the Argos system also provides global platform location facilities.

38 Specifically with regard to INMARSAT, the Group agreed that the INMARSAT-C system, with the compressed transmission format, provides considerable potential for low-cost global data collection from ships at sea. It therefore requested:

(i) the Secretariats to write to INMARSAT to urge that oceanographic data be catered for in the new compressed transmission format and that an appropriate reduced charge (for the space segment) be applied for oceanographic data collection through INMARSAT, similar to that proposed for meteorological reports;

(ii) Captain G. Mackie (UK) to work with the WMO-INMARSAT study group, on behalf of IGOSS, on the development of the compressed transmission format and associated software;

(iii) Captain G. Mackie (UK) to work with the WMO Secretariat, on behalf of IGOSS, in discussions with INMARSAT on the charges to be levied for the use of the space segment of the INMARSAT system for the transmission of oceanographic reports from ships at sea.

39 Finally on this agenda item, the Group noted that its discussions so far had been concerned solely with the platform-to-shore component of the IGOSS Telecommunication Arrangements. With regard to the terrestrial dissemination of oceanographic data, the Group reiterated that the GTS remains the most appropriate and effective instrument for such international dissemination. Identified deficiencies in oceanographic data dissemination should be remedied where possible through improvements to, and expansion of, the GTS, rather than through the establishment or use of alternative terrestrial communication systems.

5.2 RECOMMENDED SPECIAL IGOSS COMMUNICATION PROCEDURES

40 The Group noted that an example of such a special communication system is the Data Hail system developed in Canada. This system is an expansion of HF Packet to allow automatic reporting of environmental observations to shore and similarly, automatic reception and display of analysis and forecast products. The system is used on several trawlers fishing on the Grand Banks to report surface and bottom temperature observations to shore. The reports are merged with IGOSS BATHY reports from vessels offshore to map bottom temperatures over the Grand Banks. Maps of bottom temperature are transmitted back to the trawlers and used for operational fishing tactical purposes. Data Hail systems are also used on several Canadian fishery patrol vessels for routine communications. Over 40 Data Hail systems are used on the west coast of Canada for communication with land stations and patrol vessels.

41 The Group considered that systems such as Data Hail may be more appropriate for use for near-shore communications than the global-type systems discussed under the previous agenda item. It urged, however, that any investigator making use of a local communication system should make sure that data transferred through the system are eventually transferred onto the GTS for global distribution, since in many cases near-shore oceanographic observations represent extremely valuable data for IGOSS purposes.

6. QUALITY CONTROL OF IGOSS DATA

6.1 REVIEW OF EXISTING GUIDELINES

42 Mr. Keeley introduced this agenda item in presenting the latest achievements in the field of data quality control. Within the IODE community, a draft Manual of Data Quality Control Algorithms and Procedures was submitted to IODE-XIII (New-York, 17-24 January 1990) and will be published once finalized. The annexes on Minimum Quality Control Procedures for IGOSS Data to be transmitted over, and taken from, the GTS, given in the Guide to Operational Procedures for the Collection and Exchange of IGOSS Data, were revised and the Guide was amended accordingly. Finally, the preparation of a Manual on Real-time Data Quality Control for the IGOSS-IODE Global Temperature-Salinity Pilot Project (GTSPP) was co-ordinated by Dr. Keeley. The Manual was submitted to the GTSPP meeting held in Brest, France, in September 1990, and will be published as a GTSPP document.

43 The Group expressed its appreciation to Mr. Keeley for the considerable amount of work he achieved in the field of data quality control. As far as the GTSPP Quality Control Manual was concerned, it requested that any comment on possible controversial issues and/or inclusion

of additional quality control tests be forwarded to Mr. Keeley. In this context, it was agreed that the Task Team on Quality Control of Automated Systems (TT/QCAS) would review the Manual and use it as a reference. It was further agreed that the Manual might be published in the IOC Manuals and Guides series once (and if) the GTSPP developed from a Pilot Project to become a long-term programme.

44 The question of a possible translation of the Manual in the other working languages was raised. The Group agreed that this could only be done once the GTSPP has become a long-term programme and that, due to the cost of translations, Member States would probably be urged to volunteer to undertake the translation themselves, as an in-kind contribution to IGOSS.

45 The Group welcomed the offer by Dr. N. Mikhailov to prepare, with other USSR experts, software in Fortran to accompany the Manual. It was agreed that Dr. Mikhailov will further discuss this possibility with Mr. Keeley. The Group considered this task as a new demonstration project (see Annex III, item 10).

46 The Group raised the question of ways and means of automatically checking water mass data through quality control of T/S diagrams. To the knowledge of the experts, only some regional T/S climatologies are available at the present time. The Group therefore decided to request the GTSPP community to study this question, which was considered as very important, in terms of feasibility, technical possibilities and implementation. In this context, Dr. Mikhailov offered to include in Fortran software the climatic characteristics used in NODC RIHMI, USSR, to check temperatures and salinities at standard depths.

47 Under this agenda item, Mr. Y. Kimura made a presentation of quality control procedures used in the Japan Meteorological Agency. A summary of Mr. Kimura's presentation is given in Annex IV. The Group requested Mr. Kimura, with the assistance of other Japanese experts, to describe further quality control procedures for TRACKOB reports, as a new demonstration project (see Annex III, item 11). Also under this agenda item, the Group noted with interest the presentation by Dr. S. Hansen (Norway) on the European FIESTA project. Details of this project are given in Annex VII.

6.2 QUALITY CONTROL PROCEDURES FOR AUTOMATED SYSTEMS

48 Under this agenda item, Dr. J. Withrow, Co-chairman of the TT/QCAS, presented the report of the Task Team, which is given in Annex VIII. The Group expressed its appreciation to the Task Team and its Co-chairmen for the work achieved so far and endorsed the recommendations (i) that the TT/QCAS be re-established by IGOSS-VI to pursue its tasks and (ii) that the Co-chairmen of the Task Team remain unchanged and be considered as ex officio members of the GE/OTA. It further recognized that some of the Task Team's tasks were quite similar to some demonstration projects identified under Agenda Items 3.1 and 3.2 and entrusted to national experts (see Annex III). It therefore requested those national experts to work in close contact with the Task Team when their tasks were relevant to its terms of reference.

49 As far as the liaison between the TT/QCAS and IODE experts was concerned, the Group requested the IGOSS/IODE Rapporteur to ensure that any relevant development within IODE be brought to the attention of the Task Team in a timely fashion.

50 The Group further recognized that work of the TT/QCAS would materialize, inter alia, through the review of relevant OCEAN-PC software

for real-time data. It therefore requested the Task Team to co-ordinate its efforts with those undertaken by OCEAN-PC experts.

51 Finally, the Group expressed concern that the financial situation within the Secretariats might hinder the funding of a very important ad hoc meeting proposed for early 1991 to study the question of XBT fall rate. Considering, inter alia, that the TOGA and WOCE communities had already expressed their deep interest in the result of such a study, the Group recommended that every effort be undertaken to provide sufficient funding support to allow this meeting to take place in January/February 1991. Baring that, a possible solution to this problem might be to hold the meeting in conjunction with the next Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes (tentatively to be held in Washington D.C., July-August 1991).

6.3 DEVELOPMENT OF STANDARDS FOR AUTOMATIC WORK STATIONS

52 Under this agenda item, the Group was informed by Mr. Keeley of the work undertaken in Canada to build an expert system called MEDMAN to improve the data quality control realized in the Marine Environmental Data Service (MEDS) (see Annex IX). The Group expressed its interest in this undertaking and was pleased to note that the software, since it is owned by MEDS, is in the public domain.

6.4 DEVELOPMENT OF PC SOFTWARE FOR USE BY IGOSS AND IODE: "OCEAN-PC"

53 The Group was presented with the outcome of the "Expert Consultation on OCEAN-PC, a standard software package for oceanographic data processing and exchange", held at Unesco headquarters from 7 to 9 November 1990. It noted in particular the recommendation adopted by the Expert Consultation, which is reproduced in Annex X, on which it expressed general agreement.

54 The Group wished to stress and/or clarify a number of items in this context:

(i) as far as IGOSS is concerned, OCEAN-PC should have the capability to be used on-board ships in real time, to collect data and transmit them ashore, to receive analysis products and other model outputs as necessary (including satellite data) and to allow for ship-to-ship digital exchange of information;

(ii) both input and output formats should remain flexible since they have to cope with various sets of real-time and non real-time data and product exchange formats developed at the intergovernmental (such as IGOSS and IODE formats), international (such as JGOFS format) and national/private (such as DB.3) levels;

(iii) the possibility of connecting OCEAN-PC with CD-ROM's (including on-board ships) should be safeguarded, given the foreseeable extension of the use of CD-ROM's to provide for huge data sets when and as needed;

(iv) relationship between OCEAN-PC and CLICOM (developed by WMO) should be made clear, both in terms of hardware and software on the one hand, and in terms of availability to developing countries on the other hand;

(v) the GE/OTA should keep abreast of developments in the OCEAN-PC undertaking.

55 As for item (i) above, the Group recognized that such a capability was technically feasible at the cost of some severe constraints. As for items (ii) and (iii), it obtained the assurance that they would not lead to any particular problem since they were already foreseen by the Expert Consultation. In connection with item (iv), it was made clear that CLICOM was a prototype for OCEAN-PC, but that the latter was strictly speaking a free-of-charge software project, addressing much more "customers" than CLICOM since the hardware aspect of OCEAN-PC was supposed to be already solved ("everybody has a PC"). It should therefore rather link with the WMO SHARE project which involves software development and exchange. As far as item (v) above was concerned, the Group requested that its Chairman be kept informed of the progress in the OCEAN-PC project, as should the Chairman of the IODE GE/TADE, for similar reasons.

56 Dr. Mikhailov informed the Group of recent developments in the field of the use of PC's for ocean research (see Annex XI). The Group expressed its appreciation for the work undertaken in USSR in this field and requested that close contact be maintained between USSR and OCEAN-PC experts in order not to duplicate efforts and to benefit from both experiences.

7. IGOSS PRODUCTS

57 The Group recalled that IGOSS-V (Paris, November 1988) had recommended the convening of a seminar and workshop on IGOSS products in 1991, and that this recommendation had subsequently been approved by the governing bodies of IOC and WMO. Subsequently, the Japan Meteorological Agency had kindly offered to host, in Tokyo, the Seminar from 15 to 19 April 1991 and the Workshop from 22 to 24 April 1991.

58 The Group was then informed of the status of preparation of these events. The programme for the Seminar, as developed by the Organizing Committee (headed by the Chairman of IGOSS, Dr. Yves Tourre), is given in Annex XII. The Group noted with satisfaction that a first announcement of the Seminar (prepared by the USA National Ocean Service of NOAA) had been distributed, keynote speakers for all major seminar topics identified, and a substantial number of contributed papers already proposed. The Group agreed that this Seminar would represent a major milestone for IGOSS, both in demonstrating the progress already achieved in the development of operational ocean products, and also in identifying major directions for the future development of the IDPSS and the IOS. It urged as many scientists as possible with an interest in operational oceanography to participate in the Seminar, if possible through presentation of a paper.

59 The Group next considered the IGOSS Products Workshop which would follow the Seminar. Based on the original recommendation of IGOSS-V, the opinion of the IOC Assembly on the matter, and also its own understanding of the matter, the Group agreed that the two main themes for the Workshop should be:

(i) to derive conclusions from the Seminar for the future of the IDPSS, and

(ii) to provide advice on the future of the IOS and on the development of the Global Ocean Observing System, based on the results of the preceding Seminar.

60 On this basis, the Group agreed on a draft provisional agenda for the Workshop, which is given in Annex XIII.

8. MONITORING OF IGOSS DATA

61 Under this agenda item, the Group considered first a report on the monitoring undertaken by WMO of the exchange of IGOSS data, in particular BATHY/TESAC messages (reports and bulletins), over the GTS. This report, which is given in Annex XIV, is in two main parts: total numbers of BATHY/TESAC messages exchanged in 1989, and the numbers of messages exchanged during the global GTS monitoring undertaken during October 1989. With regard specifically to the latter, the Group expressed concern at the different monitoring procedures applied at the various GTS centres which, it agreed, rendered the monitoring statistics difficult to interpret. It therefore decided that very specific guidelines on monitoring procedures related to IGOSS data should be prepared and distributed to those responsible for the monitoring, prior to the next annual global monitoring. These guidelines should in particular be based on the principle of first counting all data exchanged (including duplicates and nil reports), but then, if possible, including a breakdown into real data, nil data, duplicates, etc. The Group requested experts from Australia, Germany and USA, together with the IGOSS Operations Co-ordinator, to prepare such draft monitoring guidelines, for the consideration first by the Group (by correspondence) and then by IGOSS-VI for inclusion as an annex to Guide No.3.

62 Further on the GTS monitoring statistics, the Group considered that some of the discrepancies in numbers of BATHY/TESAC, TRACKOB, and other messages received via the GTS at different centres may be due to problems in switching and routing of these messages through the network of GTS nodes. These problems may result, in turn, from a lack of information on the GTS abbreviated bulletin headers under which these messages are inserted, on the part of both receiving and switching centres. The Group therefore requested the WMO Secretariat, with the assistance of the IGOSS Operations Co-ordinator and Canada, to compile a complete list of the bulletin headers used for oceanographic data on the GTS, for publication as widely as possible, e.g., on the IGOSS.XBT and OCEAN E-mail bulletin boards, in the World Weather Watch Monthly Letter, etc. This list should then be updated at regular intervals, preferably six-monthly.

63 The Group noted that there have been instances of essentially the same data being inserted twice onto the GTS, before and after quality control, under either the same or different bulletin headers or message types. It was agreed that there was value for processing centres in continuing this practice, but at the same time it may create confusion and difficulties for recipients of the data if they are not aware of exactly what is happening. The Group therefore requested any centres undertaking such a practice to notify both the IGOSS Operations Co-ordinator and the WMO Secretariat of exactly what was being done, in order that potential users could be informed, e.g., through the IGOSS.XBT monthly report and the World Weather Watch Monthly Letter.

64 The Group next considered the monthly report prepared by the IGOSS Operations Co-ordinator and distributed on E-mail as IGOSS.XBT. It considered this report to be very valuable, to both producers and users of XBT data, although there was some feeling that the presentation format might be improved. The Group requested that the report should be expanded to include all forms of oceanographic data on the GTS, in particular TRACKOB, DRIBU and WAVEOB.

65 The Group finally considered the two types of monitoring reports related to the ships-of-opportunity themselves, viz the ship visit reports, as presently co-ordinated by the IGOSS Operations Co-ordinator, and the

ship inventories, as proposed by the Third Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes. For the former, it was agreed that these are of value to a number of programmes, including TOGA and WOCE, in particular in allowing an assessment of probe failure rates, and that they should therefore be continued. For the latter, it was noted first that they are difficult to prepare and also that there are difficulties in inputting the information into an appropriate data base. The Group nevertheless agreed that there is a need to develop and maintain such a ship-of-opportunity data base, in particular in support again of WOCE and TOGA, and that such work should be undertaken through IGOSS. It therefore recommended that:

(i) each ship-of-opportunity operating programme be invited, through an IGOSS joint circular letter, to prepare such ship inventories based on the format given in an annex to the Third Ship-of-Opportunity Meeting report, for submission to the IGOSS Operations Co-ordinator at appropriate intervals;

(ii) the IGOSS Operations Co-ordinator establish, with assistance from France and the USA, an appropriate data-base to contain this information. This data-base could then be updated regularly and made available to the ship' operators, research programmes and others concerned within the IGOSS community.

9. IGOSS PUBLICATIONS

Guide to IGOSS Data Archives and Exchange (BATHY and TESAC) (IOC Manuals and Guides No.1)

66 The Group recalled that IGOSS-V had already agreed that the Guide should be up-dated. Since this Guide is under the responsibility of IODE, proposals for up-dating should be passed to the Chairman IODE for action (Action: IOC Secretariat).

Guide to Operational Procedures for the Collection and Exchange of IGOSS Data (IOC Manuals and Guides No.3, jointly prepared by IOC and WMO)

67 The Group recalled its decision under Agenda Item 8 (see above) to prepare very specific guidelines on IGOSS data monitoring procedures to be included in Guide No.3 as a new annex. It therefore requested that the sub-group established to deal with this task produce a draft by the end of the first quarter of 1991, that the draft be circulated to OTA members for comments, and that a final proposal be submitted to IGOSS-VI (Action: IGOSS Operations Co-ordinator).

68 As far as the inclusion of new code forms in Guide No.3 was concerned, the Group considered that: (i) it had to wait for the finalization of the DRIBU code before this or a similar code be introduced into the Guide; (ii) IGOSS had, up to now, little to do with wave data, which did not make it useful to introduce the WAVEOB code into the Guide.

Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices (IOC Manuals and Guides No.4, jointly prepared by IOC and WMO)

69 The Group recalled that IGOSS-V had welcomed the kind offer of the USA to provide for a Rapporteur who would devote one year of his time over a three-year period to redraft the Guide. Unfortunately, efforts undertaken so far to mobilize the required international expertise to assist the Rapporteur have not proved successful enough to enable this huge piece of

work to be actually undertaken. After a thorough discussion of this topic, the Group decided to recommend to IGOSS-VI to abandon such a difficult undertaking and to rather consider preparing some kind of handbook, presented country by country, where simple information concerning instruments would be reproduced according to the information delivered by the IGOSS National Representatives of the countries as answers to a questionnaire. It was agreed that Mr. P. Parker and the IGOSS Operations Co-ordinator would work together to prepare a draft questionnaire to be submitted to IGOSS-VI.

70 Some members of the Group wished to express some reservations on the above recommendation, on the grounds that its implementation may cause some difficulties to their IGOSS National Representatives.

Guide to the IGOSS Data Processing and Services System (IDPSS) (WMO No. 623)

71 The Group agreed that several parts of the Guide needed at least up-dating, and probably redrafting. It recommended that this be submitted to the Workshop on IGOSS Products (Tokyo, 22-24 April 1991) on the grounds that the previous such workshop (Moscow, 9-11 April 1979) had initiated the preparation of the Guide (see Annex XIII).

10. OTHER BUSINESS

Port Meteorological Officers (PMO's)

72 The Group was presented with the guidance material which is already available to Port Meteorological Officers (PMOs) relevant to their work in servicing ships of the WMO Voluntary Observing Ships (VOS) scheme. It agreed it should consider the possibility of preparing similar PMO guidance which might assist IGOSS in the future maintenance of IGOSS ships-of-opportunity. The IGOSS Operations Co-ordinator volunteered to undertake the task of collecting requirements for such guidelines from IGOSS ship-of-opportunity management centres. Dr. W. Woodward (USA) offered to submit, in writing, informal guidelines now used in the United States. The Secretariats offered to assist in this undertaking in providing all interested parties with the report prepared by Dr. J.R. Donguy in 1981 on "Recruitment and Use of Ships of Opportunity". The final proposal will be prepared by the Secretariats with the assistance of Capt. G. Mackie (UK) and submitted to IGOSS-VI.

Global Current Meter Pilot Project (GCMPP)

73 The Group was presented with a recommendation made by the IOC ad hoc Group of Experts on a Global Ocean Observing System for an IGOSS-IODE Global Current-Meter Pilot Project. Such an initiative would be analogous to the IGOSS-IODE Global Temperature-Salinity Pilot Project. The Group expressed the view that all current measurement data should be considered rather than only current-meter data. It was nevertheless pointed out that the recommendation had referred to the ATLAS moored buoys in the Tropical Pacific which now transmit data via Service Argos; that existing code forms may be inadequate to transmit via the GTS all current data that are taken; and that most current measurement data are not now transmitted in real-time. The Group expressed its willingness to work with those now taking current observations and to explore potential code modifications if and when such changes are needed. It was pointed out that efforts should be coordinated with the WOCE Surface Velocity Programme and the relevant TOGA activities.

11. CLOSURE OF THE SESSION

74 In closing the session, the Chairman expressed his appreciation for the work just achieved and his firm belief that IGOSS is in a good position to meet the challenges that face it. He thanked the participants for their excellent spirit of co-operation and their support to the work of the Group.

75 On behalf of the participants, Mr. J. Withrow expressed his appreciation to the Chairman for his very effective handling of the session, and to the Secretariats for their support to the Group.

76 The Second Session of the IGOSS Group of Experts on Operations and Technical Applications closed at 12.30 p.m. on Friday 16 November 1990.

ANNEX I

AGENDA

1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION

1.2 ADOPTION OF THE AGENDA

1.3 WORKING ARRANGEMENTS

2. REVIEW OF THE STATE OF IMPLEMENTATION OF IGOSS-V DECISIONS RELATED TO THE WORK OF THE GROUP, AND OF OTHER RELEVANT INTERSESSIONAL EVENTS

3. OBSERVATION TECHNIQUES

3.1 RECOMMENDED TECHNIQUES TO INCREASE THE NUMBER OF SALINITY DATA EXCHANGED WITHIN IGOSS

3.2 ALONG-THE-TRACK MEASUREMENTS

4. CODE MATTERS

4.1 CHARACTER-BASED CODE FORMS

4.2 USE OF BUFR FOR IGOSS DATA (INCLUDING QC FLAGS)

4.3 RELATIONSHIP BETWEEN BUFR AND GF-3

5. COMMUNICATION SYSTEMS AND PROCEDURES

5.1 SATELLITE-BASED DATA COLLECTION SYSTEMS

5.2 RECOMMENDED SPECIAL IGOSS COMMUNICATION PROCEDURES

6. QUALITY CONTROL OF IGOSS DATA

6.1 REVIEW OF EXISTING GUIDELINES

6.2 QC PROCEDURES FOR AUTOMATED SYSTEMS

6.3 DEVELOPMENT OF STANDARDS FOR AUTOMATIC WORK STATIONS

6.4 DEVELOPMENT OF PC SOFTWARE FOR USE BY IGOSS AND IODE - "OCEAN PC"

7. **IGOSS PRODUCTS**

8. **MONITORING OF IGOSS DATA**

9. **IGOSS PUBLICATIONS**

10. **OTHER BUSINESS**

11. **CLOSURE OF THE SESSION**

ANNEX II

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ANNEX III

LIST OF TESAC/TRACKOB DEMONSTRATION PROJECTS

TESAC MESSAGES

1) Canada: MiniCTD to TESAC. Update software for formatting TESAC messages from temperature and salinity profiles derived from miniCTD's. It is also very important to inventory what miniCTD's exist in Canada to determine potential applications of the software.

2) USA: Research vessel CTD to TESAC. Determine status of Serial ASCII Instrumentation Loops (SAIL) on UNOLS research vessels. Examine the feasibility of interfacing the SEAS system to SAIL loops on UNOLS RV's to generate TESAC messages automatically when a CTD is lowered. If possible, also examine the feasibility of automatically generating other messages, such as SHIP weather or BATHY XBT data.

3) France: Rual TESAC Algorithm. The work of Pierre Rual to develop an algorithm for formatting BATHY messages is excellent. Expand the algorithm to include TESAC coding of CTD profile data.

4) USA and France: Access to Software for Automated Systems. Provide software for SEAS and ARGOS automated shipboard observing systems to assist USSR and others in development of similar systems and to encourage international standardization of procedures.

5) Norway: Implement a system for automatic TESAC coding of ADCP and CTD profiles.

TRACKOB MESSAGES

6) FRG: Automated TRACKOB encoding. Investigate possibilities for automating formatting of TRACKOB messages of SST observations from "contact" thermometers on merchant and other vessels. Investigate possibilities for similar automation of TRACKOB messages from underway salinometers on one or more research vessels.

7) USA: SAIL to TRACKOB. Investigate the feasibility of interfacing SEAS to SAIL systems on UNOLS or other research vessels for automated formatting and transmission of TRACKOB messages.

8) UK: SATNAV Ship Drift Surface Currents to TRACKOB. Investigate possibilities for automated capture of surface current measurement by ship drift from satellite navigation receiver and formatting of TRACKOB message of surface current. Cooperate with USA on SAIL system and with FRG on underway salinometer development as much as feasible.

9) Argentina and Australia: Southern Ocean TRACKOB Messages. Try to determine possibilities for routine TRACKOB reporting of surface temperature, salinity and current in Southern Ocean, particularly between South America and Antarctica and between Australia/New Zealand and Antarctica. If continued for many years, these data could show interannual changes of surface conditions in the Antarctic Circumpolar Current and possibly show how conditions in the Southern Oceans might affect global climate changes.

IGOSS QUALITY CONTROL MANUAL

10) USSR: FORTRAN Version of QC Manual. Develop FORTRAN code version of QC Manual. Try to include variable ranges of temperature and salinity by depth and season (month).

11) Japan: QC Procedures for TRACKOB Messages. Try to describe methods for QC of TRACKOB messages of surface temperature, salinity and current in a manner similar to that used in IGOSS QC manual.

ANNEX IV

COMMUNICATION SYSTEMS AND PROCEDURES

INTRODUCTION

The quality and quantity of IGOSS data can be enhanced by extensive and proper application of satellite based systems for data collection and product distribution. A broad range of available and emerging satellite and alternate communications capabilities exist. This report provides an overview of those capabilities and suggests criteria that could be used in deciding which method to use for a particular application. The author will review the status of these capabilities at IGOSS-OTA II.

SATELLITE BASED DATA COLLECTION SYSTEMS

APPLICATIONS TECHNOLOGY SATELLITE (ATS)

The Applications Technology Satellite series was a test program by NASA that began in the 1960's. ATS-3 was launched in 1967 as a test of direct broadcast of television to remote locations. During the early 1970's the ocean community was granted limited access to the satellite, and later in that decade the entire satellite and its handling system were turned over to a University of Miami operation in Florida and continue to be operated with government funding.

Only a few of the original 5 voice channels are usable and several bands for data telemetry are available at nominal 1200 baud rates. The satellite is in geosynchronous orbit with 24 hour coverage from Hawaii to the Azores and to about 70 degrees latitude. The orbital inclination allows the polar regions to be seen for approximately four hours each day. The amazing feature of this satellite is that while it was designed to last only 18 months, it is now nearly 25 years old! It is all solid state with solar power and temporary backup batteries. It may last for a very long time or may fail before I finish writing this report.

Only simple equipment is required to operate the 149MHz uplink and the 136MHz downlink. The two-way communications provides a desirable capability for some applications. ATS use typically is for voice communications from research ships and remote experimental stations to their home laboratories and with each other plus some data transmission including telemail and satellite IR facsimile data. There are no costs to use this satellite for voice or data relay.

ARGOS

The ARGOS system is well known to most ocean observation programs. The system includes a French instrument aboard a NOAA satellite (TIROS) and a combination of U.S and French receiving stations. Data downlinked by ARGOS at 136.77 or 137.77MHz is sent to computing centers in the U.S (Landover, MD) and France (Toulouse) which are connected to one another with real time data links. The data that is processed at these centers is made available over several systems including dial-up lines and GTS.

More immediate access to the ARGOS data independent of the ARGOS processing centers can be obtained with a local users terminal (LUT) that receives the direct downlink nearly simultaneously with the uplink. Use of the LUT is limited, however to the period of time when the data platform (buoy etc.) and the LUT are both in the satellite footprint (within 2600km of each other). With an LUT the user must of course do his own data processing including algorithms for platform positioning.

The great appeal of ARGOS is its ability to determine the geographical position of an object. The data throughput is relatively limited, however, because the polar orbiting satellite is in view for only a few minutes every few hours depending on one's latitude. This limitation is also a significant drawback to programs (eg. operational weather prediction) that require observations at synoptic times. Non-commercial costs for use of the ARGOS data and locating service are based on an international Joint Tariff Agreement that is negotiated annually. Present annual costs are approximately $5,000 U.S. per platform year.

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITES (GOES)

The U.S. GOES network is operated by the National Oceanic and Atmospheric Administration (NOAA) and typically includes a west and an east satellite and when fully operational can provide 24 hour coverage of the Pacific and Atlantic oceans though not the polar regions. While GOES can provide a higher data rate capability than ARGOS there is no platform positioning capability aboard, although independently determined positions can be included in the data stream.

The data collection system aboard the GOES satellites is reproduced on some, though not all, geostationary meteorological satellites that some other nations have put into orbit. Specifically, these include the GMS series from Japan, the METEOSAT series from Western Europe and the INSAT series from India. Thus, by transmitting on internationally allocated channels that are shared by these satellites, the geographical coverage can be effectively expanded beyond the footprint of a given spacecraft. This is especially valuable for moving platforms such as ocean vessels. Generally, however, complex arrangements are necessary to insure that you can retrieve your data from the national agencies operating the satellites. Use of the GOES system is at this time free to qualified users.

INTERNATIONAL MARITIME SATELLITE (INMARSAT) ORGANIZATION

Originally called MARISAT, this commercial system is based on an array of geostationary satellites that provide worldwide coverage 24 hours per day except at the poles. High data rates are available, although the communications equipment is expensive and there is a need for large gyrostabilized antennas. The cost of the communications is also relatively expensive and would be prohibitive for ocean observing programs with many platforms collecting large amounts of routine data. A major advantage of the INMARSAT system, however, is that the multinational arrangements needed to get your data back home from downlink stations around the globe are taken care of as part of the system.

INMARSAT STANDARD-C

Standard-C is a low cost, light weight satellite communications terminal that works through the INMARSAT satellites and networks but at a much lower data transmission rate. The prototype terminal is shoebox size and uses a miniature (10cm x 6cm) omnidirectional antenna. The service is expected to include a hands on telex mode, the possibility of "group calls" to, for example, a fleet grouping of terminals, and a data reporting mode that can be at scheduled intervals. Though user fees are not yet developed, the tariff will probably be by character and is expected to be substantially less expensive than the cost of using the full INMARSAT system.

GEOSTAR

GEOSTAR is a new, commercial, position-fixing and two-way data transfer service that works through two geostationary satellites. It uses a different technique than ARGOS to determine position with estimates of location accuracy in the 2-7 meter range. Still not operational, the anticipated GEOSTAR user costs are likely to be competitive with ARGOS with much better location accuracy and two-way data capability.

The overriding limitation with GEOSTAR is its coverage of mainly the United States. More geostationary satellites and a more complicated computer system would be required to have worldwide (though not polar) coverage.

ALTERNATIVE DATA TRANSFER TECHNIQUES

METEOR-BURST

Originally conceived nearly five decades ago, it has become more attractive recently with the advent of microprocessors and cheap memory. With this scheme, a master station ashore sends out a beacon that is sporadically heard by a remote station whenever a meteor trail permits the beacon signal to be scattered to the remote station. The remote station sends a data burst for a fraction of a second, which is acknowledged as having been received intact by the master. The pattern of send, check and acknowledge is repeated until the meteor trail dies away, which may take a few seconds at most.

The system is quite expensive in the several tens of thousands of U.S. dollars for the master and up to ten thousand dollars for the remote. High data rates are potentially available, though no significant oceanographic use of this technique has been made. Also, there is no U.S Federal Communications Commission (FCC) frequency allocations for meteor burst communications and the FCC has not been encouraging about licensing.

HF PACKET

In the mid-1960's short-wave or high-frequency (HF) radio (3-30MHz) began to be displaced as a method of choice for communications by the wide range of satellite telemetry methods. The satellite techniques eliminated the problems inherent in the HF ionospheric propagation such as its susceptibility to noise and interference, fading, multipath transmission and always changing propagation and "skip" characteristics which result in zones of weak or non-existent signal reception. As a result of recent improvements in antennas, receivers and algorithms for processing digital information, it is worth re-evaluating the utility of HF telemetry as an alternative to satellites for some applications.

Not long ago, amateur radio operators modified the protocol that is used to support digital packet switching networks used on, for example, Telenet, to allow its use over shared radio circuits. In a packet switching protocol, the digital data stream is separated into convenient groups or "packets" of bits. Each packet is given a header that contains destination and routing information so all those stations that hear the transmitted packet know which of them is supposed to deal with it and how.

By adding supplementary address information, intermediate relay nodes can be used on the way to the final destination. This digital repeating capability can slow the throughput of the link but does greatly increase the distance and networking possibilities. Error checking schemes are also built into the protocol and greatly improve the integrity of the data. The equipment to perform all of these functions is readily available in the few hundred dollar (U.S) range. The method has a relatively high average data rate, is error-free, two-way and not dependent on the sometimes doubtful (and expensive) satellite links that usually require national and international negotiations to secure.

UHF - VHF LINE-OF-SIGHT

In addition to the UHF - VHF satellite communications links described above, the short range (10-50Km), "ground based" line- of-sight systems have some applicability that is generally limited to the coastal areas. The equipment is easily obtained, is not very expensive and can achieve high data rates. While a possible drawback to this system is that the user must establish, maintain and monitor his own receiving site, this also means that he has complete end-to-end control over the data collection process.

OMNET INC. SHIP COMMUNICATION SERVICE

OMNET Inc., the U.S. company that provides electronic mail service to the ocean community, is presently floating a concept for a new service to satisfy a full suite of communications needs from research vessels. The idea is that any and all information that is to be transmitted from the ship, including telemails, data, mail etc., would be bundled into one package aboard the vessel and transmitted by the preselected method of choice (satellite, HF, etc.) to OMNET, Inc. There, according to prior arrangements, it would be unbundled and distributed by appropriate means to all addresses. A central element in this concept is that a major portion of the associated expense would be covered by U.S. government agencies (eg., NSF). The Agency reception to this has been to date lukewarm.

INTERNET

The interconnectivity among digital communications networks has truly been explosive in recent times. Communication is now possible from the simplest of office specific ethernets, through building/area wide networks, to locally and regionally oriented systems all the way up to the long haul, high speed networks, coast to coast and beyond. In the U.S. the National Science Foundation (NSF) is providing support for the long haul service to which any and all willing subscribers can connect and enjoy a exceptionally broad capability for exchange of information. Internet is the term used to describe that broad long haul interconnective system and NSFNET is a U.S. component of it that will soon allow data speeds up to 45MB per sec. While it appears that these networks provide a useful and versatile service it is not immediately obvious to me that they are suited for continuous large volumes of routine operational data transfer. This needs to be examined.

SELECTION OF THE APPROPRIATE COMMUNICATION SCHEME

Decisions on which data collection method to adopt must be made carefully and should be based on both technical and economic considerations. The following is a list of suggested criteria to apply in the selection process:

- Is position determination required - what accuracy?

A yes answer greatly limits the possibilities. At this point ARGOS is the most logical choice.

- What are the platform locations?

The choices will likely vary depending on whether they are within sight of land, they are mobile or for example in the polar regions.

- What are the required data rates?

Substantial differences exist among the various systems and the capabilities of each must be carefully assessed.

- What is the total number of platforms?

Large numbers may require that inexpensive commercial hardware be readily available.

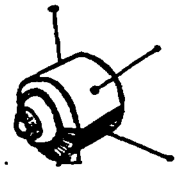
- Is the observation program long/short term?

This is not only a cost issue but also a hardware/software maintenance and service availability issue.

- Is reliability an absolute requirement - proven techniques?

The author acknowledges the assistance provided in preparing this material by Dr. Melbourne G. Briscoe. The primary source for material presented herein was:

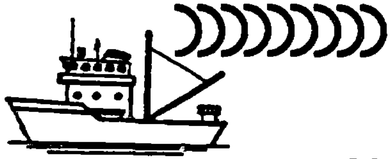
"Motivations and Methods for Ocean Data Telemetry,"
Melbourne G. Briscoe and Daniel E. Frye, MTS Journal -
Vol. 21, No.2, pp 42-57.



SATELLITE BASED

	COVERAGE	POSITION LOCATION	HARDWARE COST (USD)	RECURRING
ATS	HAWAII-AZORES NO POLAR	NO	6,000.00	--------
ARGOS	WORLDWIDE NOT SYNOPTIC	+/- 1 KM	2,000.00	27,790FF/Y
GOES	WORLDWIDE NOT POLAR	NO	4,000.00	-------
INMARSAT	SAME	NO	50,000.00	10(USD)/MINUTE
INMARSAT "C"	SAME	NO	7,000.00	BY CHARACTER
GEOSTAR	COASTAL USA	+/- 7 MILES	4,000.00	SAME

APPENDIX 2



ALTERNATIVE METHODS

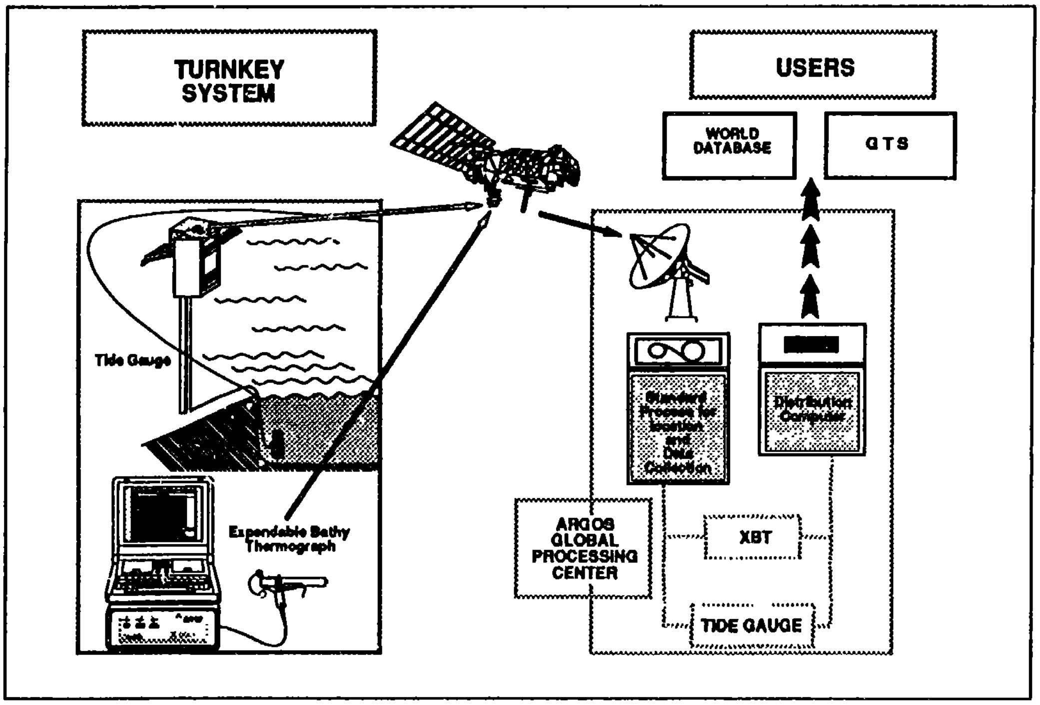
	COVERAGE	POSITION LOCATION	HARDWARE COST (USD)	RECURRING
METEOR BURST	2000 KM FROM MASTER	NO	10,000/100,000	---------
HF PACKET	VARIABLE UP TO WORLDWIDE	SAME	2,000/10,000+	---------
VHF-UHF L.O.S.	10 - 15 KM	SAME	1-2,OOO/5,000	---------
SHIP SERVER	COMMUNICATIONS LINK-DEPENDENT	SAME		
INTERNET	"WORLDWIDE'	SAME		

ANNEX V

CLS/SERVICE ARGOS OPERATIONAL SYSTEMS AND NEW DEVELOPMENTS

1. NEWS FROM ARGOS OPERATIONAL SYSTEMS

These systems essentially comprise field equipment, matched to the application, and dedicated processing services at the Argos centers. The software complements standard Argos processing, providing users with ready-to-use, customized products. Two main turnkey systems dedicated to Oceanographic applications are described below.



1.1 XBT Service

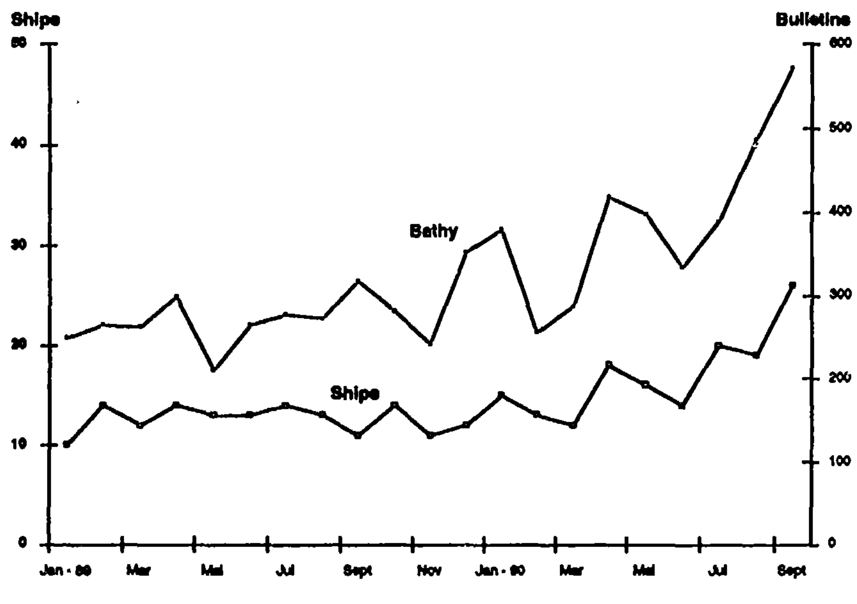
Service Argos has worked closely with ORSTOM scientists to develop an end-to-end system for the acquisition, processing and near-real-time transmission of XBT (expendable bathythermograph) data. The shipboard equipment comprises an XBT launcher, a watertight case containing the acquisition and transmission electronics, and a microcomputer. User-friendly software has been developed to drive acquisition, profile validation and extraction of bathymessages for the Argos transmission.

The main computation parameters can be re-set by the user. A dedicated software module also permits data analysis on board. At the other end of the chain, at the Argos processing centers, dedicated software validates, stores and automatically transmits the bathymessages onto the GTS. Users can also consult their XBT data by logging onto an Argos center.

The Argos VOS XBT network, operated mainly by the ORSTOM/IFREMER french organizations, has been extended this year to VOS equipped by the CSIRO (Australia).

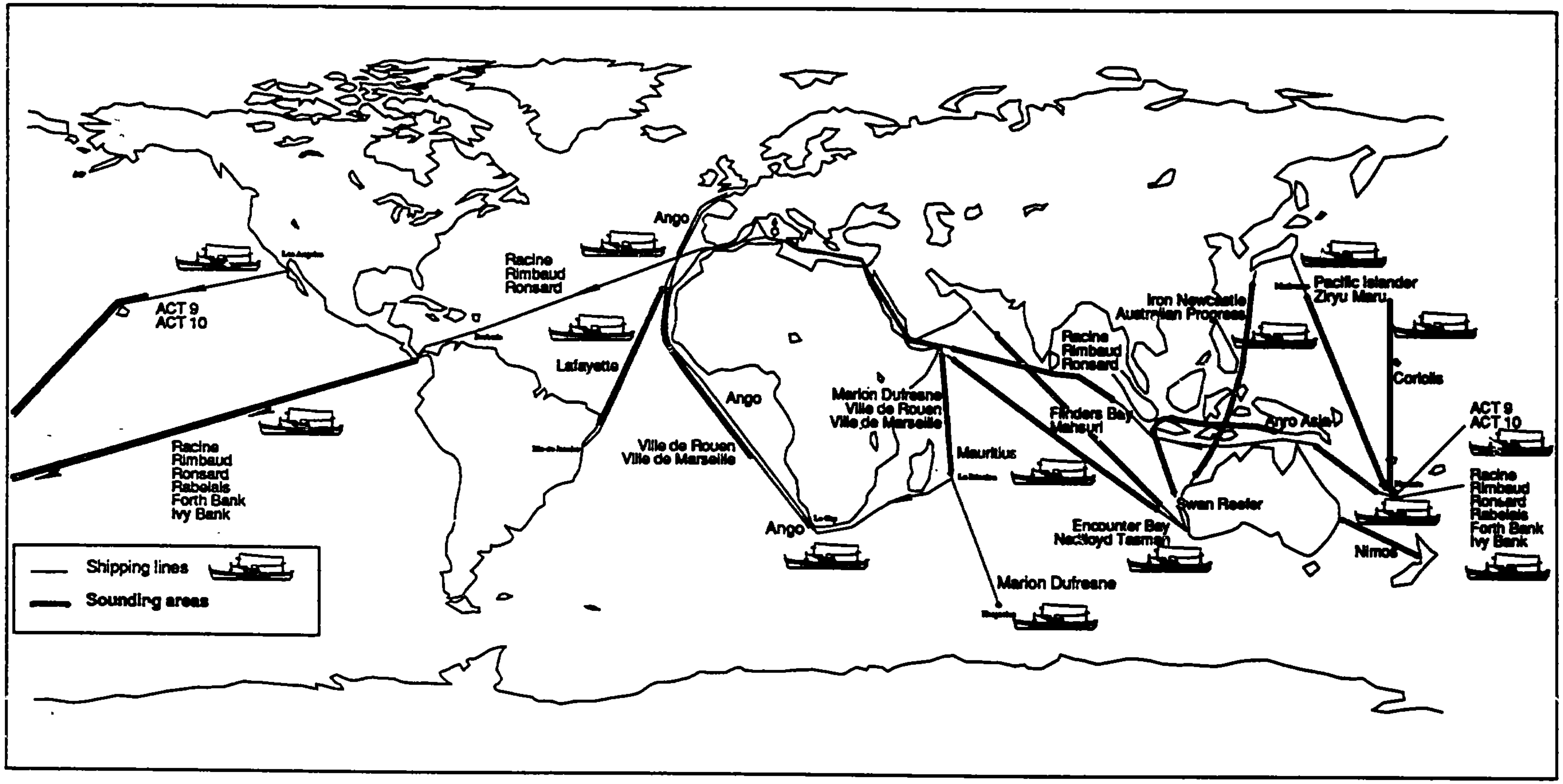
ORSTOM/IFREMER VOS are equipped with Argos XBT-ST systems. CSIRO VOS use Sippican Mark9 controlers interfaced via PC laptops to Argos Add-on units. The XBT/Add-on software comprises of two pieces linked together: an acquisition software developped by the CSIRO, based on the Sippican standard software, and largely improved to meet with VOS application, and the Argos XBT-ST software.

Same tests and bathymessages calculation are applied to profile obtained by both type of systems. Hence, the bathymessages results are homogeneous.



Argos -XBT evolution from january 1989 to september 1990
In number of ships (left scale) and number of bulletins (right scale)

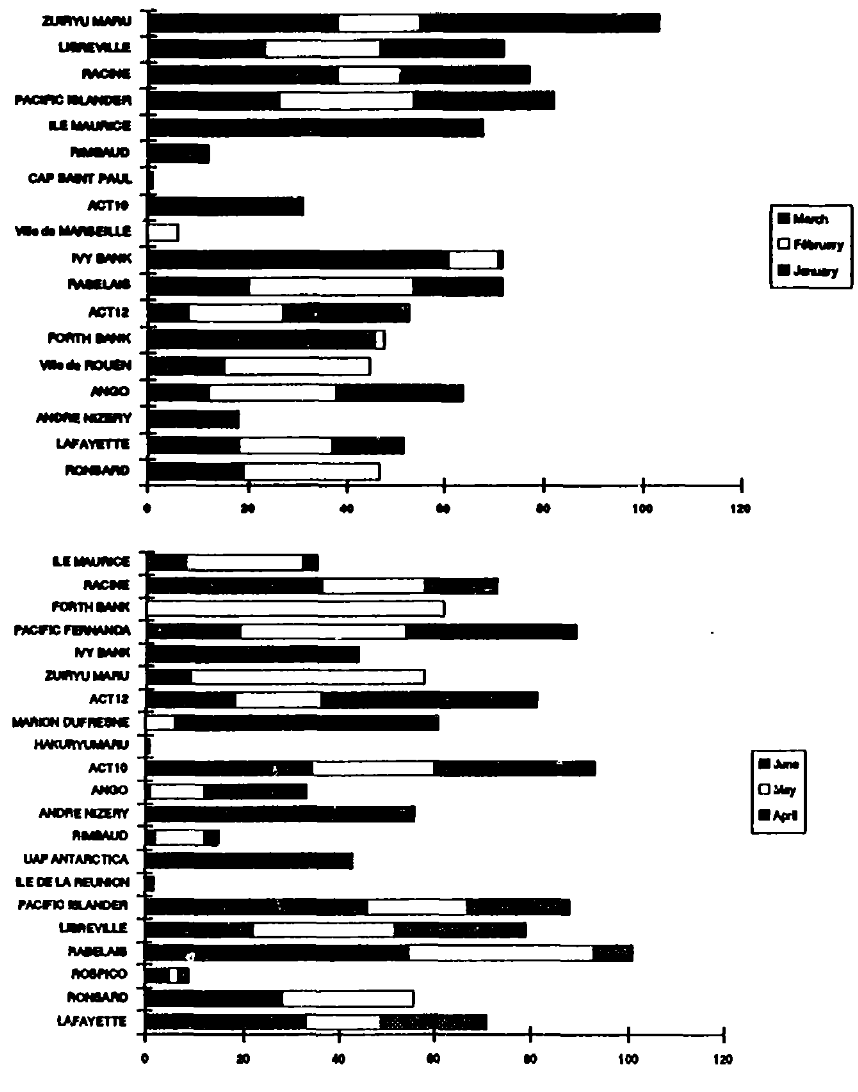
On August 28th 1990, 30 VOS vessels were equipped with Argos transmission. Total number expected for end 1990 ranges from 35 to 40.



XBT - VOS Shipping Lines with Argos Transmission

From January 1 to June 30, 1990, 2054 bathymessages collected by XBT-ST equipment and transmitted via Argos were placed onto the GTS. The equivalent figure for 1989 was 1528, and the year's total 3279.

The diagram attached show the number of bathymessages transmitted per vessel in the first two quarters of 1990.



Number of bathymessages transmitted over the GTS

1.2 Acquisition and processing of tide-gauge data

This system, developed in collaboration with ORSTOM, is based on a self-contained, programmable station for acquiring and transmitting water depths, together with software for programming the station and exploiting the data re-transmitted via Argos. The station drives high-accuracy tide-gauges, such as the Aanderaa WLR 5/7. Retransmission of the data not only provides results in near-real time, but also assures feedback on tide-gauge operation.

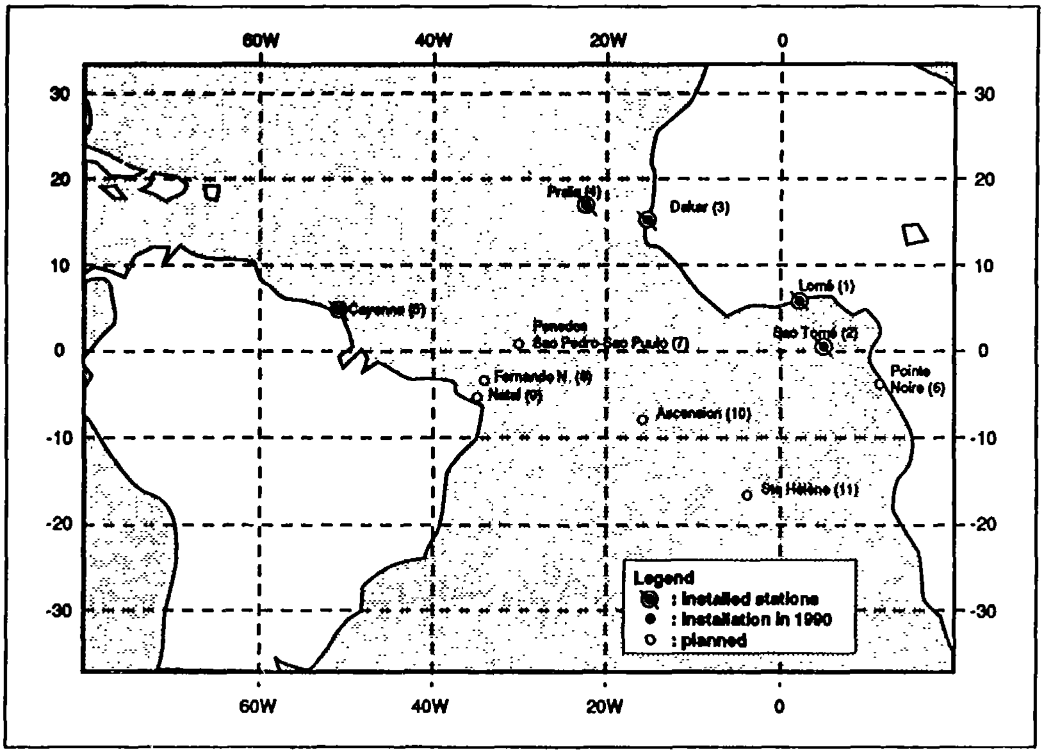
As with XBT, a Dedicated Service is being designed for the project. This will include the processing, validation, storage and distribution of water depth data to users. The data will be available on line, and will also be distributed off line on tapes, floppy disks and printout.

Argos tide-gauge network

The Argos tide-gauge stations, developed in cooperation with the ORSTOM, now fully operational, are being installed all around the world.

Atlantic

The South-Atlantic network, one of the French contribution to TOGA, is being implemented by ORSTOM:. the first station has been installed at Lomé (Togo) in early July 1989, while the second station has been operating at Sao Tome since November 1989.

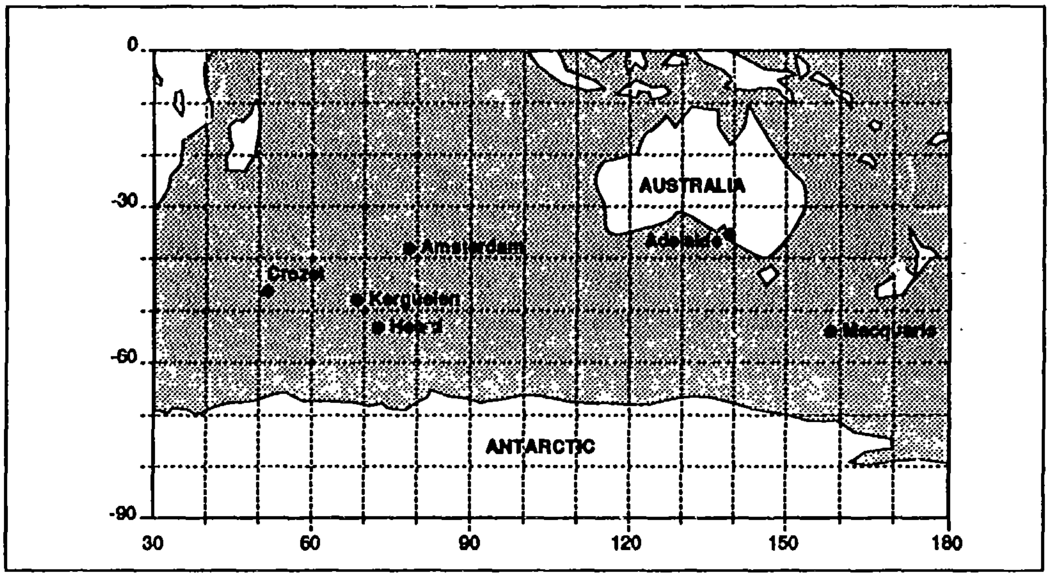


Two more stations were installed in July 1990 at Dakar (Senegal) and Praia (Cape Verde). Two further stations should be established, one at Cayenne (French Guyana) and the other at Penedos Sao Pedro-Sao Paolo (Brazil) by the end of year 1990. Four to nine stations are planned for 1991-1992, the objective being to establish South Atlantic network of ten to fifteen stations for the South Atlantic.

Pacific

One Argos tide-gauge station, operated by the Flinders University of South Australia on behalf of the Comittee of Tide and Mean Sea level, will be installed near Adelaide in 1990. Two further stations are planned for installation on Heard and Macquaries islands. Installation on ice sites is also under study.

The Australian Bureau Of Meteorology wil install a tide-gauge station on the North Australian coast before the end of 1990. Three further installations are planned for the next year.



Indian Ocean

Installation of two stations is planned in the Indian Ocean for the next southern summer: Kerguelen island and Amsterdam island. Two other stations will be installed at Crozet island and at Dumont d'Urville (Antartic) within the next two years. This operation is being conducted by the French oceanographic institute, IFREMER in cooperation with the IMG (Institut de Mécanique de Grenoble), the TAAF (Terres Australes et Antarctiques française) and the CNRS (Centre National de Recherches et d'Etudes Scientifiques).

2. NEW DEVELOPMENTS

2.1 Multisatellite Applications Extended Dissemination Service (MAEDS)

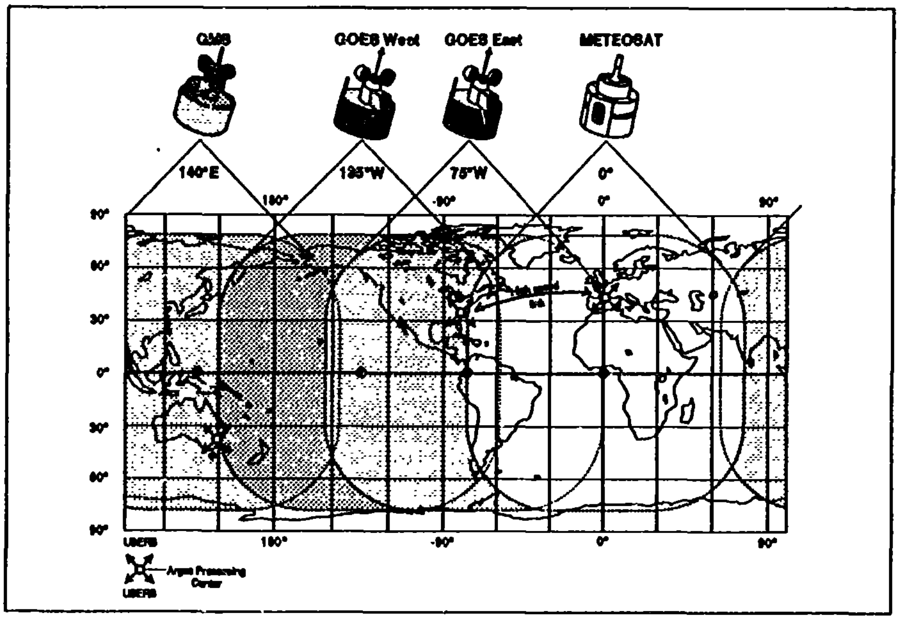
The purpose of MAEDS is to combine the features of three complementary systems, into one single service dedicated to high capacity and real-time data collection:

*** Geostationary satellites: Meteosat, Goes and later GMS**

Geostationary satellites at fixed positions relative to terrestrial reference frame with an orbital altitude of 36,000km. They provide high capacity: 649 bytes-messages up to one message per hour and real-time data (alarm channel).

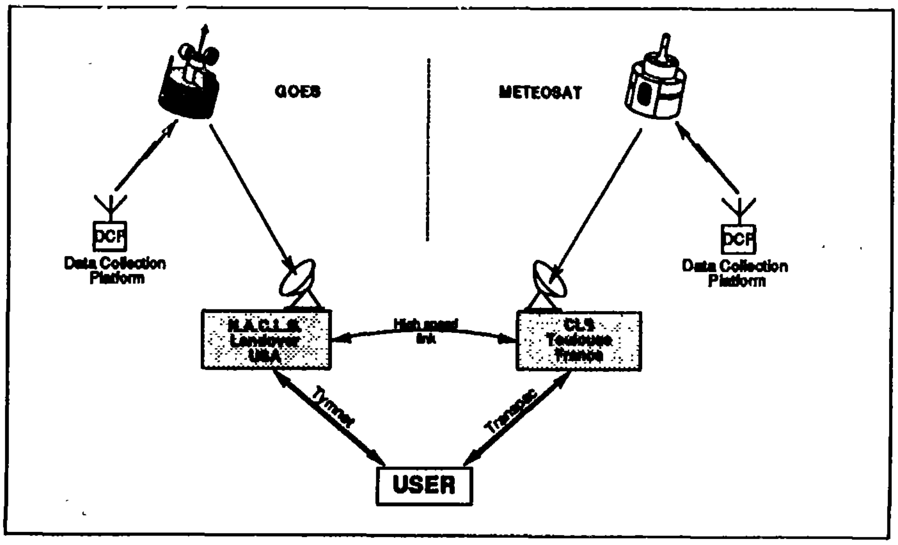
*** NOAA polar orbiting satellite and Argos system.**

The Argos system is flown aboard low-orbiting (850 km) NOAA satellites. Two satellites are simultaneously in service, allowing platforms location, short data message (256 bits) collection and global coverage



*** Argos network**

Main characteristics of this network include global distribution on-line and off-line, redundancy and regional centers, real-time data dissemination, standard and customized data processing and user guidance office facilities.



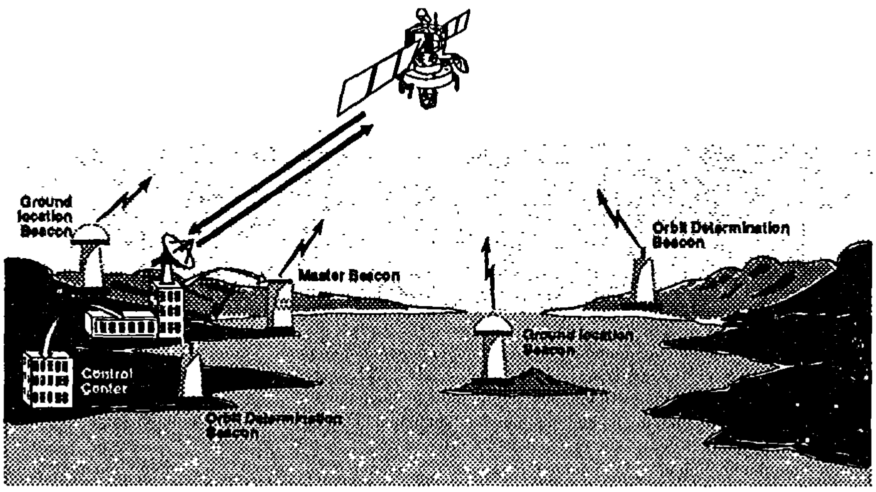
Maeds provides to Argos users, higher capacity and real-time. For Meteosat or Goes users, Maeds provides an integrated service with global coverage, redundancy in data processing and platforms locations. For example, US users will be able to download Meteosat data by connecting themeselves to the Argos processing center of Landover.

Maeds service has been implemented in October 1990 and 17 platforms are now using this system. An average of at least 70 to 80 platforms should be operational in Europe in 1991.

Note: combined Argos/Meteosat transmitters are already available.

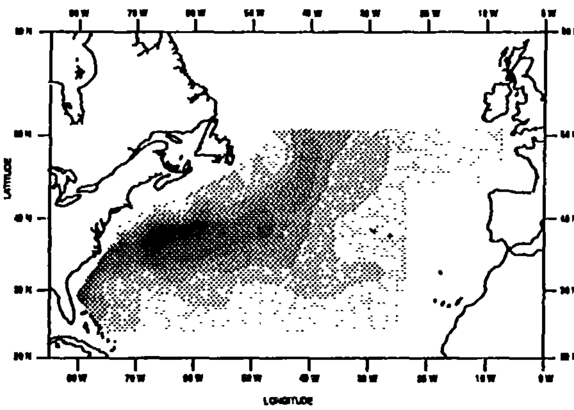
2.2 DORIS

DORIS is a worldwide location system with absolute location accuracy of 10 cm and relative location accuracy of a few cm. The system's operational features are similar to those of Argos,

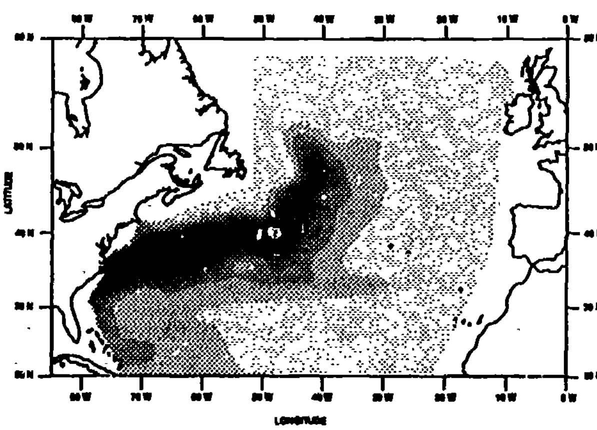


2.3 Oceanography group

The purpose of CLS Oceanography group is to provide easy access to satellite ocean data. Its activity focusses on satellite altimetry (ERS-1 and Topex-Poseidon) and drifting buoy data (under the WOCE and TOGA projects).



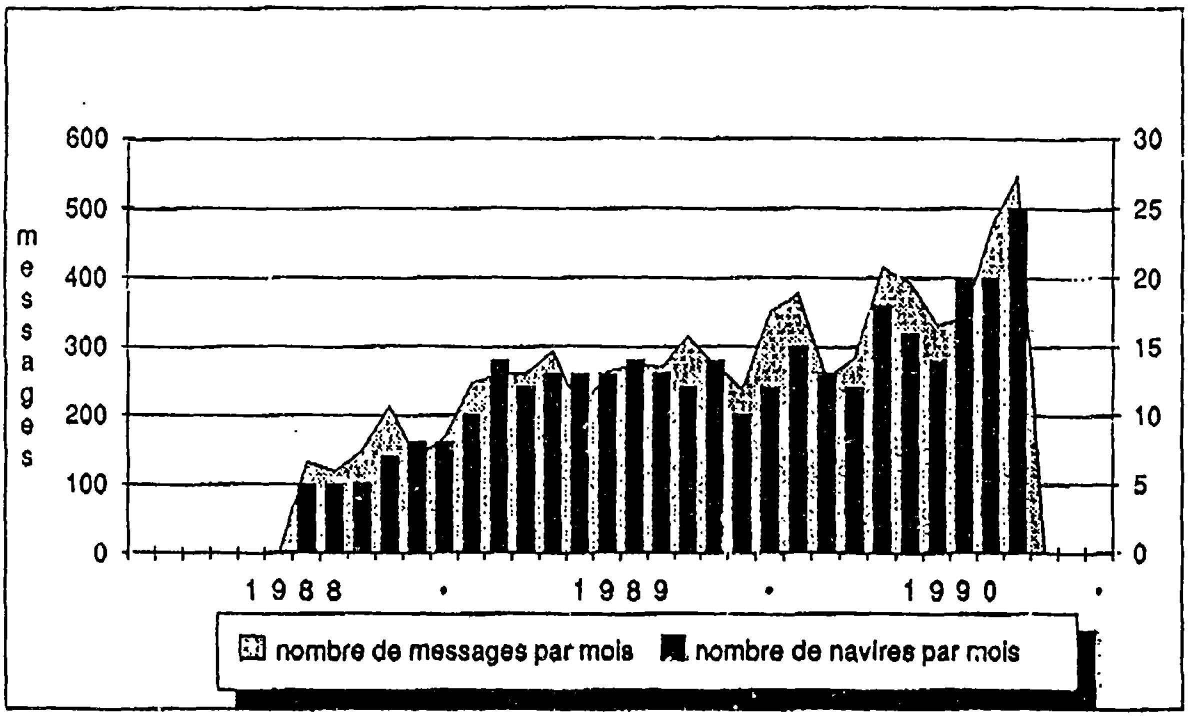
EDDY KINETIC ENERGY DEDUCED FROM DRIFTER DATA



EDDY KINETIC ENERGY DEDUCED FROM GEOSAT DATA

APPENDIX

XBT TRANSMISSION THROUGH ARGOS SYSTEM



RADIO	SHIP	XBT	EMIS	BM	EMIS/XBT
FNGS	LAFAYETTE	374	356	330	0.95
FNQC	VILLE DE ROUEN	317	308	278	0.97
FNOM	ANGO	294	278	261	0.95
FNQB	ILE MAURICE	227	220	189	0.97
DHJW	ACT9	197	198	181	1.01
FNCZ	LIBREVILLE	144	141	137	0.98
FNPA	RONSARD	132	126	124	0.95
HPEW	PACIFIC ISLANDER	105	103	100	0.98
JPJX	HAKURYU MARU	81	74	7[illegible]	0.91
FPYO	CAP SAINT PAUL	72	65	58	0.90
FNJT	KORRIGAN	59	56	48	0.95
FPID	ROSPICO	55	34	29	0.62
FNZQ	RIMBAUD (ex ELGAREN)	45	42	40	0.93
FWQP	ANDRE NIZERY	33	33	33	1.00
FNZP	RACINE (ex COSGAREN)	30	32	32	1.07
FNGB	MARION DUFRESNE	24	21	20	0.88
3BBA	MAURITIUS	11	12	7	1.09

ANNEX VI

BATHY/TESAC CHECKER
Quality Control Applied to BATHY/TESAC Reports at the Specialized Oceanographic Centre in Japan

1. Introduction

The IGOSS Specialized Oceanographic Center (SOC) for the Pacific Ocean with emphasis on the WESTPAC region, which is located in the Japan Meteorological Agency (JMA), collects various kinds of oceanographic data every day through Japanese coastal radio stations, INMARSAT, the Geostationary Meteorological Satellite (GMS), and the Global Telecommunication System (GTS). The BATHY/TESAC report is the only primary data source which gives real-time information on the vertical structure of the upper layers of the ocean in the high seas. However, the number of BATHY/TESAC reports is small, some 100 BATHY reports and 10-30 TESAC reports per day. Therefore it is necessary to perform an appropriate quality control in order to save them. A mixed man-machine system is thought to be the best means for this purpose.

This report briefly describes quality control procedures applied to BATHY/TESAC reports at the SOC, which have been in operation since January 1989. The purpose of this quality control is to make a domestic data set of BATHY/TESAC data in which all elements appear to be correct. No quality control flags are used. The data set is used in making operational oceanographic products, and then stored on magnetic tape for further use. Original reports are integrated into another data set for possible later reference. Both of the data sets of original reports and quality-controlled reports are forwarded in a delayed mode to the Japan Oceanographic Data Center (JODC), one of the RNODCs to IGOSS, for archive.

No quality control is applied to IGOSS reports at the GTS center in Tokyo (RJTD) prior to their insertion into the GTS. However, if a erroneous report is found among the BATHY reports received from Japanese ships through the Japanese coastal radio stations, INMARSAT and GMS, a corrected report with the indicator "CCA" in the abbreviated bulletin header is inserted into the GTS in a delayed mode.

2. Outline of the quality control

At first, attempts are made to identify the type of report and adjust the grouping of characters to the standard format in groups of five characters separated by one blank, exclusive of the message identifier group, by a large computer. The subsequent quality control is carried out on a personal computer, NEC PC-9801, using interactive editing procedures. The procedures are not designed completely according to the 'Minimum Quality Control Procedures for IGOSS Data Taken from the GTS' (Guide to operational procedures for the collection and exchange of IGOSS data, second edition, 1988 UNESCO).

The following items are checked in the order given in the appendices.

- message format,
- ship call sign,
- date and time of observation,
- position of observation,
- computed ship speed between adjacent reported positions,
- range of temperature/salinity,
- vertical consistency of temperature/salinity profiles,
- deviation from climatology,
- duplication of reports.

If a dubious report is found, an operator (expert) is asked whether it could be permitted, should be corrected or deleted. If necessary, the following information can be given on the screen with the possibility of visualizing immediately the corrections to be applied:

- original report,
- reported observation position (figure 1),
- ship track (figure 2)
  (all reports received during the previous ten days are also referred to),
- plot of temperature/salinity profile (figures 3 and 4).

There is often more than one error per report. Errors are corrected or deleted on each occasion.

Additional checks for horizontal consistency are applied to temperature data in the course of preparing analysis/forecast products.

3. Error statistics

An error statistic was made for the reports received from 21 through 30 September 1990 to get some information concerning the type and frequency of error. The total number of bulletins is 277, and 11 duplicates are included in the total. The errors identified during the quality control are summarized as follows:

	BATHY	TESAC
Total number of reports	910	149
(without multiply transmitted reports)		
Error in format	11	4
Error in date/time	1	
Error in position	3	
Error in ship speed	14	
(due to errors in date/time and/or position)		
Error in depth	9	8
Error in temperature	63	4
Error in salinity		3
Error in "ship call sign"	22	1

Appendix 1. Quality control procedures for BATHY reports

Quality control checks are carried out in the following order.

1. Check if the group '8888x' is present.
2. Check if the quadrant is one of 1, 3, 5 or 7.
3. Check if the first group is 'JJXX'.
4. Check if the first depth is 0.
5. Check if the depth is increasing with each observation.
6. Check if each temperature is not '000'.
7. Check if temperature is between -2 and 32 ℃.
8. Check if $(T_m - T_{m-1}) \leqq 1$ ℃, where T_m is a temperature value at any level m and T_{m-1} is a value immediately preceding (therefore shallower) T_m in the report.
9. Check if the normal of sea surface temperature is present at the position. The position at which the normal is not present is considered to be on land.

10. Check if temperature is not deviated so much from the normal by Levitus.

$$|To - Tm| < 4.0/\exp((d/250)) + 1.0 \quad (d < 1000)$$

$$|To - Tm| < 1.0 \quad (d > 1000)$$

where To and Tm are the normal and reported temperature values at the depth of 'd meters', respectively.

11. Check if the degree number of the latitude is between 0 and 89. Check if the minute number of the latitude is between 0 and 59.
12. Check if the degree number of the longitude is between 0 and 180. Check if the minute number of the longitude is between 0 and 59.
13. Check if the year indicator is the same as the current year.
14. Check if the month is between 1 and 12. Check if the month is not in the future.
15. Check if the day is between 1 and 31. Check if the serial day counted from the 1st of January is not in the future.
16. Check if the hour is between 0 and 23. Check if the minute is between 0 and 59.
17. Check if the direction of the current is between 01 and 36. Check if the current speed is less than 5 knots.
18. Check if the number of groups between '8888x' and the latitude group does not exceed three.
19. Check if the number of groups between '66666' and the call sign group does not exceed two.
20. Check if the call sign does not include any characters besides alphabets, numerals and @. Check if the call sign is none of '   ', 'DUPE', 'END ', 'MESS', 'PAGE' and 'TEST'.
21. Check if the ship speed calculated between the position and the immediately preceding position is less than 25 knots. If the call sign is 'SHIP' or if the call sign is unavailable, this check is not carried out.
22. Check if there are any reports with the same time and the same position as the report in the successive five reports.
23. Check if there are more than three pairs of groups in which the first group begins with character '2' and the successive group with '3'. The report might be a TESAC report.
24. Check if the indicator of the GTS center compiling the bulletin is not 'RJTD' or the international date-time group indicating when the bulletin was compiled is not '0500'. The report might

be a delayed mode BATHY report which was inserted onto the GTS at RJTD (Tokyo).

Appendix 2. Quality control procedures for TESAC reports

1. Check if the group '888xx' is present.
2. Check if the quadrant is one of 1, 3, 5 or 7.
3. Check if the first group is 'KKXX'.
4. Check if the first character in each group between '888xx' and '55555' or '66666' is one of 2, 3 or 4.
5. Check if depth groups are present.
6. Check if the first depth is 0.
7. Check if the depth is increasing with each observation.
8. Check if temperature groups are present.
9. Check if each temperature is not '0000'.
10. Check if temperature is between -2 and 32 ℃.
11. Check if $(T_m - T_{m-1}) \leqq 1$ ℃, where T_m is a temperature value at any level m and T_{m-1} is a value immediately preceding (therefore shallower) T_m in the report.
12. Check if salinity groups are present.
13. Check if salinity between 25 and 40.
14. Check if the normal of sea surface temperature is present at the position. The position at which the normal is not present is considered to be on land.
15. Check if temperature is not deviated so much from the normal by Levitus.

    $|T_o - T_m| < 4.0/\exp((d/250)) + 1.0 \quad (d < 1000)$

    $|T_o - T_m| < 1.0 \quad (d > 1000)$

    where T_o and T_m are the normal and reported temperature values at the depth of 'd meters', respectively.
16. Check if the degree number of the latitude is between 0 and 89.
    Check if the minute number of the latitude is between 0 and 59.
17. Check if the degree number of the longitude is between 0 and 180.
    Check if the minute number of the longitude is between 0 and 59.
18. Check if the year indicator is the same as the current year.
19. Check if the month is between 1 and 12.
    Check if the month is not in the future.
20. Check if the day is between 1 and 31.
    Check if the serial day counted from the 1st of January is not in

the future.

21. Check if the hour is between 0 and 23.
    Check if the minute is between 0 and 59.
22. Check if the number of groups between '888xx' and the latitude group does not exceed three.
23. Check if the number of groups between '55555' or '66666' and the call sign group does not exceed six.
24. Check if the call sign does not include any characters besides alphabets, numerals and @.
    Check if the call sign is none of '   ', 'DUPE', 'END ', 'MESS', 'PAGE' and 'TEST'.
25. Check if the ship speed calculated between the position and the immediately preceding position is less than 25 knots. If the call sign is 'SHIP' or if the call sign is unavailable, this check is not carried out.
26. Check if there are not any reports with the same time and the same position as the report in the successive five reports.

Captions;

figure 1 Observation position from a report.
figure 2 Ship track.
figure 3 Temperature profile from a BATHY report.
figure 4 Temperature and salinity profiles from a TESAC report.

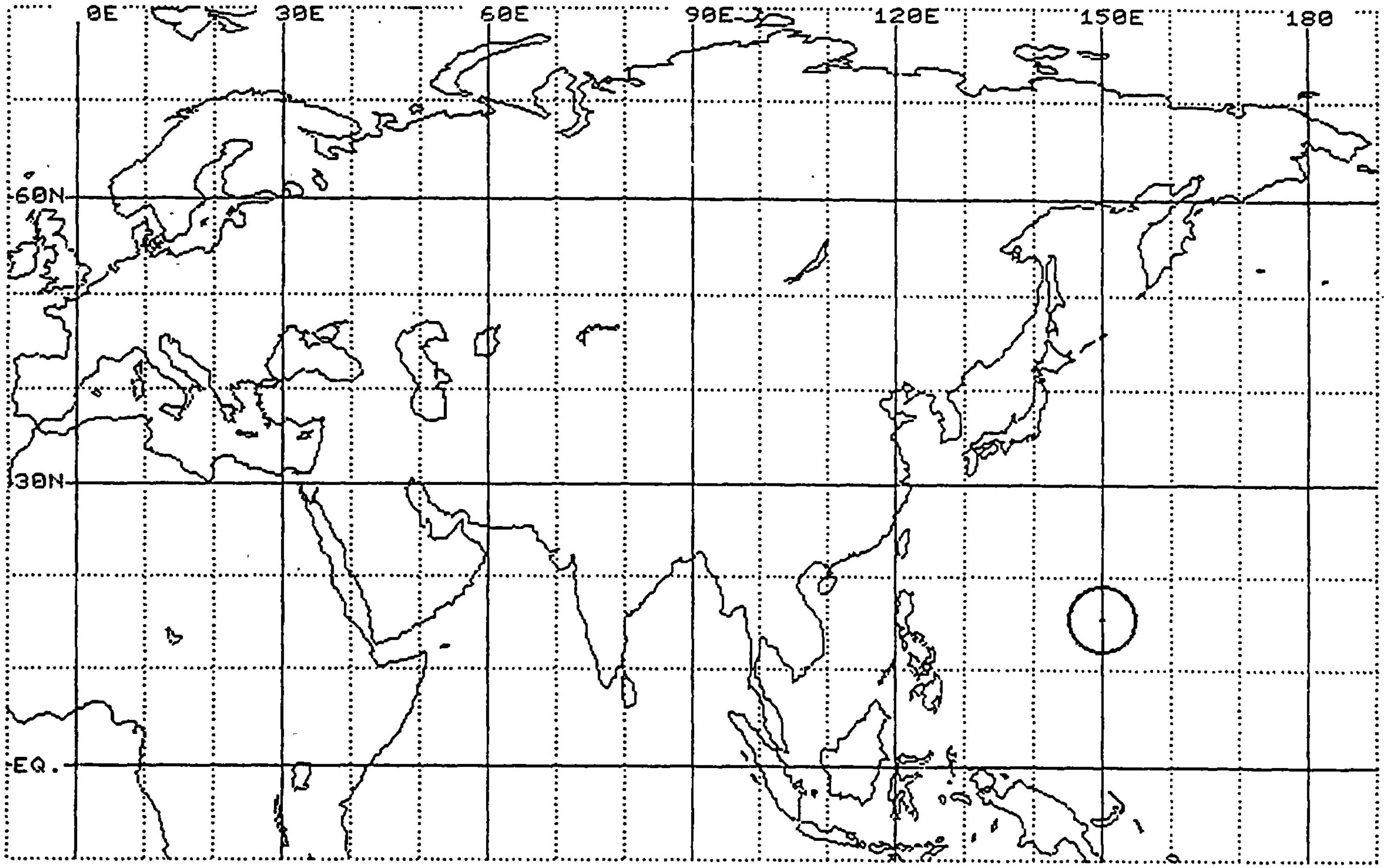


FIGURE 1

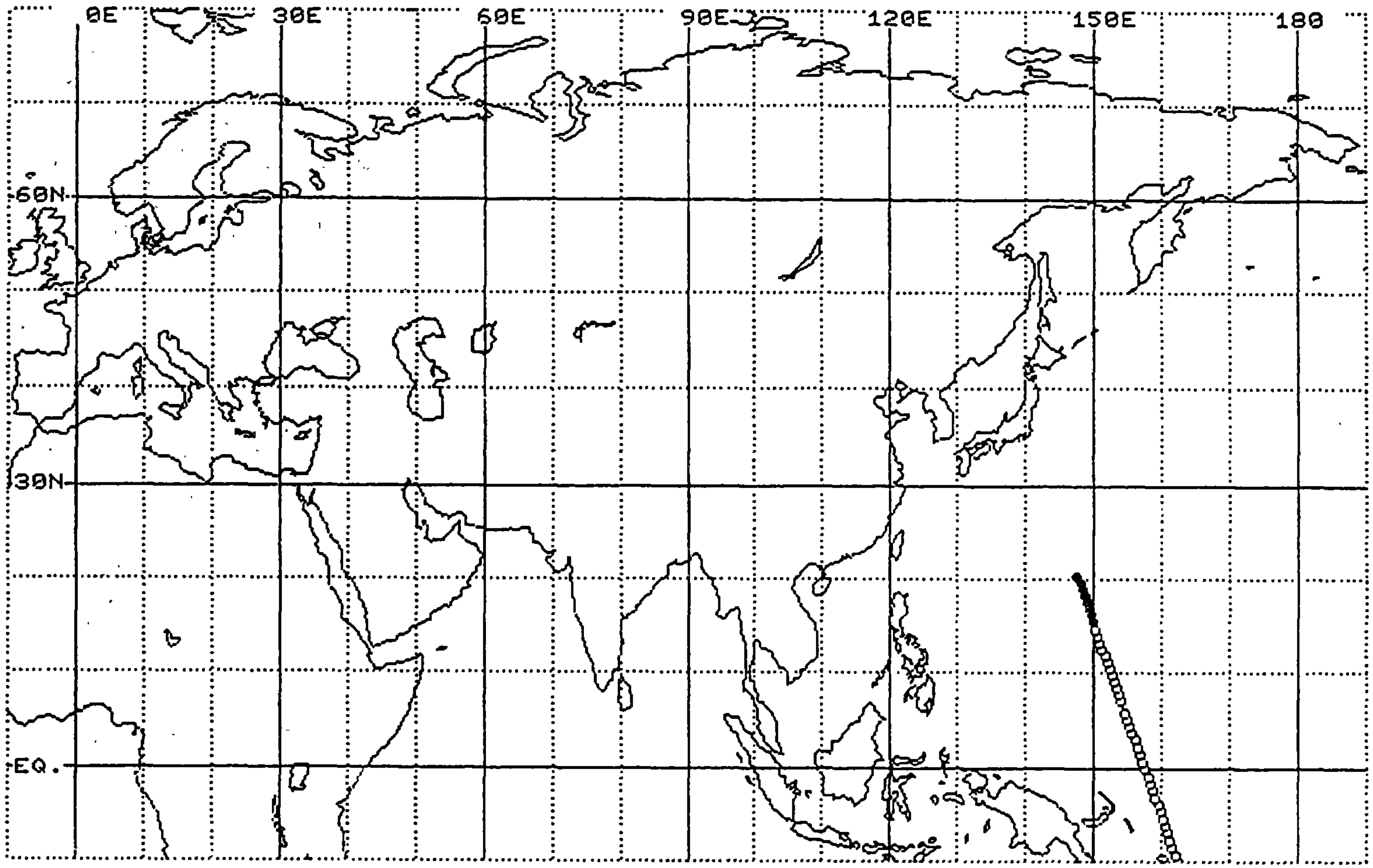


FIGURE 2

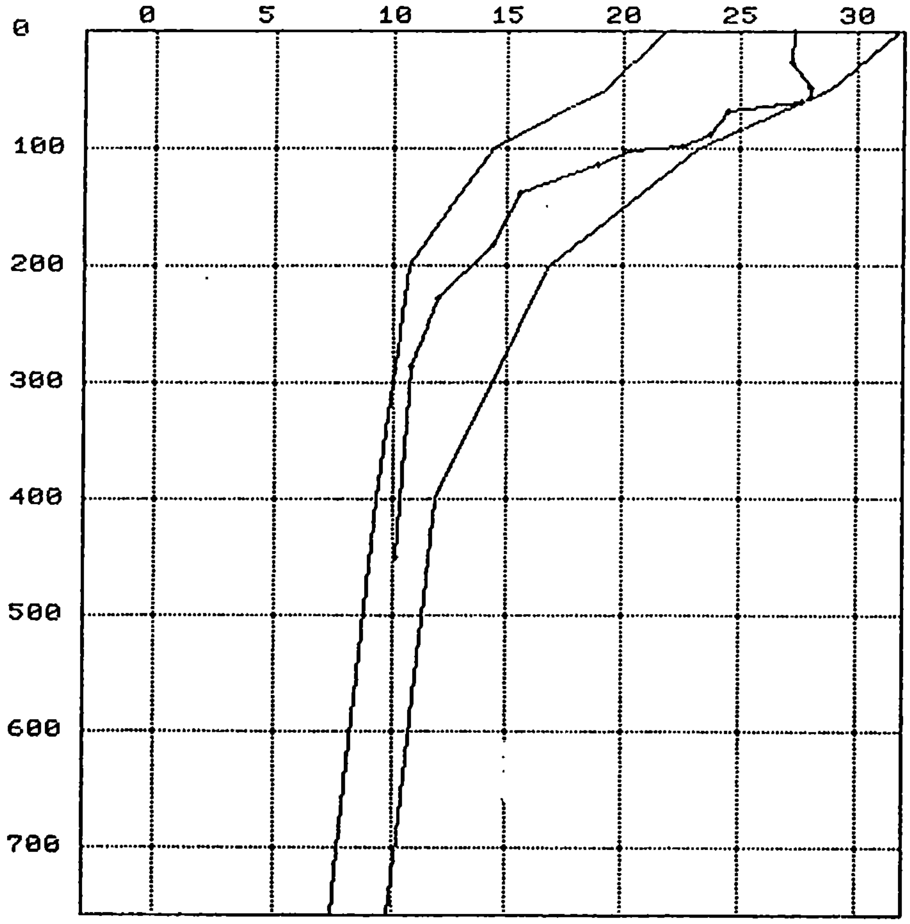


FIGURE 3

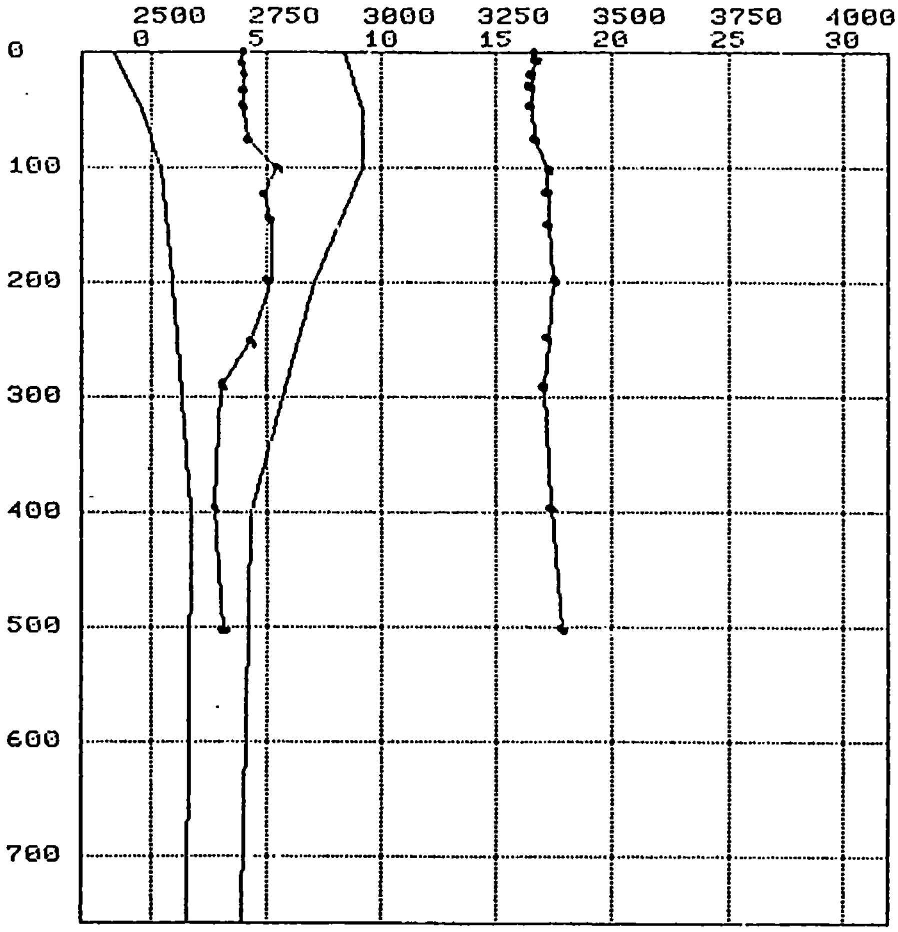

2500
2750
3000
3250
3500
3750
4000
0
5
10
15
20
25
30
0
100
200
300
400
500
600
700

FIGURE 4

ANNEX VII

FIESTA PROJECT

FIESTA is a sub-project of the EUROMAR programme. EUROMAR, specializing in modern marine environmental technology, was officially announced in June 1986 as Eureka project No.37. Apart from the European Commission itself, all the EC countries and the EFTA countries, plus Finland and Turkey, are active participants in EUROMAR. Yugoslavia has an observer status. More than 110 companies and 60 research institutes or governmental agencies from 13 countries co-operate in EUROMAR to-day and there are more than 10 operational "daughter" projects making EUROMAR one of the largest Eureka projects.

FIESTA is one of the "daughter projects" of EUROMAR. In order to interchange data between the European countries, standards have to be found upon which the individual parties can agree upon. New technical standards are normally established and introduced by relevant institutions either at the national level (such as DIN in Germany) or at the international level (such as CEN/CENLEC in the EC). FIESTA tried to identify standards that could be used in the EUROMAR programme, or to identify gaps where there was no existing standards, to develop new standards. These should cover the standardization areas in the field of marine measurements, data acquisition and environmental monitoring systems:

- sensor interfaces,
- data distribution,
- recording formats,
- operational system control including monitoring,
- equipment installation,
- quality control for data acquisition,
- remote control functions,
- sensor quality,
- measurement procedures,
- data transfer.

The project was therefore called FIESTA, derived from "Rules for Field Data Quality Standardization".

ANNEX VIII

REPORT OF THE TASK TEAM ON QUALITY CONTROL PROCEDURES FOR AUTOMATED SYSTEMS

BACKGROUND

At the Second Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship of Opportunity Programmes (Sidney, Canada, 5-8 August 1987), a task team was formed to study both the systematic and random error characteristics of each component of the [XBT] systems in use such as:

- instrument error characteristics;
- system and software performance limitations; and
- algorithms used to calculate fall rates, temperatures at depth, etc.

The First Session of the IGOSS Group of Experts on Operations and Technical Applications (Geneva, 30 November - 4 December 1987) formed a sub-group of experts to develop general recommendations regarding standards in equipment and software to be used for IGOSS purposes (particularly in the context of ship-to-shore communications). The sub-group was to take into account existing technological developments and the necessity of facilitating the participation, in IGOSS, all countries regardless of their level of technological development.

The Fifth Session of the Joint IOC-WMO Working Committee for IGOSS observed that both groups were "to deal with the quality control of data obtained from automated observing systems" and hence officially combined the two groups into a unique Task Team on Quality Control Procedures for Automated Systems, a subsidiary body of the IGOSS Group of Experts on Operations and Technical Applications. The following terms of reference were listed:

1) to study both systematic and random error characteristics in each component of the automated systems in use such as:

- instrument error characteristics;
- system and software performance limitations; and
- algorithms used to calculate fall rates, temperatures at depth, etc.

2) to recommend to the IGOSS Group of Experts on Operations and Technical Applications possible standards in equipment and software to be used for IGOSS purposes (particularly in the context of ship-to-shore communications);

3) to maintain a close working relationship with IODE experts in order to ensure consistency between IGOSS and IODE procedures in the field of quality control of data.

The Task Team held one informal ad hoc meeting in conjunction with the Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship of Opportunity Programs (Hamburg, 1989). Otherwise the Task Team worked entirely through electronic mail. The Membership of the Task Team is given in the Appendix to this document.

RESULTS

Initially the group looked at the standardization of equipment and made a preliminary list of the following items:

1. RS-232 port for data input from the XBT system
2. RS-232 port for the satellite transmitter
3. MS-DOS 2.x compatibility and upward
4. 110-220volt/50-60 Hertz compatibility
5. Data file written in ASCII
6. At least one floppy disk drive
7. Graphics capability.

The Task Team quickly decided against standardizing equipment because changing technology mandated that the system remain flexible enough to accommodate the equipment presently in use and configurations in the foreseeable future. There was more interest in standardizing the procedures used by the automated system to handle the data and making the current software available for public distribution.

There was no disagreement concerning writing the files in ASCII and the vertical resolution of the XBT appeared to be satisfactory. The temperature equation also appeared to fulfill the requirement that the XBT interface be able to resolve temperature to 0.1 degree C. There was an indication of a problem with the equation used by Sippican to calculate the depth of the probe and also a separate "bowing" problem associated with a particular SEAS unit. Both are discussed separately.

A problem surfaced with regard to TRACKOB messages during the course of the task teams deliberations. It was possible for a SEAS unit to transmit a TRACKOB message with more than 69 characters per line which was unacceptable from the GTS point of view. The suggestion was made that the software be changed so that one less 5-digit group would be printed in the line. This change would require a carriage return/line feed after every eleven groups instead of every 12. This change was implemented.

THE 'BOWING' PROBLEM

During the expansion of the CSIRO's Voluntary Observing Ship (VOS) network, CSIRO began equipping merchant ships with Bathy System SA-810 XBT controllers under the SEAS II configuration. Ships already existing in the network remained equipped with Sippican Mk-9 XBT systems. Quality control of the data recorded by one ship equipped with a Bathy Systems Controller, and another ship equipped with a Mk-9 System (both ships operating on the same route in the seas north of Australia) revealed consistently different representations of the surface isothermal layer. The Bathy Systems

Controller displayed a gradual increase (or "bowing") in temperature over the surface "isothermal layer". The Mk-9 system displayed typical surface isothermal layers (i.e., no increase in temperature). As more data was collected by ships operating in the network, the differences in the representation of this layer between the two types of systems became more apparent. In some cases, the Bathy Systems controllers displayed increases of 0.7C and above from the top to the bottom of the "isothermal" layer.

It was decided to compare both types of XBT systems against a CTD on the RV Franklin in the waters to the north-west of Australia. The study found (see Bailey et al.,, 1989) that the Bathy Systems controller was misrepresenting the temperature of this important layer, and confirmed the "bowing" problem. Unfortunately, the magnitude of the increase in temperature recorded by the Bathy Systems controller, when compared to the CTD profile, varied randomly. The temperature errors are also assumed to extend beyond the isothermal layer. It was only possible to distinguish the problem in the mixed layers where the real temperature gradient is zero. The top 3.9 metres of data recorded by the Bathy Systems controller also showed large spikes in temperature. The mean difference between the first temperature digitisation (0.6m) and the temperature at 3.9m (commonly used as the sea surface temperature) was 9.501C - 10.08C, compared to 0.411C - 0.03C for the Mk-9 system.

Following this study, an isothermal layer bowing index, defined as the maximum temperature profile minus the temperature at 5m (approximation of the sea surface temperature), was used to estimate the typical magnitude and frequency of the isothermal layer anomaly recorded by the Bathy Systems controllers deployed in the CSIRO VOS network. Potentially, 34.4% of the data was found to have errors greater than the temperature accuracy of the XBT (-0.15C).

As a result of the above findings, CSIRO advised the US NOAA National Ocean Service (NOS), who supplied the Bathy Systems controllers, and other relevant bodies of the problem. NOS is conducting an investigation into the problem, the results of which will be reported by the TT/QCAS.

XBT FALL RATE STUDY

Recently, there has been considerable interest in the accuracy of the assumed depth equations for expendable bathythermographs (XBTs). Some researchers have found the XBT to fall slightly faster than that stated by the manufacturer.

As a result of this interest, a study group has been established under the IGOSS Task Team on the Quality Control of Automated Systems to examine possible errors in the fall rate equations for XBTs and to formulate, where and if possible, depth correction algorithms. The group consists of Rick Bailey, Kimio Hanawa, Pierre Rual, Alexander Sy, and Mike Szabados. All are scientists involved in TOGA and WOCE XBT programs, and who have recently been involved in individual studies on the topic. Another member of the group is Jim Hannon from the Sippican Corporation, who are the major manufacturers of XBTs.

A series of controlled experiments, consisting of calibrated XBT versus CTD comparisons, are currently being undertaken by each member of the group. These experiments are being coordinated by Mike Szabados from the US NOAA national Ocean Service, who will collect and combine the data into one large data set and take the lead on the analysis of the data. The experiments will be completed by the end of the year, and the findings released in a report early next year.

A Co-Chairman of the Task Team has attended the Thirteenth Session of the Technical Committee for IODE and several meetings of the Joint IGOSS/IODE GTSPP to insure consistency between IGOSS & IODE in the field of quality control of data. A representative will also be present at the IGOSS/IODE Ad Hoc Consultation on Ocean PC. It is hoped that the Ocean PC effort will facilitate the participation in IGOSS and IODE of all countries regardless of their level of technological development.

RECOMMENDATIONS

It is recommended that the TT/QCAS be reconstituted under its present chairmanship to finish the following specific tasks:

1. Continue the study of the XBT Fail Rate and "bowing" issues. A Sub-group composed of Mr. Rick Bailey, Mr. Kimio Hanawa, Mr. Pierre Rual, Mr. Alexander Sy and Mr. Mike Szabados be formed under the chairmanship of Mr. Rick Bailey. The Sub-group should be funded to meet early in 1991 to review the data analysis and produce a status report on the Fall Rate Study.

2. Maintain liaison with IODE. One of the Chairmen should be funded to represent the TT/QCAS at IODE/TADE, OCEAN-PC and GTSPP meetings to insure consistency in QC and other procedures.

3. Develop an appendix to Manuals and Guides No.3 regarding methods and numerical algorithms for the pre-processing of real-time data and the selection of inflection points in automated systems. This task team should work via telemail.

The TT/QCAS should call upon its members and other known experts as necessary to address evolving technological issues of IGOSS ship-of-opportunity programme in consultation with the Chairman of the GE/OTA and the Secretariats.

It is further recommended that the Chairmen of the TT/QCAS be made members of the GE/OTA and that the Task Team meet in conjunction with each Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes.

REFERENCE

Bailey, R.J. H.,E. Phillips and G. Meyers, 1989. Relevance to TOGA of Systematic XBT Errors, Proceedings of the Western Pacific International Meeting and Workshop on TOGA COARE, Noumea, New Caledonia, May 24-30, 1989.Edited by J. Picaut, R. Lukas and T. Delcroix.

APPENDIX

TASK TEAM COMPOSITION[1]

Mr. R. Bailey	(Australia)	Co-Chairman
Mr. J. Withrow	(USA)	Co-Chairman
Dr. P. Collar	(UK)	
Mr. S. Cook	(USA)	
Dr. D. Cutchin	(USA)	
Mr. Y. Kimura	(Japan)	
Dr. M. Miyake	(Canada)	
Mr. P. Parker	(Australia)	
Dr. P. Rual	(France)	
Mr. T. Saito	(Japan)	
Dr. A. Sy	(FRG)	

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1 This list does not include those nominated members of the Task Team who did not indicate their electronic mail addresses.

ANNEX IX

A SYSTEM FOR AUTOMATIC QUALITY CONTROL OF OCEANOGRAPHIC DATA

Introduction

In 1988, MEDS contracted with a Canadian software company (CompEngServ Ltd.) to build an expert system, which was called MEDMAN. The goal was to improve MEDS data quality control to cope with forecast increases in data volumes and to ensure consistency of treatment. MEDS already had quality control software, but it was a manually intensive operation and relied upon the knowledge and experience of the person doing the work. MEDMAN quality control was to carry out objective, automated data screening to separate the large volumes of good data from small amounts of suspect data, so that technicians need only deal with the latter.

The proposal to build a system was submitted as a "best effort" contract. This meant that the software company was required to deliver as much as possible within the length of the contract. Because of the risks involved in creating such a system, this was deemed the best way to see what successes could be achieved. The work objective was to construct a system to build quality control applications, and to use the system to build one application. Work began with discussions to define a set of feasible concepts for a system. This paper describes briefly the system design and the performance of the working system.

System Characteristics

A design for construction and implementation of the system was formulated around the hardware and software allocated to the contract. Hardware consisted of a VAX2000 workstation. Software was the VAX Work Station package (including UIS graphics library) and FORTRAN language, both working in the VAX Virtual Memory System (VMS) operating environment. CompEngServ designers also requested the VMS supported C language, and Oasys C++. C++, an object-oriented language, was the primary programming language, which when translated to C, could be compiled and run on the VAX.

The functional aspects of the MEDMAN system were as follows:

a) Display Manager: a set of functions which use the UIS graphics library to formulate and display interactive windows.

b) Workroom: a workstation interface that provides the user with a set of commands and a directory of menus containing function identifiers. Here, the user can fit together a sequence of functions and execute them. Other commands provide the means to manipulate the contents of the directory.

c) Application Tools: functions to read and write to VMS files, and connect FORTRAN routines.

The Delivered System

The delivered system contains some of the functions for the Quality Control of temperature and salinity data. Specifications were taken from the Global Temperature and Salinity Pilot Project Quality Control Manual. Other functions can be added by importing them from outside of the system. The functional provisions of the application were as follows:

a) Quality Control: perform automatic, quality control checks on data station platform identifiers and date/time information.

b) User Interface: allow a technician to interact with the system to initiate the quality control process, select a test mode, view the results of the quality control process, view various displays of the data, and assign quality flags to the data.

c) Decision Support: provide the technician with information to judge the correctness of data where the knowledge base rules find an error.

d) Monitor: record the actions taken by the technician and the outcome of tests.

As a further illustration of the nature of the user interface, Figures 1 and 2 have been provided. The interface is based on the analogy of a workbench where various tools may be assembled, tested and inserted into systems. At the bottom of Figure 1 is shown the main workbench with the various options to manipulate tools listed. On the workbench is shown a series of tools, numbered 1 through 8. These had all been assembled into a single compound tool, called TSAC. The Burst Tool option was used to break the tool into its constituent parts. At the top are two drawers, one of which, QC Applications, contains the compound tool TSAC. Another tool, Climate, contains the components to do a test of data against climatology. The second drawer shown contains some simple tools from which compound tools may be assembled. At the bottom right is the various drawers, the MEDMAN Toolbox, in which various simple and compound tools may be found.

A compound tool is assembled from simple tools by pointing the mouse at the tool desired and assembling them on the workbench in the desired order of execution. Once assembled, the tool may be run from the workbench.

Figure 2 shows a simulated screen when a tool is running. Again, the workbench appears at the bottom of the screen. At the top right, the Pipeline Status box indicates which tool is currently in execution. Below this, the Select Operating Mode box, the user selects one of three possible ways of running the application. In all cases, once one option is selected, this box would disappear from the screen. Below this, the Select Data Set to be Viewed box, the user would select the option of whether to look at all of the data as they pass through the tool, or only to view those that fail a test. Again, this box would disappear when the tool is running.

When an error is detected, the error condition and an explanation appear as in the two boxes on the top left. In this figure the software has detected an unknown identifier, and explains that it is unknown because it is not in a list of known identifiers. The box marked Notes tells that this detected identifier occurs only once in the incoming data file. This is useful to know since it is then likely that the identifier is incorrectly coded. To help the user decide what to do, another box, labeled Track in this example, shows something about the station which failed the test. Finally, in boxes on the lower right, a suggestion is given as to what the user should do about the station, and if an inference was made, it is explained in the Suggestion Explanation box. The user then uses a mouse to select the desired option, and processing continues to the next data point failing a test.

System Performance

The application as delivered runs well. Features, such as user selected runtime modes, data flagging option menus, and other operations, are sensible, and simple. There are limits to the size of input files and number of tests in a set, due to the particular memory management abilities of the system as a whole.

In general, the MEDMAN system and the sample application work well and are compatible. Tools that conduct individual tests in the application, can be sequenced in any combination and order, and run with expected results. New applications can be built using methods described in MEDMAN documentation.

A FORTRAN routine reads the data file and writes to the file. The function can be expanded by FORTRAN programmers. A problem was that the Display Manager in MEDMAN was written in C++. When the source code was compiled, it was translated by the "compiler" to C and output as an object code. At this point, all of the C++ routine names were changed into arbitrary C coded identifiers. Therefore, to call a MEDMAN window function from the FORTRAN routine, the programmer must use the C coded identifiers. These can only be determined by trial and error runtime breaks in MEDMAN processing which is not a practical undertaking.

The intention of the project was to develop a foundation, which could be expanded and optimized in order to take on a major role in MEDS Quality Control processing. The MEDMAN application demonstrated that automated rules can effectively catch errors in data and provide meaningful advice.

In summary, a person uses the MEDMAN interface to select and execute a set of functions. Selection is done from menus of function names. Total functionality of the interface is completed by commands to manipulate the name list in these menus and the execution set. Both the MEDMAN interface and executing functions use the library of window functions available within the MEDMAN source code. Functions may be written in C++, C, or FORTRAN, but it is impractical to use the MEDMAN window environment in functions not written in C++. FORTRAN and C functions can use only the UIS graphic library for interactive I/O.

Future Plans

The delivered system was not complete in the capabilities required for a quality control system. That is, there is not an adequate set of tools available so that the system can be used directly in day to day processing. On the other hand, the functionality needed to add tools written either in C++ or FORTRAN is part of the software and has been successfully used to check IGOSS data.

There is still a basic memory management problem as mentioned above This has to be solved before MEDMAN can become operational. At the same time, we are building more of the tests needed to complete the quality control system. These are being built outside of the ES and will be incorporated when the memory management problem has been solved.

Other areas that would improve the ES would be to change the interface to X-Windows. This would improve the portability of the software.

Conclusions

The delivered system answered positively the basic question of whether an ES can be used in the quality control of ocean data. With the correction of the memory management problem and the incorporation of new and more tests it should be an effective tool in quality control.

FIGURE 1

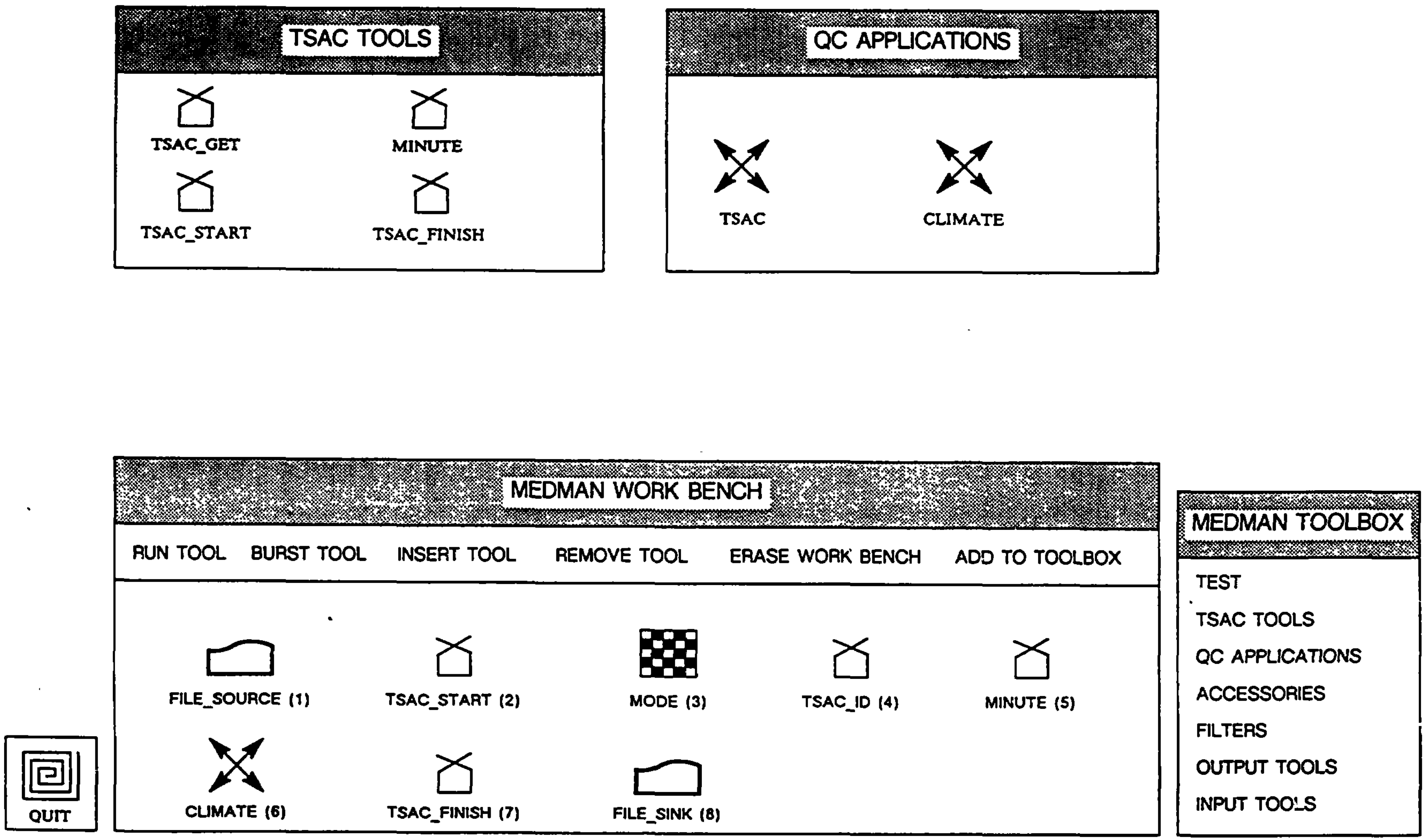
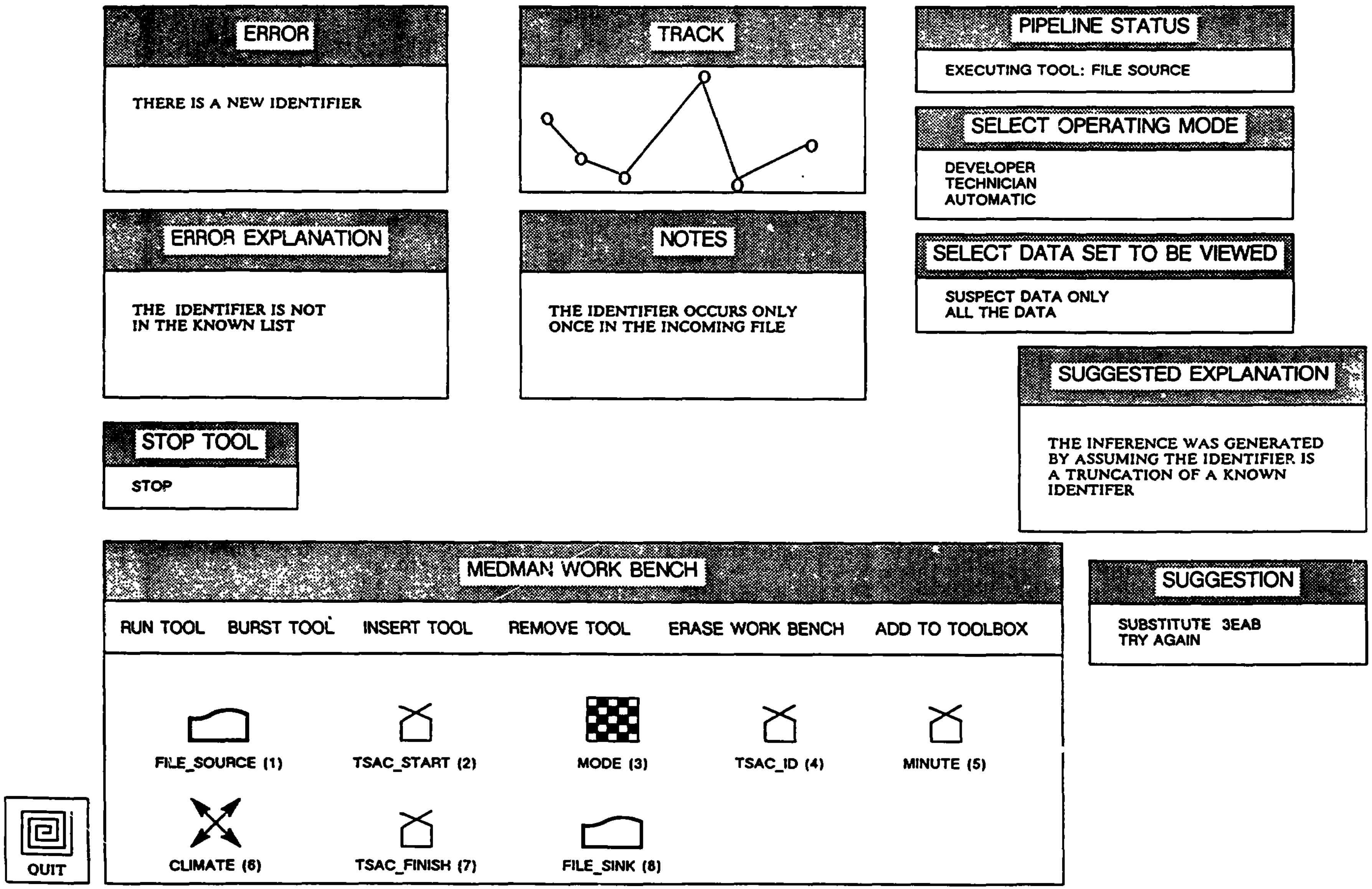

TSAC TOOLS
TSAC_GET
MINUTE
TSAC_START
TSAC_FINISH
QC APPLICATIONS
TSAC
CLIMATE
MEDMAN WORK BENCH
RUN TOOL
BURST TOOL
INSERT TOOL
REMOVE TOOL
ERASE WORK BENCH
ADD TO TOOLBOX
FILE_SOURCE (1)
TSAC_START (2)
MODE (3)
TSAC_ID (4)
MINUTE (5)
CLIMATE (6)
TSAC_FINISH (7)
FILE_SINK (8)
QUIT
MEDMAN TOOLBOX
TEST
TSAC TOOLS
QC APPLICATIONS
ACCESSORIES
FILTERS
OUTPUT TOOLS
INPUT TOOLS

FIGURE 2


ERROR
THERE IS A NEW IDENTIFIER
TRACK
PIPELINE STATUS
EXECUTING TOOL: FILE SOURCE
SELECT OPERATING MODE
DEVELOPER
TECHNICIAN
AUTOMATIC
ERROR EXPLANATION
THE IDENTIFIER IS NOT IN THE KNOWN LIST
NOTES
THE IDENTIFIER OCCURS ONLY ONCE IN THE INCOMING FILE
SELECT DATA SET TO BE VIEWED
SUSPECT DATA ONLY
ALL THE DATA
SUGGESTED EXPLANATION
THE INFERENCE WAS GENERATED BY ASSUMING THE IDENTIFIER IS A TRUNCATION OF A KNOWN IDENTIFER
STOP TOOL
STOP
MEDMAN WORK BENCH
RUN TOOL
BURST TOOL
INSERT TOOL
REMOVE TOOL
ERASE WORK BENCH
ADD TO TOOLBOX
FILE_SOURCE (1)
TSAC_START (2)
MODE (3)
TSAC_ID (4)
MINUTE (5)
CLIMATE (6)
TSAC_FINISH (7)
FILE_SINK (8)
SUGGESTION
SUBSTITUTE 3EAB
TRY AGAIN
QUIT

ANNEX X

RECOMMENDATION OCEAN-PC AD HOC-1.1

The Expert Consultation on OCEAN-PC, a Standard Software Package for Oceanographic Data Processing and Exchange,

Recognizing that marine data collected by classical and modern methods contains important information needed to understand climate change and the entire ocean system at national, regional and global levels;

Noting many requests from developing countries for tools and training to handle these marine data;

Considering that to facilitate the assembly of this data into compatible data sets that can be applied for scientific analyses and practical purposes, there is a need to provide easy to use and standardized data management tools at the level of the individual scientist;

Noting the success of the WMO CLICOM project in establishing a distributed global data management system based on PCs for climatological weather observations;

Recognizing further that personal computers are now widely used in laboratories worldwide to process marine data;

Sharing the view of the IOC Executive Council at its Twenty Third Session on the importance, especially for developing countries, of the preparation of a PC software package to support and develop marine data processing and international data exchange through the IGOSS and IODE systems;

Recommends that the Secretary IOC allocate appropriate resources and where necessary seek additional resources from Member States and international organizations to

A

implement a project to:

(i) identify available software for marine data handling, evaluate these software items in close co-operation with a selected number of marine scientists in the field and then make these available to a wide array of users;

(ii) by this means define functions and identify possible components that could be used for OCEAN-PC;

B

plan OCEAN-PC:

through use of an IOC consultant with appropriate experience in software system design and environmental data management who, in consultation with an advisory group of users, should by early 1992:

(i) derive a functional description of the system architecture and the software design;

(ii) set up a detailed implementation plan for OCEAN-PC;

(iii) submit the prepared implementation documents to IODE and IGOSS;

C

provide training:

(i) for the software packages identified in the project under A within continuing IODE training activities;

(ii) by preparing, in due course, specific training in the use of OCEAN-PC.

ANNEX XI

FUNCTIONS AND ARCHITECTURE OF A SYSTEM ON PC BASE

At present, the All-Union Research Institute of Hydrometeorological Information (RIHMI), USSR-NODC, with some other marine institutes of USSR, is working out a specialized information system for scientific research at sea. This system should include the following functional blocks:

(i) acquisition, primary processing and control of data;

(ii) creation and management of a data base (operational, delayed-mode and historical oceanographic data from different platforms : research vessels, coastal stations, buoys, etc.; results of data processing; and metadata); analysis and display of data; and results of hydrodynamical and statistical processing.

The system architecture takes into account the specific purpose of the system application. It is designed to be used by 3 groups of users:

(i) users on-board observing platforms, who will use the system capabilities to acquire the data and process them for specific oceanographic purposes;

(ii) users in research institutes and laboratories, to investigate marine processes;

(iii) users in selected collection and processing centres, to process data in the context of any projects or national structures.

Taking into account the above classification, the system architecture should have 3 configurations (levels): PC-OBSERVER, PC-RESEARCHER, PC-CENTRE (the basic level). Depending upon the level, appropriate modules will make up the desired specialized system. But all modules should be consistent (in the wide sense of the word) with each other within the overall system through some common features providing easy and free exchange of information and software products among the various levels of the system. The common features are:

(i) data base: same logical data base structure, specifications of external and internal representations of the data; same DBMS; quality control procedures, etc.;

(ii) software: programming languages; specifications of routines to access data base; specifications for user's programmes to enter the system, etc.

We hope that this three-level system will allow to unify the process of data acquisition and of processing operational, delayed-mode and historical data, to ease the system development and to initiate, in future, the establishment of a distributed data base in the form of a network, in which the above-mentioned levels (configurations) will constitute the nodes.

IGOSS PRODUCTS SEMINAR
(Tokyo, 15-19 April 1991)

Draft Seminar Programme

DAY	A.M.	LUNCH	P.M.	EVENING
1	Opening ceremony Three introductory lectures		World Oceanographic Centre/Specialized Oceanographic Centre Panel	Reception
2	Wind stress	Lunch and address on future modelling	Sea level	
3	Sea surface temperature		Upper ocean temperature/salinity	Dinner and address
4	Ocean currents and circulation	Lunch and address on future ocean satellites	Heat transport-physical and chemical fluxes	
5	Sea ice		Panel discussion on ocean nowcasting and forecasting Possible award ceremony	

ANNEX XIII

IGOSS PRODUCTS WORKSHOP
Tokyo, 22-24 April 1991

PROVISIONAL AGENDA

1. **INTRODUCTION**

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

2. **PRESENT STATUS OF THE IDPSS**

3. **IDPSS SUPPORT FOR CLIMATE-RELATED PROGRAMMES**

3.1 TOGA
3.2 WOCE
3.3 JGOFS
3.4 GEWEX
3.5 IGBP
3.6 FUTURE PROGRAMMES

4. **IDPSS PRODUCTS FOR DATA AND INFORMATION MANAGEMENT**

4.1 IODE
4.2 WMO GDPS

5. **PRIORITIES FOR OBSERVING SYSTEM DEVELOPMENT**

5.1 IGOSS OBSERVING SYSTEM
5.2 GLOBAL OCEAN OBSERVING SYSTEM

6. **FUTURE DIRECTIONS FOR IDPSS**

6.1 SYNOPTIC OCEAN ANALYSIS/PREDICTION PRODUCTS
6.2 BIOLOGY/ECOLOGY
6.3 IGOSS PRODUCTS BULLETIN
6.4 OTHER

7. **REVISION OF THE GUIDE TO THE IDPSS**

8. **CLOSURE OF THE MEETING**

EXCHA[illegible] OF BATHY AND TESAC REPORTS VIA THE GTS IN 1989.
[illegible]ORTED INPUT: Reports entered onto the GTS

Country*	Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AUSTRALIA	BATHY	-	383	367	218	1351	758	957	929	106	214	306	173	5762
	TESAC	0	0	0	0	0	0	0	0	0	0	0	0	0
CANADA	BATHY	6	7	185	0	0	155	25	15	1	47	220	165	826
	TESAC	0	0	103	83	277	89	0	51	30	4	11	39	687
FRANCE	BATHY	284	307	368	360	-	-	308	315	340	325	296	384	3287
	TESAC	0	0	0	0	-	-	0	0	0	0	5	0	5
GERMAN DEM. REPUBLIC	BATHY	-	0	0	0	0	0	0	0	0	0	0	0	0
	TESAC	-	6	1	12	18	13	4	37	18	2	14	4	129
GERMANY, FED. REPUBLIC OF	BATHY	228	332	82	5	333	109	136	71	195	181	128	83	1883
	TESAC	0	0	22	3	0	0	0	0	0	0	0	0	25
JAPAN	BATHY	278	534	184	285	422	180	432	335	134	547	319	167	3817
	TESAC	0	0	0	0	0	0	0	0	0	0	0	0	0
USSR	BATHY	448	495	464	366	623	410	346	386	635	467	558	746	5944
	TESAC**	363	429	415	410	493	195	110	91	490	388	520	607	4511
UNITED KINGDOM	BATHY	39	36	52	61	41	70	59	29	16	27	23	26	479
	TESAC	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	BATHY	948	1470	1341	1241	1550	1289	1169	1218	1290	1132	1200	755	14603
	TESAC	0	0	0	0	0	0	3	0	2	0	0	0	12
OTHERS***	BATHY	244	160	168	138	178	140	196	187	161	176	180	146	2014
	TESAC	0	0	0	29	11	0	0	11	5	0	10	0	75
TOTAL INPUT	BATHY	2475	3724	3211	2674	4498	3111	3628	3455	2878	3116	3200	2645	38615
	TESAC	363	435	550	540	802	298	117	190	545	394	560	650	5444
DAILY AVERAGE INPUT	BATHY	79.8	133.0	103.6	89.1	145.1	103.7	117.0	111.4	95.9	100.5	106.7	85.3	105.8
	TESAC	11.7	15.5	17.7	18.0	25.9	9.9	3.8	6.1	18.2	12.7	18.7	21.0	14.9

* Countries reporting INPUT on IGOSS statistical evaluation sheets

** USSR TESAC figures include INPUT from Ocean Station C

*** Countries or territories delivering INPUT but not submitting IGOSS statistical evaluation sheets: China, French Polynesia, Iceland, New Caledonia, South Africa****, Sweden, ECMWF (Reading, United Kingdom), Solomon Islands

**** The Government of the Republic of South Africa has been suspended by Resolution 38 (Cg-VII) from exercising its rights and enjoying its privileges as a Member of WMO.

EXCHANGE OF BATHY AND TESAC REPORTS VIA THE GTS IN 1989

REPORTED OUTPUT: Reports received via the GTS from other sources

Country*	Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AUSTRALIA	BATHY	-	1419	1500	1226	1177	1673	2270	2171	2214	2042	2373	1526	19591
	TESAC	-	332	335	229	335	301	321	353	428	305	407	385	3731
CANADA	BATHY	2228	2849	2388	2253	3116	2135	2715	2763	2749	3218	2600	2124	31138
	TESAC	327	346	338	234	340	254	304	252	388	296	384	472	3935
FRANCE	BATHY	2011	1965	2367	2106	-	-	2427	2647	2419	2698	2544	2057	23241
	TESAC	344	271	484	293	-	-	404	412	492	376	435	460	3971
GERMAN DEM. REPUBLIC	BATHY	831	676	530	260	719	580	164	710	541	619	644	752	7026
	TESAC	173	114	218	100	200	162	50	186	213	203	296	297	2212
GERMANY, FED. REPUBLIC OF	BATHY	1492	1866	1909	1852	2089	1382	2076	2161	2107	3025	1999	1916	23874
	TESAC	273	316	320	323	533	343	366	339	503	403	432	478	4629
JAPAN	BATHY	1823	2033	2520	2172	2898	2128	2601	2871	2598	3096	2686	2362	29788
	TESAC	351	391	499	389	632	433	455	420	491	398	504	543	5506
USSR	BATHY	2312	2160	1554	1948	1863	1519	1509	1389	1992	1922	2148	1422	21738
	TESAC	3	0	0	79	104	92	0	0	0	0	0	1	279
UNITED KINGDOM	BATHY	3092	3235	3351	2219	3468	2350	2810	2403	2781	3066	2654	1956	33385
	TESAC	324	292	317	219	278	218	277	181	296	232	272	281	3187
USA	BATHY	1318	1901	1254	1213	1757	1225	1552	1637	1458	2496	1474	1560	18845
	TESAC	263	324	389	340	585	333	324	310	405	317	376	336	4302

* Countries reporting OUTPUT on IGOSS statistical evaluation sheets

EXCH[illegible] OF BATHY AND TESAC REPORTS VIA THE GTS IN 1989

Reported (BATHY plus TESAC)
INPUT: Reports entered onto the GTS from other sources
OUTPUT: Reports received via the GTS

Country*	Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AUSTRALIA	INPUT	-	383	367	218	1351	758	957	929	106	214	306	173	5762
	OUTPUT	-	1751	1835	1455	1512	1974	2591	2524	2642	2347	2780	1911	23322
CANADA	INPUT	6	7	288	83	277	244	25	66	31	51	231	204	1513
	OUTPUT	2555	3195	2726	2487	3456	2389	3019	3015	3137	3514	2984	2596	35073
FRANCE	INPUT	284	307	368	360	-	-	308	315	340	325	301	384	3292
	OUTPUT	2355	2236	2851	2399	-	-	2831	3059	2911	3074	2979	2517	27212
GERMAN DEM. REPUBLIC	INPUT	0	6	1	12	18	13	4	37	18	2	14	4	129
	OUTPUT	1004	790	748	360	919	742	214	896	754	822	940	1049	9238
GERMANY, FED. REPUBLIC OF	INPUT	228	332	104	8	333	109	136	71	195	181	128	83	1908
	OUTPUT	1765	2182	2229	2175	2622	1725	2442	2500	2610	3428	2431	2394	28503
JAPAN	INPUT	278	534	184	285	422	180	432	335	134	547	319	167	3817
	OUTPUT	2174	2424	3019	2561	3530	2561	3056	3291	3089	3494	3190	2905	35294
USSR	INPUT**	811	924	879	776	1116	605	456	477	1125	855	1078	1353	10455
	OUTPUT	2315	2160	1554	2027	1967	1611	1509	1389	1992	1922	2148	1423	22017
UNITED KINGDOM	INPUT	39	36	52	61	41	70	59	29	16	27	23	26	479
	OUTPUT	3416	3527	3668	2438	3746	2568	3087	2584	3077	3298	2926	2237	36572
USA	INPUT	948	1470	1341	1241	1550	1290	1172	1218	1292	1132	1200	755	14615
	OUTPUT	1581	2225	1643	1553	2342	1558	1876	1947	1863	2813	1850	1896	23147
OTHERS***	INPUT	244	160	177	167	189	140	196	168	166	176	160	146	2089
TOTAL	INPUT	2838	4159	3761	3214	5300	3409	3745	3645	3423	3510	3760	3295	44059
DAILY AVERAGE	INPUT	91.5	148.5	121.3	107.1	171.0	113.6	120.8	121.5	114.1	113.2	125.3	106.3	120.7

* Countries reporting INPUT on IGOSS statistical evaluation sheets
** U.S.S.R. TESAC figures include INPUT from Ocean Station C
*** Countries or territories delivering INPUT but not submitting IGOSS statistical evaluation sheets: China, French Polynesia, Iceland, New Caledonia, South Africa****, Sweden, ECMWF (Reading, United Kingdom), Solomon Islands
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WORLD METEOROLOGICAL ORGANIZATION

RESULTS OF THE OCTOBER 1989 GLOBAL MONITORING RELATED TO BATHY/TESAC BULLETINS AND REPORTS

1. The WMO Secretariat has compared the results of the October 1989 global monitoring related to BATHY/TESAC bulletins and reports as provided by the three World Meteorological Centres (Melbourne, Moscow and Washington) an other WWW centres (Bracknell, Montreal and Tokyo). The first analysis has shown that major discrepancies in the availability of data between the centres were due to the differences in the implementation of the monitoring procedures at the centres, in particular as regards the counting of duplicated bulletins and reports. The replies to the questionnaire related to the monitoring procedures, as provided by the centres concerned, are given in Table A. Since the results are presented at the level of each bulletin identified by its abbreviated heading, the WMO Secretariat has compared the results of these centres, bulletin by bulletin over two days (2-3 October 1989), deleting the duplicated bulletins when they could be detected on the basis of bulletins received at Tokyo.

2. In Table B, the numbers of reports and bulletins are given for the various centres of origin. In Table C, detailed information is given on the times of reception and the number of reports for each bulletin. The number of reports reported to be received on 2 and 3 October 1989 range from 133 to 171; it can be noted in particular: (a) that Bracknell reported not having received three reports out of the 171 reports received at Tokyo, and Washington seven reports; (b) that Bracknell and Washington reported not to have received two bulletins out of the 72 bulletins available at Tokyo.

TABLE A

RESULTS OF THE ANNUAL GLOBAL MONITORING OF THE OPERATION OF THE WWW
Replies to the questionnaire related to the monitoring procedures implemented at MTN centres
Monitoring period: 1 to 15 October 1989

Centre	Is the monitoring automated?	Is the counting of bulletins & reports performed before quality control ?	Are bulletins & reports counted only if received or transmitted on the GTS channels?	Are duplicated bulletins disregarded?	Are bulletins including only NIL reports counted ?	Are bulletins including COR or CCx counted in addition to bulletins to be corrected?	Are duplicated reports included in bulletins having the same ab - breviated headings disregarded?	Are duplicated reports included in bulletins having different ab - breviated headings disregarded?	Are NIL reports disregarded?	Are reports included in bulletins including the indicator COR or CCx disregarded?
RTH Bracknell	No[1]	Yes[1]	Yes[1]	No[1]	Yes[1]	Yes[1]	No[1]	No[1]	Yes[1]	No[1]
RTH Tokyo	Yes[2]	Yes[2]	Yes[2]	No[2]	No[2]	Yes	No[2]	No[2]	Yes[2]	No[2]
WMC Melbourne	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No
WMC Washington	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No

[1] Monitoring procedures for BATHY/TESAC, CLIMAT and CLIMAT TEMP.
[2] Monitoring procedures for BATHY/TESAC, CLIMAT, CLIMAT TEMP, SHIP and AIREP.

TABLE B

NUMBER OF BATHY/TESAC BULLETINS AND REPORTS RECEIVED AT CENTRES

Monitoring period: 2-3 October 1989

Centre of origin	Received at											
	BRACKNELL		MELBOURNE		MONTREAL		MOSCOW		TOKYO		WASHINGTON	
(CCCC)	report	bulletin	report	bulletin	report	bulletin	report	bulletin	report	bulletin	report	bulletin
RJTD (Tokyo)	35	32	37	34	31	30	23	23	37	35	35	32
LEPW (Paris)	18	3	17	2	15	2	19	3	18	3	18	3
RUMB (Khabarovsk)	13	5	13	5	10	2	7	2	13	5	13	5
RUMS (Moscow)	43	15	44	15	30	9	43	14	44	15	40	15
ESWI (Norrköping)	8	2	-	-	2	2	8	2	8	2	8	2
EDZW (Offenbach)	1	1	1	1	1	1	1	1	1	1	1	1
KNWC (Monterey)	8	3	0	3	3	3	8	3	8	3	7	3
EGRR (Bracknell)	2	2	2	2	2	2	1	1	2	2	2	2
KWBC (Washington)	40	7	40	7	40	7	23	4	40	7	40	7
TOTAL	168	70	154	69	134	58	133	53	171	72	164	70
DAILY AVERAGE	84	35	77	35	67	29	67	27	86	36	82	35

TABLE C
RECEPTION OF BATHY/TESAC BULLETINS AT CENTRES
Monitoring period: 2-3 October 1989

Abbreviated heading				Received at											
				BRACKNELL		MELBOURNE		MONTREAL		MOSCOW		TOKYO		WASHINGTON	
TTAAii	CCCC	YYGGgg	BBB	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports
SOVX20	RJTD	020000		020043	1	020040	1	020059	1	·02044	1	020039	1	020039	1
SOVX01	RJTD	020100		020117	1	026112	1	020134	1	-	-	020112	1	020111	1
SOVX20	RJTD	020100		020130	1	020129	1	020143	1	020134	1	020128	1	020128	1
SOVX20	RJTD	020200		020232	1	020229	1	020244	1	020231	1	020229	1	020229	1
SOXX5	KNWC	020000		020314	3	020313	0	020322	1	020314	3	020313	3	020310	3
SOVX01	RJTD	020400		020414	1	020412	1	020424	1	020432	1	020412	1	-	-
SOVX20	RJTD	020400		020428	1	020426	1	020436	1	02427	1	020426	1	020430	1
SOVX20	RJTD	020500		020544	1	020542	1	020553	1	020555	1	020542	1	020542	1
SOVX01	RJTD	020543		020543	2	020543	2	020553	2	-	-	020543	2	020543	2
SOVX20	RJTD	020600		020634	1	020624	1	020636	1	020632	1	020624	1	020624	1
SOVX01	RJTD	020700		020716	1	020712	1	020725	1	-	-	020712	1	020714	1
SOVX20	RJTD	020700		020758	1	020755	1	020808	1	020757	1	020755	1	020755	1
SOWD10	RUMS	020600	RTD	020648	1	020727	1	-	-	020646	1	020739	1	020725	1
SOVF10	RUMS	020600		020648	3	020747	3	-	-	020646	3	020739	3	020725	3
SOWD10	RUMS	020600	RTD	020649	1	020727	1	-	-	020647	1	020740	1	020725	1
SOVF10	RUMS	020600	RTD	020707	1	020748	1	020735	1	020704	1	020740	1	020726	1
SOVF10	RUMS	020600	RTD	020707	1	020747	1	-	-	020704	1	020740	1	020600	1
SOVX20	RJTD	021000		021023	1	021014	1	-	-	021143	1	021014	1	021019	1
SOVX20	RJTD	021000		021037	1	021033	1	021031	1	021144	1	021033	1	021033	1
SOSN01	ESWI	020700		021030	4	-	-	021042	1	021143	4	021032	4	021030	4
SOVX20	RJTD	021100		021153	1	021151	1	021205	1	021153	1	021151	1	021151	1
SOVX20	RJTD	021300		-	-	021338	1	-	-	-	-	021338	1	-	-
SOVX01	RJTD	021600		021615	1	021612	1	021624	1	-	-	021612	1	021612	1
SOVF1	LFPW	021500		021633	13	021635	13	021644	13	021632	13	021635	13	021632	13
SOVF1	LFPW	021500	RRA	021633	4	021635	4	-	-	021633	4	021635	4	021633	4
SOVX20	RJTD	021700		021716	1	021715	1	021724	1	021715	1	0217531	1	021714	1
SOVX20	RJTD	021700		021748	1	021746	1	-	-	021748	1	021746	1	021747	1
SOVX20	RJTD	021800		021957	1	021843	1	022011	1	021956	1	021843	1	021929	1
SOVB10	RUHB	021800		021804	6	022044	6	022011	6	021802	6	021811	6	021929	6
SOVX01	RJTD	021900		021959	1	021912	1	022011	1	-	-	021912	1	021932	1

TABLE C (contd.)
RECEPTION OF BATHY/TESAC BULLETINS AT CENTRES
Monitoring period: 2-3 October 1989

Abbreviated heading				Received at											
				BRACKNELL		MELBOURNE		MONTREAL		MOSCOW		TOKYO		WASHINGTON	
TTAAii	CCCC	YYGGgg	BBB	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports
SOVX20	RJTD	022000		022059	1	022058	1	022011	1	022059	1	022057	1	022057	1
SOVF10	RUMS	021800		021843	3	022046	3	022011	3	021839	3	022029	3	021931	3
SOVF10	RUMS	021800	RTD	021848	3	022046	3	-	-	021840	3	022029	3	021931	3
SOVA10	RUMS	021800		021854	8	022047	8	022011	8	021844	8	022029	8	021931	4
SOVX20	RJTD	022100		022145	1	022123	1	022131	1	022124	1	022123	1	022122	1
SOVF1	LFPW	022100		022132	1	-	-	022144	2	022133	2	022134	1	022132	1
SOUX20	RJTD	022300		022342	1	022340	1	022351	1	-	-	022340	1	022339	1
SOWF1	EGRR	022300		022354	1	030005	1	030013	1	-	-	030005	1	030003	1
SOVX01	RJTD	030100		030117	1	030112	1	030137	1	-	-	030112	1	030111	1
SOVX20	RJTD	030200		030217	1	030215	1	030228	1	030215	1	030215	1	030214	1
SOVX01	RJTD	030243		030245	3	030243	3	030253	3	-	-	030243	3	030242	3
SOXX5	KNWC	030000		030315	4	030315	0	030328	1	030315	4	030315	4	030313	3
SOXX4	KNWC	030000		030315	1	030315	0	030328	1	030315	1	030315	1	030313	1
SOVX01	RJTD	030400		030415	1	030412	1	030423	1	-	-	030412	1	030412	1
SOVX20	RJTD	030400		030436	1	030442	1	030444	1	030435	1	030433	1	030432	1
SOVB10	RUHB	021200		030600	1	030649	1	-	-	030558	1	030624	1	020602	1
SOVB10	RUHB	021800	RTD	030600	1	030649	1	-	-	-	-	030624	1	020605	1
SOWD10	RUMS	030600		030645	2	030638	2	-	-	030629	2	030634	2	030947	2
SOVX20	RJTD	030700		030913	1	030724	1	030730	1	030911	1	030724	1	030724	1
SOVB10	RUHB	030600		030615	1	030928	1	-	-	-	-	030927	1	030926	1
SOVF10	RUMS	030600		030645	3	030949	3	030956	3	030629	3	030948	3	030946	3
SOVF10	RUMS	030600	RTD	030645	3	030949	4	-	-	030634	4	030949	4	030947	4
SOSN01	ESWI	030700		030819	4	-	-	030956	1	030818	4	030952	4	030947	-4
SOVF01	EDZW	030935		030944	1	030954	1	030956	1	030947	1	030952	1	030948	1
SOVX20	RJTD	031000		031156	1	031039	1	031134	1	-	-	031039	1	031039	1
SOVD1	KWBC	031218		031221	6	031222	6	031228	6	-	-	301221	6	(x)	6
SOVD2	KWBC	031218		031221	6	031223	6	031228	6	-	-	031221	6	(x)	6
SOVD3	KWBC	031218		031221	5	031223	5	031228	5	-	-	C31221	5	(x)	5

RECEPTION OF BATHY/TESAC BULLETINS AT CENTRES

Monitoring period: 2-3 October 1989

Abbreviated heading				Received at: BRACKNELL		MELBOURNE		MONTREAL		MOSCOW		TOKYO		WASHINGTON	
TTAAii	CCCC	YYGGgg	BBB	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports	Time of receipt	Reports
SOVX20	RJTD	031300		-	-	031321	1	031336	1	031322	1	031321	1	031321	1
SOWFI	EGRR	031100		031228	1	031329	1	031337	1	031233	1	031329	1	031327	1
SOVX20	RJTD	031500		031601	1	031559	1	031608	1	031603	1	031559	1	031558	1
SOVD1	KWBC	031607		031618	7	031642	7	031624	7	031616	7	031638	7	(*)	7
SOVD2	KWBC	031607		031618	5	031642	5	031624	5	031616	5	031638	5	(*)	5
SOVD3	KWBC	031607		031618	6	031643	6	031627	6	031616	6	031638	6	(*)	6
SOVD4	KWBC	031607		031618	5	031643	5	031627	5	031617	5	031638	5	(*)	5
SOVB10	RUHB	031800		031758	4	031858	4	031852	4	-	-	031747	4	031835	4
SOVX20	RJTD	031800		031849	1	031843	1	031902	1	031918	1	031843	1	031843	1
SOVA10	RUMS	031800		031838	8	031913	8	031902	8	031914	8	031854	8	031849	8
SOVF10	RUMS	031800		031838	4	031913	4	031902	4	031914	4	031854	4	031849	4
SOVF10	RUMS	031800	RTD	031856	1	031915	1	031925	1	031918	1	031857	1	031910	1
SOVF10	RUMS	031800	RTD	031911	1	031925	1	031914	1	-	-	031916	1	031849	1
SOVX20	RJTD	032100		032129	1	032138	1	032147	1	032141	1	032138	1	032137	1
TOTAL					70		69		58		53		72		70

(*) <u>Note</u>: Washington did not provide monitoring results related to KWBC bulletins; it is assumed that the number of the bulletins and reports available at Washington were identical to other centres.