Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IODE Group of Experts on Technical Aspects of Data Exchange

Sixth Session

Geneva, Switzerland, 22-29 June 1994

UNESCO

TABLE OF CONTENTS

1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION

1 The Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange was called to order at the WMO Headquarters in Geneva at 09.30 on Wednesday, 22 June 1994 under the Chairmanship of Mr. J.R. Keeley. In its introductory remarks, the Chairman explained that the Session would conduct its first two days by meeting jointly with the IGOSS Group of Experts on Operations and Technical Applications to discuss issues of mutual interest. The OTA Session was already underway. The TADE Session would meet jointly with the OTA on Wednesday and Thursday morning, and would participate in the approval of the part of the OTA session report which would be common to both Groups, on Friday morning. The TADE Group would then reconvene alone (whilst welcoming the participation of any OTA member able and wishing to attend) on Friday afternoon for discussion of subsequent agenda items. The TADE session would go on the following Monday (27 June), Tuesday and Wednesday when the Summary Report of the Session might be expected to be approved.

2 The List of Participants in the Session is given in Annex VIII.

1.2 ADOPTION OF THE AGENDA

3 The Group adopted the Agenda for the Session as reproduced in Annex I.

1.3 WORKING ARRANGEMENTS

4 The Group kindly confirmed the working arrangements agreed to by the GE/OTA. Subsequent arrangements might be made later on during its own Session.

5 At this point of the Session, it was agreed that the overlapping part of the OTA and TADE Sessions would be co-chaired by the OTA and TADE Chairmen.

2. ISSUES OF JOINT INTEREST TO IGOSS AND IODE

6 This agenda item covers partly items of interest to both IODE GE/TADE and IGOSS GE/OTA. It was therefore considered during the joint OTA/TADE session, as were the other items below that show an OTA agenda item attached to them. A discussion of the primary issues of separate and joint concern for the two groups, prepared by the Chairmen, is given in Annex II.

2.1 BINARY UNIVERSAL FORM OF REPRESENTATION **[OTA agenda item 4.2 - Use of BUFR for oceanographic data]**

2.2 FLEX AND SEALEV **[OTA agenda item 4.1 - Character-based code forms]**

7 The joint session agreed to discuss these two items together and to record the discussion as a single agenda item.

8 The Meeting recalled that the Binary Universal Form for Data Representation (BUFR) is a binary format developed and implemented by WMO for the exchange of meteorological and other environmental data over electronic networks and in particular the GTS. It is a formal policy of the WMO Commission for Basic Systems that the use of BUFR should be progressively extended as communications circuits are upgraded to the necessary standard, with the use of character codes being gradually phased out. At the same time, **no new** character codes should be implemented for data transmission on the GTS. Work had been carried out, jointly by CBS and IGOSS, to expand the BUFR tables to include capabilities to carry all types of oceanographic data, as defined in GF3. A general description of the main features of BUFR, as well as the development work for its expansion to include oceanographic variables and information is given in Annex III. In addition, the Meeting noted that BUFR would also shortly have the capability to carry quality control information which is a very important development for oceanographic purposes.

9 The Meeting noted all these developments with interest, and expressed its considerable appreciation to Mr. Keeley for his efforts in adapting and

expanding BUFR to carry oceanographic data. It agreed that, increasingly in the future, BUFR will and must be used for the real-time exchange of oceanographic data, as well as accompanying metadata. At the same time, however, it stressed that other formats were being used, and were often more appropriate, for non-real-time exchange and for data archival.

10 The Meeting further agreed that BUFR should have full capabilities to carry all types of oceanographic data and information in real-time on the GTS, and in this context endorsed the methodology adopted by Mr. Keeley, based on the GF3 tables. It requested Mr. Keeley to continue and complete this work on behalf of both IGOSS and IODE.

11 The Meeting accepted with appreciation the offer by NOS/USA to encode and transmit on the GTS, sub-surface temperature data from SEAS units in BUFR as well as BATHY code. This would be regarded as a test data set for the use of BUFR for oceanographic purposes. The Meeting recommended to NOS that high-resolution temperature profiles should be used in the BUFR messages. The Meeting also accepted with appreciation the offers by Australia and Canada to investigate the possibilities to receive, decode and manage these reports. It was agreed that the ultimate goal of these tests was to develop, test and eventually make generally available, user-friendly software for encoding and decoding oceanographic data as BUFR messages.

12 The Meeting noted with interest that modifications to the BATHY code, based on the work of the TT/QCAS, to enable certain metadata (probe and recorder type, fall-rate equation used) to be carried with each BATHY message, had been finalized and were expected to be adopted by CBS in August 1994. The implementation date would be 8 November 1995. It expressed its appreciation to Mr. R. Bailey, Chairman of TT/QCAS, to the IGOSS Operations Co-ordinator, and to Mr. Keeley for their efforts in this regard.

13 The Meeting further noted with interest:

(i) The adoption by CBS, for implementation on a trial basis, of a new SEALEV character code (based on the original IFC concept) for the real-time transmission of sea level data;

(ii) Work, jointly by CBS and IGOSS, to develop a universal character code form CREX (based on earlier efforts such as IFC, BTAB and FLEX), which would provide for a tabular ASCII representation of BUFR reports and also allow for the GTS transmission in character form of new types of meteorological and oceanographic data.

14 With regard to CREX, the session expressed its appreciation to Mr. Keeley for the work already accomplished and requested him to continue his joint efforts with CBS to finalize the code. Concerning SEALEV, the Meeting accepted the offer of NODC/USA to investigate existing requirements for the use of this code. If there were no such requirements, it was recommended that CBS be advised to discontinue the use of the code, with any future sea-level requirements to be satisfied through BUFR and CREX.

2.3 GLOBAL TEMPERATURE AND SALINITY PILOT PROJECT (GTSPP) **[OTA agenda item 4.5 - Global Temperature Salinity Pilot Project]**

15 The Meeting reviewed a document describing the status of the GTSPP at the time of the Steering Group meeting, in November 1993 . The document noted the efforts of GTSPP, working in co-operation with JODC and both the Russian Federation and the USA navies, to include more data in the project. The Meeting welcomed these efforts and encouraged greater co-operation with other countries where possible. The GTSPP requested that OTA take whatever steps that were required to increase the flow of real-time data on the GTS so that a greater fraction of the data collected would be available as low resolution data and in particular to improve the reporting of salinity data. The GTSPP also requested that TADE undertake actions that will improve the timeliness and efficiency of exchange so that high resolution data would become available as quickly as possible. The Meeting noted that its efforts reported in other sections of the summary report were intended to respond positively to this request. The Meeting requested that TADE take up the question of acquiring thermosalinograph data for archival.

2.4 DATA MONITORING **[OTA agenda item 4.7 - IGOSS data monitoring]**

16 The Meeting noted with interest and appreciation the routine monitoring of the real-time exchange of oceanographic data undertaken by the IGOSS Operations Co-ordinator, by the WMO Secretariat and by the GTSPP. It appreciated in particular the very detailed monitoring and analysis carried out on a monthly basis by the GTSPP, with identified anomalies in receipt being passed directly to relevant GTS centres for their consideration. In addition, information on ships reporting bad quality data was passed to the IGOSS Operations Co-ordinator and the WOCE IPO for follow-up action.

17 With regard to the monitoring undertaken by WMO, the Meeting recognized the difficulties in ensuring that GTS centres apply exactly the same procedures in their monitoring, which was nevertheless essential to the identification of real GTS exchange problems. To assist in overcoming this problem, and also to assist WMO generally in correcting anomalies in GTS data exchange, the Meeting strongly recommended that GTSPP and WMO should work as closely as possible together in their monitoring efforts. In particular, GTSPP monitoring results during the annual GTS monitoring period (1-15 October each year) should be passed to the WMO Secretariat for their consideration.

18 Finally with regard to IGOSS data monitoring the Meeting requested the IGOSS Operations Co-ordinator, together with the GTSPP, NOS/USA and Mr. R. Bailey, to study the question of the possible end-to-end monitoring of reports from observation to receipt at data centres from the GTS. A proposal concerning such monitoring should be co-ordinated by NOS and prepared for consideration by IGOSS-VII.

19 The Meeting was presented with an historical review and the latest developments concerning Reports of Scientific Cruises and Oceanographic Programmes (ROSCOPs), or Cruise Summary Reports (CSRs). It expressed its appreciation to ICES, acting as the IODE RNODC-Formats, for the efforts it devoted to digitize many cruise reports, which proves a very efficient use of the ROSCOP database as a searchable catalogue. It was also appreciated that the database is made available on Internet as well as on OCEAN PC. It was regretted that too few scientists were willing to fill in the ROSCOP form, since the database might provide for a potentially powerful tool to keep track of various kinds of oceanic data from various locations and time periods. In this connection, it was noted that :

(i) NODCs might well - and indeed do - complete the form *in loco* PIs, as well as ICES do so when possible. A possible rationale for that might be found *inter alia* in the fact that, as far as ROSCOP III - the present version - is concerned, the list of parameters has been disconnected from the form itself, which makes it more difficult to complete;

(ii) software has been developed by the Irish NODC to computerize the completion of the form, which seems to be attractive to scientists.

20 The Meeting noted that the University of Delaware also has a system for maintaining similar information in support of WOCE. Both systems had capabilities which would be of use to GOOS but neither had all of the functions that were considered useful. The Meeting felt it useful to continue to observe the evolution of these systems.

21 It was further noted that, up to now, no operational activities (such as ship-of-opportunity measurements) are recorded under the ROSCOP scheme (with the exception, since 1966, of the British Continuous Plankton Recording (CPR) experiment, thanks to ICES).

22 The Meeting decided on the following course of action:

(i) Recommendation will be made to IODE to again encourage scientists to complete the ROSCOP form after each cruise. Both NODC and IODE National Representatives were encouraged to actively pursue the compilation of ROSCOP forms after every cruise;

(ii) The Chairman of the GE/TADE and the head of the RNODC-Formats (ICES Secretary) will, with the assistance of the IOC Secretariat as necessary, study the question of the presentation of the

ROSCOP form and its associated parameter list, as well as on the problem of the ships-of-opportunity;

(iii) The Irish software will be published and its usage encouraged.

2.5 QUALITY CONTROL PROCEDURES **[OTA agenda item 4.3 - Review of existing quality control guidelines** and **4.4 - Quality control procedures for automated systems]**

23 The Meeting was presented with two documents concerning quality control procedures used by the GTSPP for real-time data. The first document provided statistics on the failure directed by GTSPP tests, and a discussion of the interpretation of the information. The second document presented modifications in testing procedures approved at the last Steering Group meeting for GTSPP in Ottawa in November, 1993.

24 The Meeting was informed by the Chairman of the IGOSS Task Team on Quality Control Procedures for Automated Systems (TT/QCAS) of a workshop on quality control planned by the participants of the WOCE UOT DACs to be held in late 1994. The goal is to bring together those participants doing the quality control so that a greater degree of mutual understanding and consistency in assigning data quality can be achieved.

25 The Meeting was presented with the activities of ICES, the US NODC and others to use the same data set in an intercomparison exercise of their quality control procedures. Only preliminary results of this exercise are available as yet, but this too will help to standardize quality control procedures. A report will become available via the ICES Working Group on Marine Data Management.

26 Finally, the Meeting was informed that the IGOSS TT/QCAS was undertaking a study to determine the correct way to reduce a high resolution profile to inflection points and therefore encode the profiles into BATHY or TESAC messages. To assist in this effort, members were asked to document software procedures used in their agencies and to send this information to the Chairman of the Task Team for consideration. Australia, Canada and the USA specifically offered to co-operate in this regard.

27 In light of these discussions, the Meeting requested the Chairman of OTA, in consultation with the Chairman of IGOSS, to work with members having experience in quality control to revise certain sections of Manuals and Guides #3. Specifically, the information on encoding BATHY and TESAC messages produced by the Task Team should be reflected in the section of the Guide dealing with quality control procedures to be applied before data are inserted onto the GTS. In addition, and in light of the procedures developed by the GTSPP and others, the section dealing with quality control to be performed on data taken from the GTS should also be revised as appropriate, due reference being made to Manuals and Guides Series No. 22.

3. DATA, INFORMATION AND FORMATS

3.1 OCEAN-PC **[OTA agenda item 4.8 - Ocean-PC]**

28 The Meeting reviewed three documents concerning Ocean-PC. The first was prepared by the Secretariat and discussed the status of the project. The second document prepared by the Chairman of GE/OTA discussed some of the possible future directions for development of the project. The third document was an evaluation of the functionality of Ocean-PC and contained a number of detailed recommendations.

29 The Meeting was informed that developments in Ocean-PC were accomplished largely through voluntary contributions of time and software and not as the result of external funding. Because funding was low, improvements to Ocean-PC had to be made on an opportunistic basis and not necessarily in directions which were the most preferred. The lack of funding is a serious problem to Ocean-PC. However, additional funding may not become available until specific project goals are established (see paragraph 32). In this respect, Ms. E. Tanner noted that Australia could support a possible mechanism to explore ways of attracting money for the task, subject to guidelines provided in the future project goals (see paragraph 32). The Meeting welcomed this news and encouraged IOC to take whatever other steps were possible to allocate money for software development for the project.

30 The Chairman of OTA stated that the Ocean-PC "shoe-box" of software was seriously out of date and therefore needed revision. The Meeting requested that the Coordinator of Ocean-PC take steps to update the "shoe-box" before the next IGOSS and IODE sessions.

31 In response to instructions by the IGOSS Bureau Meeting held in January 1994, the OTA group discussed the usefulness of Ocean-PC to IGOSS. Considering the small point of contact between the present version of Ocean-PC and IGOSS, it was deemed to be only of mild interest. However, if Ocean-PC could be expanded to read data in IGOSS formats, and if these data could be supplied to Ocean-PC users, such as via electronic access to GTSPP data sets in a timely way, then the interest in Ocean-PC would be raised substantially. Likewise, if the information in the IGOSS Products Bulletin were also available in digital form on line for display by Ocean-PC, interest in Ocean-PC by IGOSS would be increased. The Meeting suggested that the co-ordinator of Ocean-PC investigate how such developments could be made, and report to IGOSS-VII.

32 The TADE members remarked that while there were many possibilities for developments of Ocean-PC, choosing the optimal path was dependent on knowing the goal. This would help to evaluate detailed comments and suggestions such as provided by Mr. N. Mikhailov. The Meeting requested that the Ocean-PC coordinator work with the Chairman of TADE to develop a document that states the goals of Ocean-PC, with indications of the desired functions and their relative importance to the project. Members of OTA and TADE were requested to send comments to both people. This document was to be prepared in time for IGOSS-VII

33 The version of Ocean-PC evaluated by Mr. N. Mikhailov was not the most recent and the Meeting was informed that some of the shortcomings noted had already been addressed. Recognizing that Ocean-PC is an evolving project, the Chairman of TADE was requested to ask Mr. N. Mikhailov to undertake another evaluation, with a document to be prepared in time for the next IODE Session. The evaluation should not proceed immediately since further development of the product seemed likely.

3.2 INSTRUMENTATION

34 The first item discussed the management of data from undulating instruments. The Group was informed of the work undertaken in Australia, the UK, in Canada and by the ICES Marine Data Management Working Group. In all cases, the management issue broke down into two items. It was recommended that data be archived nationally at 1 Hz resolution. This means that information about the position and time be recorded at every observation value. Since many such instruments record temperature and salinity with a CTD, and there is the international standard to exchange these data at 1 or 2 dbars (according to the recommendation of SCOR Working Group 51), this was adopted for international exchange. If there are other variables measured, these would be averaged to the same extent as for temperature and salinity. At the same time, it was recognized that certain users would want profiles created from the undulating instruments. Given that there were different averaging schemes used, the data centres agreed that profiles constructed from these instruments and created by the originators should also be exchanged. It is considered important that all of the information about the data collection methods, calibration and averaging algorithms accompany the data and is properly archived with the constructed profiles.

35 The discussions turned to data collected by ADCP. A document prepared by JODC as RNODC for ADCP data was reviewed. Recommendations from a recent ICES meeting stated that it was premature for data centres to become involved with this type of data. However, Mr. D. Hamilton noted that his centre was starting to receive these data, and indeed the RNODC for these data had already been established. The Group noted an information document prepared by Mr. Keeley describing how ADCP data collected by the private sector in Canada was to be submitted to MEDS. The Group considered the latter document to be a good starting point for recommended structures and contents of ADCP data sets submitted to a data centre. It was decided that no further action be

taken at this time although data centres were encouraged to use the information document as met their national purposes.

36 The Group was informed by Mr. Hamilton that the management of acoustic tomography data was under discussion in his country. Mr. J. Wallace also noted a research project has been funded under the MAST Programme to collect this type of data. Since no further information was available, the Group requested both members to act as contact points on this issue between TADE and the cited organizations and that the matter would be reviewed at the next TADE Session.

3.3 REMOTE SENSING

37 The Group was informed IOC had requested Mr. Keeley and Mr. Hamilton to attend the Comittee on Earth Observation Satellites (CEOS) meetings held in Ottawa and near Washington in February of 1994. IOC had requested their advice about whether there should be a greater representation by IOC at this very technical level. Mr. Keeley attended the sessions on Catalogue Subgroup and the Network Subgroup. Mr. Hamilton was able to attend only the session of the Auxiliary Data Subgroup (ADS). He reported that the ADS is looking to IOC to help develop an Auxiliary Data Reference Guidelines document in which earth-referenced data sets useful for producing or using satellite data sets will be documented. The ADS wants information on ocean data sets in near-operational time frame (1-7 days), and is not interested in historical data sets. It was agreed by TADE that this matter should be referred to the IGOSS OTA and to the GTSPP. The Group instructed the Chairman to contact the Chairman of OTA and request he co-ordinate the response to the ADS.

38 Mr. Keeley noted that as expected the work of the groups is strongly biased towards satellite data. The catalogue and inventory systems that they have built are based on the NASA Master Directory (MD) model. The structure of the MD entries is awkward for including in-situ data. The question of network performance still is an issue so that they are considering scaling down the information required about a data set so that less information will need to be searched and retrieved. There is little doubt that the whole system will go ahead and likely expand within the satellite community primarily.

39 The Group concluded that there is no question that satellite data are and will increase in importance for the oceanographic community. At the same time, the CEOS committees are well funded with members devoting significant portions of their time to tasks requested by the committees. If IOC wanted a significant presence, a member with the interest to permit spending a significant fraction of their time must be sought. No member of TADE considered this a possible activity. In addition, the representative of the Secretariat reported that it was most unlikely that IOC be able to provide funding for participants to travel to the semi-annual CEOS meetings all over the world. In view of that, the Group agreed that TADE cannot participate in CEOS work.

40 The Group nevertheless considered it to be important for IOC to continue to be informed of CEOS activities and to send appropriate representatives to the technical meetings as resources permit. In this way IOC can decide when it might wish to take a more active role.

3.4 MODERN FORMATS

41 The Group reviewed the summary of the work carried at an *ad hoc* meeting which took place in Copenhagen last year. The result of this meeting was the Format Guidelines document discussed under agenda 5.1 and a generalized form of GF3, called the GETADE format, which would be suitable for a number of different media and data types. Mr. Keeley informed the Group that the format had been tested at MEDS and in cooperation with N. Mikhailov with Russian navy data. In addition, it appeared to have good application in managing data received in spreadsheet export formats.

42 The Group noted that it was important to IOC to have a response when asked for a recommended format for data. Since GF3 was designed for magnetic tapes, and since these were not always the medium of choice, the GE/TADE format would be suitable. It was noted that it builds upon the philosophy of GF3 and allows exchanging the same information on other exchange media such as diskette, CD-ROM, 4mm and 8mm magnetic tape. The Group recommended that the action items developed at the Copenhagen meeting be pursued as a way to prove the capabilities and uses of the format. The Group instructed the Chairman to continue his efforts with other members of the Group to refine the format and to produce a report and examples of usage for the next IODE Session.

43 In the discussions of Ocean-PC held jointly with OTA, it was suggested that Ocean-PC should develop modules that communicate using a common format. This format would need to be sufficiently flexible to handle a wide variety of parameters including time series, ocean profiles such as from ADCPs and other types of oceanographic data. It would be advantageous for the format to be self describing. It would best be an ASCII form so that users of Ocean-PC could write their own software against the format. Finally, it should be consistent with established IODE exchange practices. The GE/TADE format appeared to meet these requirements and so the Group suggested to the Coordinator of Ocean-PC to consider this. The Coordinator noted that OceanPC modules had developed by voluntary efforts to date and if volunteers stepped forward to make use of this format, he thought that the work would be worthwhile. The Group therefore recommended that the Ocean-PC Coordinator talk to software contributors to Ocean-PC to seek their response and help.

3.5 GENERAL FORMAT ISSUES

44 There were a number of issues discussed under this agenda item. The first discussions centered around the multiplicity of formats of data submitted to national data centres. This was causing an increasing burden on data centres and although many formats were relatively straightforward to handle, each one required an investment in resources. One approach to meet this problem was to share software. Actions taken on this approach are dealt with under agenda item 6.2. Sharing software can be very helpful but is dependent upon common hardware or software systems and some commonality in output formats. Another way would be to share resources. In brief this would mean that one data centre would act to reformat data for another centre if it already had the necessary software and could assist. Centres would need to be assured that there would be an equitable sharing of such resources, but this could reduce the software required by any one centre. The advantage is that the software exists at only one centre, and so it is a simple matter to maintain. The Group considered this to be a worthwhile idea to pursue. Certain members of TADE suggested that they would try the concept in an informal way. The members were requested to keep the Chairman of TADE informed of their actions in this regard, and he would prepare an information paper for the next IODE Session.

45 The discussions turned to the advantages and disadvantages of netCDF and HDF as exchange formats. The Group was informed that netCDF is used by CSIRO in Australia for all of its data. Its advantages are that it was a common way to manage data of many different types, particularly gridded data, and is supported by read and write software as well as by data presentation software. The weakness of netCDF lay primarily in that there is no standardized way to refer to variables. Mr. Hamilton informed the Group that he inquired about this recently, and this weakness was confirmed. Members noted that TADE should promote building bridges between formats used in the ocean community. One way to do that is, when IODE data centres became involved in the use of netCDF, that use be made of the GF3 parameter codes tables to reference variables. Ms. Tanner accepted the task to keep the Group informed of experience gained in this work so that other members would have a point of contact for further inquiries. It was agreed that this would be discussed at the next TADE Session to review experience and react to the use of netCDF as needed.

46 Currently AODC is involved in Object Oriented development work using the Objectstore Object-Oriented Database in order to investigate the applicability of this technology to manage oceanographic data types. The primary advantage of an ODBMS is the ability to support complex objects in an efficient and easy-to-manipulate form. A complex object consists of data and processes that manipulate that data. In contrast, RDBMS products provide access to their data only in terms of tables consisting of rows and columns, and other than triggers, an RDBMS can store only relatively simple logic at the table level. Inherent values enable an object class to be implemented as a set of shared routines or modules for each object type in the class.

47 The Queensland University of Technology (QUT) are interested in the object area in relation to spatial data. The OGIS model being investigated

by QUT should be extended in an application-specific way so that oceanographers can easily move into this environment. The OGIS will shortly release a realistic version of the class library to comment on in regard to oceanography. The Group requested Ms. Tanner to keep the Chairman and members informed of these activities.

3.6 METADATA MANAGEMENT

48 This agenda item dealt with the need for metadata management by data centres. Mr. Wallace, acting as an observer from CEC, noted that the issue of complete metadata was considered of great importance to MAST. The Group was informed of work undertaken at the AODC to manage metadata using a relational database and associated software tools. Both Mr. Wallace and Mr. Keeley noted similar work undertaken at their centres. The Group agreed that it was important to manage the data and metadata together and electronically. The Group requested Mr. Hamilton to prepare a paper laying out guidelines for metadata management. To support this activity, Ms. Tanner, Mr. Wallace and Mr. Keeley would distribute to other members of TADE information about the work taking place at their centres on this topic. The other members of TADE would review this information and supply comments to Mr. Hamilton by October, 1994. Mr. Hamilton would prepare a draft of his document to be circulated to TADE members by the start of 1995. A final form would be ready in time for the next IODE Session.

49 At the previous TADE Session, work was to be undertaken by BODC to investigate the scanning of track charts received with ROSCOP forms in order to have the complete information received with ROSCOPs in electronic form. The Group was informed that no progress had been made and that there was some question if this was possible given the poor state of some of the received charts. This latter point was reiterated by Mr. H. Dooley. The Group considered that the best result would be obtained if station positions were available at the time the ROSCOP was submitted (if the data had not yet been received). Since this is not usually available, some members thought it worthwhile to digitize the submitted track charts or failing this to optically scan the document and store the information digitally. The Group concluded that the value of digital track charts before data were received depended on the circumstances under which a data centre operated. It was thought that this matter would be revisited in the future when there was more experience obtained by members on which some decisions could be taken.

4. CO-OPERATION WITH OTHER PROGRAMMES

4.1 GLOBAL OCEAN OBSERVING SYSTEM (GOOS)
4.2 GLOBAL CLIMATE OBSERVING SYSTEM (GCOS) **[OTA agenda item 4.6 - Review of relevant ocean data management systems]**

50 Under this item, the Meeting reviewed:

(i) Recent developments with GOOS and GCOS, in particular the preparation of a draft GCOS data management plan;

(ii) A status report prepared by Mr. B. Searle (acting vice-Chairman of IGOSS) on existing IGOSS/IODE data management activities which would support a future GOOS;

(iii) The implementation of a Distributed Data Bases system within the WWW of WMO;

(iv) Data collection and management systems SEAS, NEONS and NODDS (see Annex IV);

(v) A demonstration IGOSS data management project, based on NEONS, proposed by Australia and Malaysia with possible future extension to other South-East Asian countries (see Annex V).

51 The Meeting noted these developments with interest. It agreed that it would be of considerable value to both IGOSS and IODE to develop a coherent Data Management Plan (DMP) to include both IGOSS and IODE data streams. This DMP should aim to anticipate as much as possible future GOOS data management requirements, and also be coherent with the GCOS DMP and the WWW/DDB

structure. The Meeting accepted the kind offer of Dr. D. McLain to prepare a first draft of an IGOSS/IODE DMP, based on the status report of Mr. Searle and the GCOS DMP. It agreed that the plan should be ready in time for consideration by the next session of I-GOOS (tentatively mid-1995), and that to meet this deadline the following timetable should be followed:

(i) first draft plan completed by September 1994 for review by the chairmen of TADE, IGOSS and IODE and by the Secretariats

(ii) Revised draft to be distributed to OTA and TADE members for further review in November 1994

(iii) Final revised draft to I-GOOS-II mid-1995.

52 The Meeting urged members of both OTA and TADE to provide their initial thoughts on the structure and contents of the DMP to Dr. McLain by mid-July 1994 at the latest.

53 With regard to the proposed regional demonstration project for South-East Asia, the Meeting first recognized the importance of regional data/product management and sharing projects in general, in particular in allowing developing countries direct access to large data bases. At the same time, this access would encourage these countries to submit their own data for inclusion in these data bases. The Meeting further recognized the responsibility of IGOSS/IODE to encourage the use of global standards and formats for data exchange in such regional projects, while acknowledging that a variety of data base management systems may be used internally by different data bases.

54 In this context, the Meeting endorsed the proposed South-East Asian project. It agreed that the project would allow OTA and TADE to properly assess the value of systems such as NEONS for regional oceanographic data management, in particular through the direct involvement of members of both groups in the project. It therefore requested these members to prepare a consolidated report on the project in due course, for consideration by IGOSS and IODE.

4.3 JGOFS

55 There were two documents considered under this agenda item. The first was prepared by R. Lowry who is also the Chairman of the International JGOFS Data Management Committee. The second was prepared by the manager of JGOFS data at MEDS in Canada. Both papers pointed to the fact that JGOFS data typically contain a wide variety of variables although few observations for each. It was noted that a data dictionary that could be used to describe the observed variables would be of help in reducing the confusion that sometimes arose due to the large number of variables. It was stated that GF3 code tables formed a solid basis on which such a data dictionary could be based but that it required the addition of more variables and an extension to the information contained in the tables. The Group noted that the terms of reference of both the RNODC-Formats and of TADE contained instruction to maintain and extend GF3 tables as requested. The Group confirmed this responsibility and requested the Chairman and the RNODC-Formats to contact the authors of the documents to offer IODE services to work with them to increase the functionality of the GF3 tables to their areas of concern.

4.4 WORKSHOP

56 The Group reviewed the document circulated by the Chairman discussing the ideas set forth at the last IODE Officers meeting. It was felt that it was quite important to continue to encourage scientists and data managers to work together to improve the IODE system. The Group decided that the goals presented in the document while useful to introduce the advantages of electronic data and information exchange would be less likely to attract scientists. Noting that it had been difficult to find a host for a meeting separate from the IODE venue, Mr. Wallace offered to explore the possibilities of hosting such a workshop in Dublin. This was strongly welcomed since it allowed the possibility to generate a theme for the workshop which would be more likely to attract a scientific audience. At the same time, by choosing dates which tended to coincide with a scientific meeting, hosted by WOCE for example, for attracting the scientific community would be easier. The Chairman thanked Mr. Wallace and requested that he work with Mr. Dooley to complete a draft agenda and timetable and to seek the necessary approval for the meeting in Dublin. They were requested to forward the agenda by the end of July to the IODE officers for their consideration. It was agreed that there would be two basic themes. The first was a discussion of quality control and metadata requirements for data centres, for data originators and for secondary users. The second theme would examine the issue of what type and how much data was needed to support international programmes and what exchange mechanisms are appropriate.

57 It was also considered that software demonstrations should take place during the forthcoming IODE Session with the general theme outlined in the afore-mentioned document. It was felt that activities undertaken by TADE members and others in the ocean community could be demonstrated to show delegates to IODE some of the possibilities available using electronic data exchange. Mr. Wallace and Mr. Dooley were requested to investigate the available facilities and to develop a potential list of demonstrators (see agenda item 6.1). The Group considered that the planned demonstration at IODE and the independent workshop would be a proper response to the recommendations of the Ocean Climate Data Workshop.

5. GENERAL FORMAT 3 (GF3)

5.1 GF3 MANUALS
5.2 GF3 and BUFR

58 The Group reviewed a paper prepared by the Chairman discussing a variety of matters concerning the documentation of GF3. It welcomed the statement of the Chairman that the final volume on GF3 Standard Subsets would be completed in time for the next IODE Session.

59 The Group next considered the work already performed to include GF3 parameter code tables in BUFR (and reported under agenda item 2.1). The Group recalled that trials of encoding ocean data in BUFR will begin through cooperative efforts at the Australian Meteorological Service and the Australian Oceanographic Data Service as noted in agenda item 2.1. Noting that BUFR does not require the description of the method used to make an observation to be provided along with the observation and noting that this information is of importance, the Group requested the Chairman to prepare a document which will provide guidelines on the use of BUFR for oceanographic data. This document should be prepared as soon as possible in order to assist the trials. The Chairman agreed to prepare a draft and to circulate it to members of TADE by September 1994.

60 The Group turned to discussion of the format guidelines prepared as a result of the Modern Formats ad hoc meeting which took place last year. The document (included as an annex to document 7) was welcomed. The primary use of this document would be for data centres to advise data providers on the submission of data. The Group noted some revision was necessary and requested that the Chairman make the changes as soon as possible.

61 At the same time it was recognized that additional guidelines were desirable for specific types of data. In this respect, Ms. Tanner, Mr. Hamilton and Mr. M. Brown offered to prepare such guidelines (specifically CTD, current meter and drifting buoy data respectively) based on the idea of GF3 standard subsets. These documents will be circulated to TADE members by the end of July 1994. Then, after consideration of content and uniformity of style, the Chairman will request documents for other subsets to be prepared by members. The Group recommended that the documents on guidelines be published by IOC in a format that could be easily updated.

5.3 EXTENSIONS TO CODE TABLES

62 The Group discussed document 9 which indicated that in order for GTSPP data to be encoded in BUFR, some work was also necessary to extend the GF3 code tables to handle certain parameters. The Group was informed that MEDS in cooperation with the US was undertaking action in this regard and requested that MEDS keep the GE/TADE informed of progress.

63 The question was asked if there were any overlap in codes used by ROSCOP-III and GF3 tables. Mr. Dooley remarked that ROSCOP codes dealt with the information at a more general level but that there were some inconsistencies between the two. The Group agreed that any future revision of the ROSCOP form should work towards a resolution of these inconsistencies.

64 The Group noted that many data suppliers were using plain text to describe their data sets. While this is convenient, it makes data descriptions vulnerable to spelling mistakes, language dependence, and imprecision of terminology. Despite the apparent drawbacks, code tables help to guard against just such problems. However, the Group considered that in order for IOC code tables to be of great use they must be clearly described, easily available, widely employed and kept up to date. Actions concerning availability are reported under agenda item 6.1. The maintenance of the code tables is the responsibility of the RNODC-Formats and the Chairman of the Group.

65 The Group was informed that the US NODC had recently purchased digital ship information from Lloyds of London. The Group requested that members of TADE be informed if information from the file could be shared among IOC Member States.

6. EXCHANGE CAPABILITIES

6.1 OCEAN NETWORK

66 The Group reviewed document 8 discussing various ways that electronic data and information transfers are changing the way data providers and users work. The Group noted that the GTSPP was quite successful in taking advantage of Internet to exchange files. Mr. Dooley cautioned that techniques of data and information exchange must take proper consideration of the capabilities between exchanging centres such as communications speeds, and client and server software which were available.He also informed the Group of a task undertaken by the ICES Marine Data Management Working Group to define a common framework using the gopher utility of Internet for the presentation of information concerning NODC/DNA activities within ICES Member States. This need was also stated in the document reviewed by TADE. The Group agreed that it would be sensible for TADE to work with the ICES Working Group. It therefore requested that Mr. Dooley act as the point of contact and to distribute information to and pass comments from TADE to the ICES Working Group.

67 The Group noted that it was difficult for individuals to be fully aware of all of the capabilities and information available on Internet related to oceanography. Ms. Tanner noted that information about oceanographic and meteorological data sources is available by anonymous ftp from *rtfm.mit.edu* in directory *pub/usenet/news.answers/weather/data* in files *part 1* and *part 2*. Members were encouraged to look at this information.

68 Each NODC/DNA is currently at different stages of development with regard to utilizing and understanding the various Internet utilities. Thus, in order to bring each NODC/DNA currently connected to Internet to a common level of capability, Ms. Tanner was requested to set up an electronic conference amongst NODCs in order to allow them to learn about Internet facilities by means of direct experience.

69 The Group considered that the cooperation between the ICES and TADE Groups would hasten the development of the framework to be defined. In the meantime, members of TADE intended to proceed with their own organizations plans to develop services available over Internet. The Group agreed that this was the way to get an Ocean network started and would give valuable first hand experience when the time came to evaluate proposals of how ocean data and information should be organized for presentation on Internet. The existing or planned services offered by four organizations are listed in Annex VI.

6.2 SOFTWARE INVENTORY

70 The Group was presented with the progress made in compiling an IODE software inventory. In particular, a draft questionnaire was presented to the

session. The Group agreed that the questionnaire had a broad scope but recommended the following changes:

(i) The questionnaire should more clearly differentiate between commercially and freely available software;

(ii) The questionnaire should allow for a one line description of each software application;

(iii) The questionnaire should address the availability of oceanographic CD-ROMs;

(iv) The questionnaire should avoid a free-text format where possible.

71 The Group agreed that Mr. Wallace will modify the questionnaire and distribute it to the IODE NODCs and DNAs through the Australian and US NODCs. The returned forms will be digitized between the AODC, US NODC and the Irish Marine Data Centre. The digitizing software will be provided by the Irish centre and the digitized datasets will also be merged by the Irish centre. The complete inventory will be available on disk and will also be posted on Internet by the AODC. The Group requested that Mr. Wallace liaise with the co-ordinator of Ocean-PC to update the "shoe-box".

7. OTHER BUSINESS

72 In discussions at the OTA Session the question of management of thermosalinograph data was raised. The Group was informed that there existed a backlog of such data collected by NOS ships and that the availability of such data for exchange would be investigated by C. Noe. The Group was reminded that salinity data collected by such instruments need to be properly calibrated and that this was often a problem. Nevertheless, such data were considered to be useful and should be made available to IODE users. The Chairman was requested to contact the Chairman of the WOCE Surface Salinity Programme to get their guidance of this matter. Information so acquired would be passed to members of TADE for comment and consideration. It was considered that until further consideration could be given, that these guidelines should be used in managing the data collected by NOS.

73 The Group also discussed the relationship of IGOSS data and the delayed mode data exchanged within IODE. It was noted that salinity data collected by CTDs and sent in real time would not be fully calibrated and so are of unknown accuracy and precision. This underscores the need for the acquisition of the delayed mode, fully calibrated CTD data on which the real time messages are based. .The Group urged all NODCs to make special efforts in this regard. The Group requested that the GTSPP should work closely with those submitting TESAC messages to ensure the delayed mode data reach the appropriate archive centres.

8. CLOSURE OF THE SESSION

74 In closing the Session, the Chairman thanked the members present for their invaluable contributions to the discussions. He expressed regrets at the unfortunate absence of some members, due to various reasons. He finally thanked WMO for the excellent facilities offered to the Session.

75 The members present unanimously expressed their deep appreciation to the Chairman for his smooth, clear and wise guidance of the Session.

76 The Sixth Session of the IODE Group of Experts on the Technical Aspects of Data Exchange closed on Wednesday, 29 June 1994, at 12.35.

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. ISSUES OF JOINT INTEREST TO IGOSS AND IODE

2.1 BINARY UNIVERSAL FORM FOR REPRESENTATION (BUFR)
2.2 FLEX AND SEALEV
2.3 GLOBAL TEMPERATURE AND SALINITY PILOT PROJECT (GTSPP)
2.4 DATA MONITORING
2.5 QUALITY CONTROL PROCEDURES

3. DATA, INFORMATION AND FORMATS

3.1 OCEAN-PC
3.2 INSTRUMENTATION
3.3 REMOTE-SENSING DATA
3.4 MODERN FORMATS AD HOC GROUP
3.5 GENERAL FORMAT ISSUES
3.6 METADATA MANAGEMENT

4. CO-OPERATION WITH OTHER PROGRAMMES

4.1 GLOBAL OCEAN OBSERVING SYSTEM (GOOS)
4.2 GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)
4.3 JOINT GLOBAL OCEAN FLUX STUDY (JGOFS)
4.4 WORKSHOP

5. GENERAL FORMAT 3 (GF3)

5.1 GF3 MANUALS
5.2 GF3 AND BUFR
5.3 EXTENSIONS TO CODE TABLES

6. EXCHANGE CAPABILITIES

6.1 OCEAN NETWORK
6.2 SOFTWARE INVENTORY

7. OTHER BUSINESS

8. CLOSURE OF THE SESSION

ANNEX II

OTA AND TADE CO-OPERATION

Introduction

The global observing programmes of GOOS, GCOS and GTOS are planned to collect large amounts of data within the next decade. Data from these programmes will need to be combined to study the various interactions between the climate systems of the earth. The integration from these diverse sources will be used for both scientific research, and in operational programmes of weather prediction, fisheries support, and search and rescue activities to name a few. The integration of data for these operational programmes will place large demands on data management to provide the means of moving data from the collectors to users in a timely way, in providing data to users in a way that allows ready combination with other data, and in distributing the results to consumers of the products.

While it is early in the planning, it is clear what will be some of the demands on ocean data management systems if GOOS is to succeed. GOOS intends to handle much larger data volumes than have been handled to date. There is the requirement to include more diverse data sources such as from in-situ instrumentation, and from satellites. These data must move quickly from the point of collection through data management systems to those analyzing the data to produce products and moving these products to users.

Given the general goals stated, it is worthwhile to review the current state of data management and to focus in this discussion on the roles played by the IGOSS OTA and IODE TADE groups.

Review of the Present

The IGOSS system is charged with supporting the collection of data from ocean programmes and moving the data to data management centres where they may be used in various analyzed products. For IGOSS, operational, or real-time data are defined to be those data collected within 30 days of present. The IGOSS system relies on the GTS of the WMO to move data around the world to the data centres. There are 5 character code forms currently used to move data which are of direct interest to the oceanographic community. Specifically these are temperature profile data in the BATHY code, temperature, salinity and current profiles (although to date, no current profile data have been exchanged) in the TESAC code, data from drifting or moored buoys in the DRIFTER code, surface temperature and salinity data along a track in TRACKOB code and spectral wave information in WAVEOB code. The volumes of these data in total, except for DRIFTER data, are quite small compared to the volumes of meteorological data moving on the GTS. Originally, data collected at sea was moved ashore in voice messages to coastal radio stations and from there onto the GTS. This has changed so that increasingly, satellite communications are being used. Because of the definition of real-time, shorter duration cruises can wait until coming to port to relay the data to the GTS.

The OTA group has for many years focused on the maintenance of the relevant GTS code forms for the exchange of data. In the past, issues of quality control of the data, and some monitoring of data exchange were also of interest. Of recent significance has been the establishment of a Task Team to examine the fall rate of XBTs and this has resulted in important implications to oceanographic data management. Quality control has been discussed in the light of ensuring data that are placed on the GTS are as good as the observer can ensure. Monitoring has been relatively simple counts of data received at the various data centres compared to numbers of messages sent. Lately, OTA has started to change its focus to develop a universal character code form for data, to increase the volume of data collections and to improve data products derived from real-time data.

In contrast, IODE has focused on the collection of oceanographic data of many diverse types (physical, geophysical, meteorological, chemical, wave) largely from research programmes and well after the data collection was made. This concentration on research data in so-called delayed mode drove IODE to examine a number of issues. Of past interest and that grew out of large cooperative science programmes was the development of a general format for the exchange of a broad variety of oceanographic data on magnetic tape (GF3). At the same time, there was the attempt to monitor data collections through the use of such forms as ROSCOP. Additionally, there was the compilation of catalogues describing data collections that exist at the various data centres operating within the IODE system.

In terms of data management, IODE has encouraged a system of data centres in member countries, RNODCs for specialized data sets, and WDCs acting as clearing houses of global data. Well thought out policies of data exchange and cooperation between contributing data centres are a strong point of this system.

TADE as the committee of IODE responsible for technical matters, focused on the development of the GF3 format. Members of TADE have developed software to support the writing and reading of GF3 on a variety of computer hardware. At the same time, a major revision of the ROSCOP form (subsequently called the Cruise Summary Report, CSR) was undertaken to improve the ease of filling it in and thereby encourage its use. TADE is in the process of turning its attentions to other aspects of data exchange including accommodating the data from new forms of instrumentation, and to the exchange of both data and information by means of electronic networks.

The IODE and WMO have also become involved in some recent projects that are moving oceanographic data management into new areas and increasing the capabilities for exchange. Of these, two are highlighted here. The first is the data rescue project known as GODAR. It is well known that not all of the ocean data collected in the past has been submitted to the IODE system. It is also clear, that some of these data are in danger of being lost. This project has worked hard over the last year and has recovered over 1,000,000 profiles. Members of this project estimate that there is the potential to recover perhaps up to 4,000,000 more profiles.

A second project, the Global Temperature and Salinity Pilot Project, GTSPP, has worked to modernize the management of ocean data from real-time collection to delayed mode acquisition of the higher resolution, higher quality profiles of temperature and salinity data from which the real-time GTS messages are derived. Some of the features of the GTSPP is the development of well documented and common quality control software, software that can be of great assistance in identifying duplicate data and a formatting scheme that more tightly integrates metadata and data.

Both of these projects are taking steps to increase the availability of ocean data. The former by recovering data collected but never included in world archives, and the latter but improving the managing of data in the archives.

Other Developments

There are other projects, and initiatives undertaken by others that need to be mentioned at this point. These illustrate the range of activities taking place and help to define the milieu in which data management must operate.

First, there is the explosive growth in international electronic networks, specifically Internet. While there are many countries not yet accessible through Internet, it seems clear that it will not be long before all of the countries of the world will be linked this way.

Second, within the WMO has been the development of a formatting scheme, called BUFR, which is very flexible in the representation of data for exchange. It is a binary format and so relies on electronic connections with error correcting protocols. WMO is also embarking on a development of distributed databases that is modeled on a client-server architecture.

Third is the increasing use of personal computers in the management of oceanographic data by scientists as well as others. IODE has recognized the value of encouraging this by supporting the OceanPC project to help capture data in forms that permit easier exchange between individuals, NODCs and WDCs.

Fourth, there is the introduction of data bases and software that supports both data retrievals, and display. One such example of this is the NEONS and NODDS systems.

Fifth, there is the capability to distribute large volumes of data on low cost media such as CD-ROMs which are available to all users of PCs. This allows users to have all of the relevant data to their study available to their PC

Sixth, There is the development of 2 way satellite communications to ships at sea. This means that it is now possible to both move data ashore rapidly, but also to move products derived from the data back to the ships at sea.

Data Management Issues

If GOOS is to succeed, it must take advantage of systems and institutions already in place that can meet the challenges of greater data volumes, greater data diversity and more timely handling of data. This means the roles of such committees as OTA and TADE must also face these demands and work more closely together. One way to accomplish this is for OTA and TADE to hold overlapping meetings.

Data will have to be moved more rapidly from data collection platforms whether ships, buoys, moorings or satellites to shore where they can become accessible to all. Getting the data ashore more rapidly is very important and must take advantage of new developments in technology.

Once ashore, the data must be processed to combine them from diverse sources, to assess their quality, to remove any duplications that may occur, to add information about the data collection process, to generate products from the data and to move the products and data to end users.

One concern has to be the rapid integration of data from diverse sources. This does not necessarily require that all data be managed in the same format. Indeed, it may be that data collected from such diverse instrumentation as satellites and in-situ probes may not readily be contained in a single form. However, the integration of data from diverse instruments is required. Various attempts are being made to integrate data into all encompassing formats. Such is the goal of developing forms such as BUFR, CDF and HDF for example. Each of these has strengths but as yet no one form is well suited to all kinds of data.

The entire process from data collection to data centres and inclusion in products must be monitored to ensure that there are no data lost, and that all data collected do eventually reach international data archives. Equally important is to assure data move from processing centres to users as either data or products and that this takes place quickly and efficiently.

The basic concern is to provide a more rapid management of data collected through real-time and delayed mode systems. One way to do this is to adopt the model used in the GTSPP. So, instead of diverse centres around the world each collecting portions of the data, a data centre accepts the task of being the global centre for one type of data. This allows the centre to concentrate on global data acquisitions and management of the single data type including more sophisticated quality control, duplicates management, data monitoring, metadata integration and product development. Other data centres can then concentrate on other types of data exchanged either in both real-time and delayed mode, or just in delayed mode. Really, this is just an extension of the concept of RNODCs. If this mode of operation is to work, however, it is necessary for data centres to be reliably linked by electronic networks. One data centre must be able to access data from a specialized centre just as if the data were maintained at its own centre and in with the same or better turnaround from data receipt to user. In this way, the global system supports all users and specialization can occur.

Roles for OTA and TADE

OTA and TADE should continue to focus on their traditional roles in this data exchange system. However, there are areas where cooperation will be crucial. OTA must continue to assume the role of leader in the furthering of exchange of real-time data. Specifically OTA can lead the following activities:

a) It is clear that BUFR is the format of preference for exchange of data on the GTS for meteorological data. Discussions between TADE and WMO have reached the stage where there is soon to be inclusion of GF3 parameter codes into BUFR tables. What this will mean is that any of the parameters covered by GF3 at present, may be exchanged in binary form using BUFR. As a fallout of this work, a cross reference table is developed between BUFR and GF3 code tables. While GF3 codes should remain in the domain of TADE, OTA needs to work with TADE and WMO for the development of parameter codes required for real-time data, and to work with WMO on improvements to BUFR.
There is a substantial amount of software available to both read and write BUFR. OTA should encourage its members to become more deeply involved in its use.

b) OTA needs to support activities that increase the reliability of data collection at sea. The extension of the Task Team investigating XBT fall rates is extremely important in this regard. Likewise, inter calibration of other in-situ instruments or similar activities are required.

c) OTA needs to continue to support activities that increase the reliability of the data getting ashore as quickly as possible. This means working with agencies such as Inmarsat in developing ways to exchange data, with Service Argos in the distribution of data from drifters and in testing other ways data can be relayed ashore. Encouraging further development of such automatic systems as SEAS is another area for OTA involvement.

d) OTA needs to encourage members to make use of real-time data in the development of products and services that support GOOS activities. Development of the range of products in the IGOSS Products Bulletin as well as making those products available electronically is one way. Working with systems that allow the sending of these and new products to ships at sea is very important in encouraging greater data collection.

For its part, TADE needs to concentrate on certain other areas of data management.

a) TADE needs to continue to support GF3 for those agencies for whom this is most appropriate. In particular, TADE needs to upgrade and expand the breadth of parameters included in GF3 code tables to permit even more diverse data to be integrated within a single system.

b) TADE needs to accomplish the closer integration of data and associated metadata. It is clear that the information about a data collection is very important. In the past, partly due to inadequate technology, the information and the data were separated. GF3 has made a start in this regard, but more formalism is needed. The GTSPP has shown progress in this as well. More work is still required.

c) TADE needs to work actively to promote linking of data centres and users through electronic networks. The more active cooperation fostered by electronic data exchange will encourage centres to closely align their data management practices and thereby improve the timeliness of data exchange. It will also promote the use of common data formats between centres which also is desirable.

d) TADE needs to be more active in monitoring data collections so that all of the data collected are included in the global oceanographic data management system. Developing means of handling electronic CSRs, including graphics is one avenue to pursue. Some of the activities of the GTSPP are making progress in more rapidly notifying ship operator's of problems in their data collections, but there is still the requirement for more active work to gather cruise information.

e) TADE needs to improve the capabilities of data centres to process data more quickly. There are a number of ways to approach this including the exchange of software, the encouragement of projects such as OceanPC which standardize data forms, and the development of software that permits more rapid handling of data from PCs.

The areas of cooperation between OTA and TADE would be as follows :

a) Both OTA and TADE data exchanges will make use of code tables. From the OTA view, the identification of ship call signs and more complete identification of origins of data is important. As BUFR gains use, OTA and TADE must work together in the maintenance of GF3 parameter codes. Associated code lists of instrumentation, methods of data collection and so on will be needed as well. More rapid dissemination of these lists will also be necessary.

b) OTA and TADE must both take part in monitoring of data collections. IGOSS has typically concentrated on the VOS programme while IODE on research platforms. There are other programmes that utilize the GTS, such as the TOGA/TAO data, that lie outside these programmes. OTA should broaden its interests to all platforms and programmes collecting data at sea and that could report data in real-time. Likewise, TADE must take a more active interest in data exchanged in real-time from the point of view of better integration with data acquired in delayed mode.

c) Both committees must take steps to encourage the more rapid exchange of data. OTA must continue to support data exchange on the GTS since at present this is the most widespread network available. In future, data exchange over other networks such as Internet will become more important and OTA and TADE must expand their interests to make both data and information available to users through these networks.

d) OTA and TADE must expand their cooperation to develop quality control procedures and to encourage the widespread application of these techniques. In so doing, users will gain confidence in the data, and so accept the judgment of the data quality. In this way, less duplication of effort in assessing data quality will take place.

Conclusions

This paper has discussed the general goals of global programmes such as GOOS that will influence data management in the future. It has reviewed the present state of data management within IOC and focused on the roles played by OTA and TADE. In order to further the broad goals of GOOS, there has been the general statement of the areas where these two committees need to work. In so doing, the tasks are divided into those suitable for each committee, but whose joint work will improve the management of ocean data and thereby further the goals of GOOS. It is imperative that members of both committees and member states of IGOSS and IODE commit a portion of their resources to support these activities since it is only through the cooperative efforts of individual member states that the lofty goals of improved data management to meet the demands of GOOS can be met.

ANNEX III

USE OF BUFR FOR OCEANOGRAPHIC DATA

BUFR - Introduction

With the planned development of GCOS and GOOS, it will be increasingly important to streamline the exchange of data between the meteorological and oceanographic communities. One of the ways to accomplish this is if meteorologists and oceanographers agree to a common mechanism for exchanging data. In so doing this will allow for tighter integration of data collected by either community. Such a goal is desirable since it will permit more uniform data management practices across the two communities.

At the last OTA meeting, it was agreed that IGOSS would move forward towards incorporating GF3 parameter codes into BUFR. This work has progressed slowly. At the last meeting of the WMO Subgroup on Codes in September, 1993 it was agreed that the chairman would work with the chairman of GE TADE to develop the code tables.

Characteristics of BUFR and GF3

The meeting will recall that BUFR is a binary format developed for the exchange of data over electronic networks and in particular the GTS. Because it is binary it is a requirement that the electronic network supports error correction protocols. BUFR is an attractive messaging scheme because it is compact, is self describing through its code tables and very flexible in accommodating both different kinds of data and logical data structures. These properties are very similar to the characteristics of the IODE format GF3 which was designed for the exchange of information related to oceanographic data collections on magnetic tape.

A preliminary comparison of GF3 and BUFR tables found a few areas of overlap in the parameters included, mostly in the meteorological, oceanographic and position and time variables. In these particular tables, many variables appear to be either the same or very nearly the same. It is the fact that they appear to be nearly the same that introduces some complications since these apparent differences need to be resolved. For those variables which are clearly not common between the two formatting schemes, it is mostly straightforward to develop the BUFR code tables for GF3 parameters.

GF3 differs from BUFR in a number of features. First, the GF3 parameter code includes not only a specification of the observed parameter, but also the method used to make the measurement. In GF3 it is not possible to provide an observed value without indicating how the measurement was collected. In translating from GF3 to BUFR, this tie is broken. BUFR encodes the observed parameter as one parameter code and the technique used as another. Unless the person encoding the BUFR message is diligent about the work, information about the method of observation may not be included. Part of the job of translating the GF3 codes to BUFR is in developing the code tables for the method of observation (from the GF3 tables) but also in stating the desired links between the observed value and the method.

GF3 differs from BUFR in that the units of observations are linked to the observed variable. If the units are standard SI, this is readily indicated. If the units are not SI, the encoder can mark the observed value as such and can provide within the formatting scheme the multiplicative and additive factors that convert from non SI to SI units. This capability is lost in going to BUFR; variables are defined in SI units only. While this has no impact on encoding information, it does represent a loss of flexibility.

A third difference between GF3 and BUFR is that BUFR tables define the typical range of the observed variable. This is done by indicating a reference value (that is the value to be added to the value transmitted in the BUFR message) and the width in bits required to contain values. There is no such information encoded in GF3 tables which means that typical ranges must be established for every variable. In most cases this is not a problem in principle although in practice it is not so easy for a single individual to know all of the ranges for each variable. A different situation arises for those variables that are measured for example by chemical techniques. So, it is necessary for some variables to indicate that an observed value is in fact below or above a measurable threshold; that is the absolute value is not known. It is not clear at the moment how this can be handled in BUFR. Related to this is the fact that for certain variables being measured in oceanography today, an example being in the JGOFS program, it is not known what are the typical ranges to be expected. Some may argue that such data would not be a candidate for GTS exchange, and this may be so, but the data certainly would be exchanged electronically. Considering the goal of more uniform data management practices between the oceanographic and meteorological communities, the requirement to handle the problem in BUFR.

A fourth difference between BUFR and GF3 is that GF3 permits the encoder to provide as much additional information as wanted to accompany the data. This information is included in what are known as Plain Language Records of GF3. All this does really is to allow the data provider to write the information in a completely non structured way but that is best suited to describe the data collection at both the very general level of the entire data set or at each an every observed value as may be appropriate. The capability to do this is particularly important to programs such as JGOFS where the techniques and descriptions of data and sample collection and the handling process is as important as the numbers themselves. At present it is not clear what capability is available in BUFR to support this.

Progress

Given the above discussion, it was necessary to consider alternate ways to translate GF3 tables and to choose a strategy before embarking on the task. It had been decided that the GF3 tables be reviewed by a representative of the meteorological community to identify those parameters in the GF3 tables that are considered to be already in BUFR tables. This has been done. The results were then passed to the chairman of GE-TADE who is now developing the necessary tables for the rest of the parameters.

To date, all of the tables have been developed but not all of the typical ranges have been set. This requires the assistance of others of the GE-TADE group and is being pursued. It is expected that by the time of the OTA/TADE meeting, most of the work will be completed.

As of writing this document, no work has yet been done to test how typical oceanographic data would be both written and read from BUFR. Again it is hoped that there will be further progress to be reported by the time of the meeting. Such work is necessary to be sure that BUFR is suitable for use given how the translation of variables has been done, but also to provide the software support that can be distributed in the oceanographic community which will promote the use of BUFR.

ANNEX IV

OCEAN DATA MANAGEMENT SYSTEMS DEVELOPED BY THE U.S. NAVY

GOOS will necessarily be based on existing systems in use around the world. Linking these systems into an integrated system will be the problem. Fortunately, many users are installing common software which will simplify this linking. Three systems, SEAS, NEONS and NODDS, have been developed by the US and are widely used.

SEAS

The NOAA/NOS Shipboard Environmental data Acquisition System (SEAS) is installed on over 100 vessels and is familiar to many IGOSS participants. SEAS supports manual entry of surface weather observations for encoding as a WMO SHIP weather report and also automatic digitization of an XBT profile for encoding as a BATHY message. The messages are sent to shore analysis centers in real-time via GOES or INMARSAT-A satellite. TESAC and TRACKOB messages can also be entered into the system and transmitted to shore. SEAS is being modified to report data to shore in binary via INMARSAT-C (See Section 5.0).

NEONS

The Naval Environmental Operational Nowcasting System (NEONS) database management system (DBMS) was developed by the US Naval Research Laboratory (NRL) for nowcasting of marine conditions and is now being installed at many weather facilities. NEONS is based on WMO and computer industry standards (UNIX, SQL, X-Windows, etc) and is fast and efficient. NEONS is designed to store data in binary strings (Binary Large OBjects or BLOBs) in WMO standard BUFR and GRIB. Use of binary strings makes the system compute-bound, rather than I/O-bound and thus allows it to take advantage of fast new RISC processors. NEONS uses a commercial DBMS (Empress) to keep track of the location and contents of the binary strings.

NEONS was designed to support interactive "nowcasting", that is, the ability to rapidly search for all available atmospheric and oceanic data in a time/space region from local and remote databases. Using visualization software, one can overlay each data set on others to show the development of a feature in time and space. The US Navy has installed NEON systems at Fleet Numerical Meteorological and Oceanography Center, Naval Oceanographic Office, Mississippi State University Center for Air Sea Technology, and in shipboard systems.

NRL provided NEONS to other organizations and countries at no cost. The systems are now used at several operational weather forecasting centers:

- Canadian Atmospheric Environment Service,
- Australian Bureau of Meteorology,
- UK Meteorological Office,
- Meteo France,
- Tunisian Meteorological Institute,
- Taiwan Central Weather Bureau, and
- Swiss Meteorological Service

and non-operational meteorological centers:

- US National Center for Atmospheric Research,
- Global Weather Dynamics Inc. in the US,
- ICSC World Laboratory in Italy,
- Bradford University in the UK, and
- Max Plank Institute in Germany.

NEON systems are being proposed for use by the Icelandic Meteorological Office, the Royal Netherlands Meteorological Institute and the Malaysian Meteorological Service. The World Laboratory of the International Center for Scientific Culture (ICSC) is developing a portable meteorological workstation. The ICSC system uses a NEONS DBMS and includes software for regional numerical weather forecasting, oceanographic modelling and visualization. ICSC has installed its system in Tunisia and may install the system at other national meteorological services in the Mediterranean region in the future.

NEON systems are also used for climatic data. The US NOAA National Climate Data Center (NCDC) has installed NEONS to support the Global Climate Perspectives System (GCPS). Other NOAA offices (Climate Analysis Center, Climate Diagnostics and Monitoring Laboratory and National Marine Fisheries Service) have also installed NEON systems to share data with NCDC in GCPS. Since NCDC is expanding GCPS to Germany and the UK, GCPS is a prototype for GCOS.

Both NRL and NCDC have written Data Browser software so that users can browse files on a NEONS database and download data sets of interest, either locally or remotely via Internet. Data Browsers are more convenient that the "file transfer protocol" or "ftp" now widely used on Internet. There is little standardization of present ftp files as to availability, quality, timeliness, or coverage. More importantly, ftp suffers the same problems as mailing magnetic tapes; that is, many files are in different formats and the user must convert the data to his own format for use. The Data Browsers can convert data to other formats (ASCII, HDF, GrADS or netCDF) for input to other programs. NRL has posted a working version of its Data Browser on Internet for public demonstrations.

NODDS

The Navy Oceanographic Data Distribution System (NODDS) was developed by Fleet Numerical Meteorological and Oceanography Center (FNMOC) for dial-up modem real-time distribution of weather and ocean analyses and forecasts, satellite images and ocean model outputs. NODDS is programmed in QuickBASIC for operation on a MS-DOS (286 or better) PCs. The system transmits numeric data in a character form ("OTH GOLD") for use on telex lines as well as binary-compatible circuits. The PC plots the numeric data "off-line", that is, the PC receives numeric gridded data and contour plots the display map on a background file of coastlines and lat/long reference lines. Gridded fields are sent as 2 ASCII characters (or 16 bits) per gridpoint while satellite and model output data are compressed using a variety of methods. NODDS is installed at over 750 locations globally for dial-up by telephone and via INMARSAT-A on ships. The system will be adapted to the digital INMARSAT-C. An "XVT" version of NODDS is being developed for use on other operating systems (eg, MS Windows, OS/2, Macintosh OS and UNIX X-Windows).

NOAA NOS/OAB is developing a civilian version of NODDS to send real-time FNMOC and NMC products to government agencies, universities, schools and others. OAB's "NODDS Host" software is based on NEONS for storage of 30 days of historical data as well as real-time data. OAB has tested NODDS with INMARSAT-A and will test it with INMARSAT-C.

A Possible Application of SEAS, NEONS and NODDS in GOOS

A possible application of the SEAS, NEONS and NODDS data systems in GOOS has been proposed by Dr. Bjoern Erlingsson of the Sea Ice Research Division of the Icelandic Meteorological Office (IMO). Dr. Erlingsson proposes to make in-situ ocean observations with SEAS on several hundred fishing and research vessels and report the data to shore in real-time via INMARSAT-C. Ashore at IMO, the data will be mapped, analyzed and stored with NEONS (possibly using ICSC's regional forecasting system). The gridded fields will be sent to the ships in near real-time via INMARSAT-C for off-line coutour plotting with NODDS.

The proposed IMO program will result in a large increase in the number of ocean observations in the North Atlantic and be a vital part of GOOS. Besides real-time weather and ocean products, many additional services could also be provided, including: 1) access to special data sets, 2) merge and display of the vessel's own observations with reports from surrounding vessels, and 3) access to climatological data on CD-ROMs. Expansion of the NODDS software will be needed to support these services.

ANNEX V

PROPOSAL FOR A NEONS DEMONSTRATION PROJECT IN THE SOUTH-WEST PACIFIC

At the IGOSS Bureau meeting in Sydney (17-21 January 1994) Australia agreed to investigate the feasibility of setting up a demonstration project, based on NEONS, that would establish the practicalities of enabling regional access to oceanographic data held in national databases. Specifically the ASEAN countries (Malaysia, Singapore, Indonesia, Thailand, Brunei, Philippines) were identified as ideal partners with Australia for such a project. These countries have very rapidly developing economies and are investing heavily in national infrastructure, including information technologies and, environmental monitoring and scientific activities.:

Australia has comparatively well developed national scientific and technological infrastructure and capabilities, particularly in respect of its communications, information technologies and operational and research scientific programs (eg. meteorology and oceanography). Australia has already established the international links necessary to connect into wider international data networks that rely on the Internet, and is using NEONS coupled with Empress extensively within its own national meteorological relational database management system (RDBMS) and has a large number of products from both the Bureau of Meteorology and the Australian Oceanographic Data Centre (AODC) that could be made available for regional access.

The Malaysian Meteorological Service has expressed strong interest in participating in the demonstration project, through initial approaches by Do Lim Joo Tick and Mr Kwong Lun Tuen to the IGOSS Bureau, to OTA Chairman Dr McLain and recently the Head of Australia's National Meteorological Centre (NMC) Dr Geoff Love.

The Demonstration Project Proposal

The Demonstration Project proposed by Australia would enable the Malaysian Meteorological Service access to the Australian database over Internet initially for a limited duration, in a phased program, and could be readily set up. Currently access to Bureau of Meteorology systems to external users is limited, because of well grounded concerns about hackers breaching security protocols. It is the intention of NMC to provide more ready and long-term access but this cannot be provided immediately. Special provisions will however be made for the Demonstration Project.

The Project would consist of 2 phases:

Phase 1

During this phase, which would run for an agreed period of around 3 months or so (because of limitations described above), Malaysia would be given remote access to the Bureau's database, via the NEONS browser. In addition nominated products could be placed on a server for downloading back to Malaysia. This could best be described as a non-interactive mode.

This will require:

- Malaysia to have access to a Unix box/terminal and be connected to Internet (which I understand the Malaysian Meteorological Service now has);

- nomination of a range of products from the Bureau's database (to be determined by mutual agreement) which will be available for browsing and/or downloading from the access server;

- the AODC may supply some of the products/holdings from its Geographic Information System (GIS) to the Bureau for inclusion in the project, but they will not be "online" (ie. not browsable from their GIS database directly);

* Malaysia informing the Bureau of its IP address so as to allow X-terminal access to occur.

Agreement to proceed is anticipated to be fairly quick, once arrangements with Malaysia about selection of products have been made. August-September` 1994 has been suggested as a possible period to carry out this phase.

Phase 2

During this phase full database utility would be established for Malaysia, which would require them obtaining (or purchasing) a licence for the Empress database software, plus some initial training in the installation and operational use of the NEONS/Empress RDBMS. This would provide access to data directly from the database, rather than just allowing browsing as in Phase 1.

This would entail:

- purchase of an Empress licence for a single site. The cost of this licence will depend upon local commercial arrangements with Empress and the type of Unix platform being used. Suggested prices range from A$10,000 to $30,000+;

* training of a staff member from the Malaysian Meteorological Service in Melbourne for maybe two weeks.

A more formal recognition of the establishment of the Demonstration Project, from the IGOSS establishment, would also be helpful.

Prospects for an ASEAN project

The longer term prospects of- developing an ASEAN-wide project would require some capital expenditure, to integrate AODC contributions (sourced from Sydney) into the Bureau's data management system (located in Melbourne} and to install Unix boxes and communications links in other ASEAN countries. This would entail:

- the purchase of a new file server to allow external access to the Bureau's database system, which has been planned for the 1994/95 financial year;

* installation of NEONS/Empress software at AODC (mainly Empress licensing costs of about A$ 1 0,000);

* cost of setting up ASEAN countries other than Malaysia, which would involve considerable expenditure of perhaps A$100,000-200,00+.

Possible approaches to obtaining funding would need to be considered. ASEAN could request development assistance from Australia, through the Australian International Development Assistance Bureau (AIDAB). AIDAB has had long standing involvement in development work in ASEAN, including recently a remote sensing infrastructure project in the Philippines in which the Bureau participated. Other avenues, eg. UNDP, could also be tried.

ANNEX VI

SERVICES OFFERED IN THE FRAMEWORK OF OCEAN NETWORK

H. Dooley

ICES maintains an anonymous ftp (*server.ices.inst.dk*) with the following information available :

1. ROSCOP software and database for a PC updated monthly.

2. OceanPC software updated as needed.

3. A map based inventory of ICES ocean profile data holdings updated monthly.

4. IOC country and ship codes in ASCII files and updated as required.

5. An inventory of oceanographic activities in the ICES area in WordPerfect 5.1 and updated annually.

He intends to place documents relating to RNODC Formats activities on the site.

E. Tanner

AODC intends to make available the following information :

1. A document containing an inventory of AODC holdings

2. The planned GETADE software inventory.

3. The Format Guidelines document reviewed at this Session.

4. Some of their ocean data holdings.

D. Hamilton

NODC currently supports both a gopher and Mosaic interface on Internet. Some of the information presently available are the following :

1. Textual descriptions of NODC and WDC-A activities.

2. Exchange file format descriptions.

3. Planned inventories of GTSPP data and station position maps.

J.R. Keeley

MEDS is planning to make available information concerning the GTSPP and data received. The following are expected to be placed in an anonymous ftp.

1. Monitoring information on the real-time data flows of the GTSPP.

2. Monthly maps of data collected in real-time.

3. Monthly or more frequent compilations of real-time data received at MEDS.

4. Description of the exchange format of the GTSPP.

ACTION SHEET ON TADE-VI DECISIONS
(Geneva, 22-29 June 1994)

Item	Subject	Action proposed	Resp.	Target date	Comments
2.1, 2.2 para. 10, 11, 13	Codes	(i) To continue and complete the work on expanding BUFR to include oceanographic data on the basis of GF3 tables;	J. R. Keeley	ASAP	
		(ii) To encode high-resolution temperature profiles in BUFR and investigate the possibilities to receive, decode and manage these reports;	NOS/USA, Australia, Canada	Continuous	
		(iii) To finalize the code CREX for the GTS transmission in character form of new types of meteorological and oceanographic data;	J. R. Keeley together with CBS experts	OTA-IV	
		(iv) To investigate existing requirements for SEALEV	NODC/USA	ASAP	
2.3 para: 15	GTSPP	(i) To increase real-time data flow	OTA	Continuous	
		(ii) To improve timeliness and efficiency of delated-mode data	TADE	Continuous	
		(iii) To study how to acquire thermosalinograph data for archival	TADE	TADE-VII	

Item	Subject	Action proposed	Resp.	Target date	Comments
2.4 para: 17, 18, 22	IGOSS data monitoring	(i) WMO and GTSPP co-operate closely in IGOSS data monitoring;	WMO Secretariat, GTSPP	Continuous	
		(ii) To study the question of the possible end-to-end monitoring of reports from observation to receipt at data centres from the GTS;	IGOSS Op. Co-ordinator with GTSPP, NOS/USA and R. Bailey	IGOSS-VII	
		(iii) To encourage scientists to compile the ROSCOP forms	NODC's IODE Nat. Rep.	Continuous	
		(iv) To study ROSCOP form presentation and how to include SOO's	Chairman TADE, RNODC-Formats, IOC Secretariat	TADE-VII	
		(v) To publicize the Irish software and encourage its usage	Irish NODC, IOC Secretariat	ASAP	
2.5 para: 26, 27	Quality control	(i) To document the software procedures of different agencies to reduce high resolution profiles to inflection points;	TT/QCAS, Australia, Canada, USA	ASAP	
		(ii) To revise Manuals and Guides No.3	Chairman OTA in consult. with Chairmen IGOSS, TT/QCAS, GTSPP	OTA-IV	
3.1 para: 30, 31	Ocean-PC	(i) To take steps to update the Ocean-PC "shoe-box" of software;	Ocean-PC Co-ordinator	IGOSS-VII IODE-XV	
		(ii) To investigate how developments leading to IGOSS increased interest in Ocean-PC could be made	Ocean-PC Co-ordinator	IGOSS-VII	
		(iii) To develop a document on the goals of Ocean-PC;	Chairman TADE, Ocean-PC Co-ord.	IGOSS-VII, IODE-XV	
		(iv) To provide input to above	OTA & TADE memb.	ASAP	

Item	Subject	Action proposed	Resp.	Target date	Comments
3.2 para: 34, 35	Instrumentation	(i) To follow recommendations of SCOR WG 51 for international exchange of data from undulating instruments	NODCs	Continuous	
		(ii) To archive all information about data collection methods, calibration and averaging algorithms	NODCs	Continuous	
		(iii) To encourage centres to use the information doc. on ADCP data (MEDS)	Chairman TADE	IODE-XV	
3.3 para: 37, 40	Remote sensing	(i) To respond to ADS request re. Auxiliary Data Reference Guidelines doc.	Chairman TADE, Chairman OTA	ASAP	
		(ii) To continue to be informed of CEOS activities	IOC Secretariat	Continuous	
3.4 para: 42, 43	Modern formats	(i) To pursue the action items developed at the Copenhagen meeting re. GETADE format	(see mtg. rpt.)	(id.)	
		(ii) To refine the format and document its usages	Chairman TADE, volunt. members	IODE-XV	
		(iii) To address Ocean-PC contributors re. the usage of the format	Ocean-PC co.ord.	ASAP	
3.5 para: 44, 45, 47	General format issues	(i) To informally try the software sharing concept and report to IODE	volunteer TADE members	IODE-XV	
		(ii) To use netCDF with GF3 parameter codes tables and report to TADE	E. Tanner	TADE-VII	
		(iii) To keep TADE informed of ODBMS use in relation to spatial data (QUT)	E. Tanner	as avail.	

Item	Subject	Action proposed	Resp.	Target date	Comments
3.6 para: 48, 49	Metadata management	(i) To prepare paper laying out guidelines	D. Hamilton	early 1995	
		(ii) To inform other TADE members of their related activities	E. Tanner, J. Wallace, J. R. Keeley	ASAP	
		(iii) To comment on draft paper	TADE members	ASAP	
		(iv) To submit final form to IODE	D. Hamilton	IODE-XV	
		(v) To review value of digitizing track charts before data are received	TADE members	TADE-VII	
4.1, 4.2 para:	Ocean data management (GOOS &GCOS)	(i) To develop a coherent DMP to include both IGOSS and IODE data streams:			
		- to provide initial thoughts on the structure and contents of the DMP to Chairman OTA;	OTA & TADE members	July 1994	
		- to prepare first draft plan;	Chairman OTA	Sept. 1994	
		- to review the draft plan;	OTA & TADE members	Nov.1994	
		- to prepare final revised draft plan for I-GOOS-II.	Chairman OTA, Secretariats	mid-1995	
		(ii) To prepare a consolidated report on the South-East Asian project for regional oceanographic data management	Relevant OTA & TADE members	IGOSS-VII IODE-XV	
4.3 para: 55	JGOFS	To offer IODE services to authors of JGOFS papers	Chairman TADE, RNODC-Formats	ASAP	
4.4 para: 56, 57	Workshop	(i) To seek possibility to host workshop on advantages of electronic data and information exchange in Dublin, in connection with a scientific meeting	J. Wallace	ASAP	
		(ii) To prepare draft agenda and timetable	J. Wallace, H. Dooley	ASAP	
		(iii) To investigate facilities for software demonstration & seek potential demonstrators	J. Wallace, H. Dooley	ASAP	

Item	Subject	Action proposed	Resp.	Target date	Comments
5.1, 5.2 para: 59, 60, 61	GF3	(i) To prepare guidelines on use of BUFR for oceanographic data (ii) To revise format guidelines (*ad hoc* mtg on Modern Formats, 1993) (iii) To prepare additional guidelines (iv) To request docs. for other subsets (v) To publish docs. in a format that could be easily updated	Chairman TADE Chairman TADE E. Tanner, D. Hamilton, M. Brown Chairman TADE IOC Secretariat	Sept.1994 ASAP July 1994 as necess. as avail.	
5.3 para: 63, 65	Extensions to code tables	(i) To eliminate inconsistencies between ROSCOP-III and GF3 tables (ii) To inform TADE members if the digital ship information file puchased from Lloyds could be shared among Member States	RNODC-Formats US NODC	as necess. ASAP	
6.1 para: 66, 68, 69	Ocean network	(i) To act as contact point between TADE & the ICES Marine Data Management WG (ii) To set up an electronic conference among NODCs (iii) To develop services available over INTERNET	H. Dooley E. Tanner TADE members	continuous ASAP as possible	
6.2 para: 71	Software inventory	(i) To modify and distribute questionnaire (ii) To digitize returned forms and merge digitized data sets (iii) To post complete inventory on Internet (iv) To update the Ocean PC "shoe-box"	J. Wallace Irish MDC, with AODC & US NODC AODC J. Wallace, Ocean-PC co-ord.	ASAP as avail. as avail. continuous	
7 para: 72	Thermosalinograph data	To get guidance from WOCE Surface Salinity Programme re. calibration problems	Chairman TADE	ASAP	

Item	**Subject**	**Action proposed**	**Resp.**	**Target date**	**Comments**
7 para: 73	CTD data	To make special efforts to acquire delayed mode, fully calibrated CTD data	all NODCs	continuous	

ANNEX VIII

LIST OF PARTICIPANTS

BROWN, Murray	Minerals Management Service (MS5430) 1201 Elmwood Park Blvd. New Orleans, LA 70123 USA tel +1 504 736 2910 fax +1 504 736 2610 Email OMNET: M.BROWN.MMS
DOOLEY, Harry D.	Oceanography Secretary ICES, Palaegade 2 1261 Copenhagen K Denmark tel +45 33 154 225 fax +45 33 934 215 Email Internet: harry@server.ices.inst.dk
HAMILTON, Douglas	Chief, Data Base Management Division National Oceanographic Data Center 1825 Connecticut Avenue N.W. Washington, D.C. 20235 USA tel +1 202 606 4636 fax +1 202 606 4586 Email Internet: d.hamilton@nodc.noaa.gov
KEELEY, J.R. (**Chairman**)	Chief, Ocean Information and Systems Division Marine Environmental Data Service Department of Fisheries and Oceans 1202 - 200 Kent Street Ottawa, Ontario K1A 0E6 CANADA tel +1 613 990 0246 fax +1 613 990 5510 Email OMNET: R.KEELEY internet:keeley@ottmed.meds.dfo.ca
TANNER, Edwina Louise	Data Manager Australian Oceanographic Data Centre Leval 2, MHQ Annexe Wylde Street Potts Point, NSW 2011 Australia tel +61 2 563 4806 fax +61 2 563 4820 Email Internet: edwina@aodc.gov.au
WALLACE, John (also acting as EUMETSAT Observer)	Manager of the Irish Marine Data Centre 80 Harcourt Street Dublin 2 Ireland tel +353 1 475 7100 fax +353 1 475 7104 Email Internet: J.WALLACE@EUROKOM.IE
SECRETARIAT	Yves Tréglos Assistant Secretary IOC IOC, UNESCO, 1 rue Miollis B 5.08 bis 75732 Paris Cédex 15 France tel +33 1 4568 3976 fax +33 1 4056 9316 Email OMNET: IOC.SECRETARIAT

ANNEX IX

LIST OF ACRONYMS

ADCP	Acoustic Doppler Current Profiler
ADS	Auxiliary Data Sub-group (CEOS)
AODC	Australian Oceanographic Data Centre
ASCII	American Standards Committee for Information Interchange
BODC	British Oceanographic Data Centre
BTAB	BUFR TABular Form
BUFR	Binary Universal Form for Representation [of meteorologicl data]
CBS	Commission for Basic Systems
CD-ROM	Compact Disk - Read Only Memory
CEC	Commission of European Communities
CEOS	Committee on Earth Observation Satellites
CPR	Continuous Plankton Recorder
CREX	Characte form for the Representation and Exchange of data
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CSR	Cruise Summary Report
CTD	Conductivity - Temperature - Depth
DAC	(Upper Ocean Thermal) Data Assembly Centre
DDB	Distributed Data Base
DMP	Data Management Plan
DNA	Designated National Agency
FLEX	Flexible Universal Character Code
GCOS	Global Climate Obseving System
GE	Group of Experts
GF3	General Format No.3
GOOS	Global Ocean Observing System
GTS	Global Telecommunication System
GTSPP	Global Temperature and Salinity Pilot Project
HDF	Hierarchical Data Format
I-GOOS	Intergovernmental Committee for GOOS
ICES	International Council for the Exploration of the Sea
IFC	IGOSS Flexible Code
IGOSS	Integrated Global Ocean Services System

IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and information Exchange
IPO	International Planning Office
JGOFS	Joint Global Ocean Flux Study
JODC	Japan Oceanographic Data Centre
MAST	Specific Research and Technological Development Programme in the field of Marine Science and Technology
MD	Master Directory
MEDS	Marine Environmental Data Service (Canada)
NASA	National Aeronautics and Space Administration (USA)
NEONS	Naval Environmental Operational Nowcasting System
netCDF	Network Common Data Format
NODC	National Oceanographic Data Centre
NODDS	Navy Oceanographic Data Distribution System
NOS	National Oceanographic Service (USA)
ODBMS	Object Oriented Data Base Management System
OGIS	Object Oriented Geographic Information System
OTA	Operations and Technical Applications (IGOSS)
QCAS	Quality Control of Automated Systems
QUT	Queensland University of Technology (Australia)
RDBMS	Relational Data Base Management System
RNODC	Responsible National Oceanographic Data Centre
ROSCOP	Report of Scientific Cruises and Oceanographic Programmes
SCOR	Scientific Committee on Oceanic Research
SEALEV	Flexible character code for reporting sea-level data
SEAS	Shipboard Environmental Data Acquisition System
TADE	Technical Aspects of Data exchange (IODE)
TT	Task Team
UNESCO	United Nations Educational, Scientific and Cultural Organization
UOT DAC	Upper Ocean Thermal Data Assembly Centre
WG	Working Group
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment

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