

**IGOSS**  
**(Integrated Global Ocean Station System);**

**General plan and implementation programme**  
**for phase I**

APPROVED BY IOC AT ITS SIXTH SESSION  
UNESCO, PARIS, 2-13 SEPTEMBER 1969

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## PREFACE

By Resolution V-20, the IOC established a permanent Working Committee for an Integrated Global Ocean Station System (IGOSS) and authorized it to plan and coordinate an IOC programme of studies and services in oceanic areas, both within the Commission and jointly with WMO and other organizations. The Working Committee for IGOS, together with the WMO Executive Committee Panel on Meteorological Aspects of Ocean Affairs, responded to this charge by preparing the General Plan and Implementation Programme of IGOS for Phase I, subsequently adopted by the IOC at its Sixth Session (Resolution VI-7) and by the President of WMO on behalf of the WMO Executive Committee.

An intergovernmental oceanographic information and prediction service is, in all respects, a complicated, multidisciplinary undertaking. It is therefore imperative that the progress of such a programme follow well-conceived guidelines while allowing imaginative innovations to influence and alter its development. Publication of the present General Plan has the dual objective of providing IGOS participants with an operational scheme through which specific required elements of the implementation programme can be developed and of stimulating interest in and support for IGOS.

Phase I of IGOS has been implemented in a passive sense: code forms for transmission of ocean parameters have been developed and approved for international use; manuals are being prepared on data acquisition and non-real time exchange; and WMO and the IOC have provided means to carry out other aspects of implementation. At the third joint session of the IOC Working Committee for IGOS and the WMO Executive Committee Panel on Meteorological Aspects of Ocean Affairs, it was decided to implement a pilot project in 1971. This implies that the active, service-oriented part of Phase I of IGOS will be implemented; in accordance with the Phase I plan, data will be collected, exchanged, processed and disseminated in the form of oceanographic products. Phase II - further development and improvement - is a natural extension of the pilot project.

#### IV

IGOSS is at the same time both a service to and a beneficiary from related marine environmental programmes. The mechanisms established by the IOC and WMO for implementing this Plan are being integrated systematically into an operational programme. This and subsequent issues within the IOC Technical Series which deal with aspects of IGOS, along with the IGOS Programme Information Circular, will provide participants and other interested parties with timely information on the status of IGOS and on methods for its implementation.

The IOC Secretariat

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## SECTION I

### INTRODUCTION

#### 1. Purpose and values of IGOSS

1.1 The purpose of an Integrated Global Ocean Station System (IGOSS) is to provide more extensive and timely information on, and prediction of, the state of the ocean and its interaction with the atmosphere, and to support research on the processes of the ocean, so that nations can provide improved oceanographic services to increase the safety and efficiency of their marine activities.

1.2 The need for improved services and scientific advice stems from mankind's continuously growing need for more food and other resources from the ocean, for improved maritime transport, and for better protection against hazards of the ocean and atmosphere.

1.3 While oceanography and meteorology have already progressed a long way towards understanding oceanic and atmospheric processes, a more systematic, multi-disciplinary approach is needed to provide the data necessary for continuous monitoring of oceanic conditions on a global scale and for improving and/or developing reliable methods of forecasting.

1.4 What has been lacking so far is an approach whereby the environmental characteristics of both the ocean and the atmosphere could be observed and measured at a sufficient number of points to permit a coherent analysis of the processes therein and of their interaction, both at any given moment and in their evolution.

1.5 The ocean and the atmosphere should be observed and studied together because they continuously affect each other in a number of important ways. The ocean, as a reservoir of heat and moisture, determines to a large extent our weather and climate; the atmosphere, in turn, is the scene of energy transformations which provide for an important energy feed-back into the ocean, determining in large measure its dynamic and thermodynamic conditions.

1.6 Additional strong impetus for the development of IGOSS comes from the present powerful upsurge of public interest towards the ocean, in particular its mineral resources, and from the recent achievements in ocean technology and engineering.

1.7 In recent years resolutions\* adopted by the United Nations General Assembly have reflected the immense importance of considerations of the environment and the Assembly called upon members and international organizations concerned to join together in taking measures to greatly extend our knowledge of the processes that occur in the atmosphere and the oceans. Considering this group of resolutions together, they can be regarded as forming a comprehensive unity with wide-ranging objectives for increasing the world's knowledge of the atmosphere and the oceans and using this knowledge to the benefit of mankind.

1.8 Meteorological programmes are being expanded by the World Meteorological Organization (WMO) and oceanographic programmes are being expanded by Unesco's Intergovernmental Oceanographic Commission (IOC). As indicated earlier, physical

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\* Resolutions 1720 (XVI), 1802 (XVII), 1963 (XVIII), 2172 (XXI), 2340 (XXII), 2413, 2414 and 2467 (XXIII).

processes within and between the ocean and the atmosphere are closely related and many aspects must be studied in conjunction. Meteorological programmes are by their very nature not directed towards satisfying the full range of requirements for services and information gathering regarding the oceans that are likely to arise as a result of the expanding use of the ocean; IGOSS is directed more specifically toward the oceans, particularly in respect of certain services and data-gathering projects. Common interests, systems and resources will be involved to a fairly considerable extent; hence close collaboration is being maintained between IOC and WMO in the planning of IGOSS and its relation to the World Weather Watch. The two programmes, World Weather Watch (WWW) of the WMO and IGOSS of the IOC, must be looked at in conjunction with a view to the ultimate development of complete data gathering, data processing, and prediction services which avoid duplication of efforts and means.

1.9 Member States have expressed interest in IGOSS as a major contribution to a support service for navigation and maritime commerce, fishing and petroleum industries, coastal warnings, health and recreation activities, and various research projects. Improved oceanographic and meteorological operational data are expected to increase considerably the accuracy of long and short-term weather and oceanographic forecasts; observations from fixed points will serve as reference stations for assembling and interpreting data from meteorological satellites. The data from global observation will provide a rich source for the oceanographic and meteorological sciences, allowing new openings for theoretical and empirical research which might reveal and quantify as yet undiscovered laws in ocean and atmospheric processes.

1.10 Further successful development of automatic observation techniques, unmanned ocean stations, aircraft and satellite observation, telecommunications, and oceanographic and meteorological data-processing will make a global system possible.

## SECTION II

### PRINCIPLES AND SCOPE OF IGOSS

#### 2. General description

2.1 The IGOSS will provide from the oceanographic side oceanographic and some meteorological data for forecast services and research in a manner similar to meteorological programmes, such as WWW, and in a complementary fashion. IGOSS will comprise acquisition of oceanographic data, the rapid collection of such data from all parts of the world oceans by various means available, their rapid transmission or relay to designated centres for data processing and products (e.g. forecasts, charts) and the rapid distribution of products to users according to stated user requirements. Also, all data acquired will be stored at appropriate data centres for archival data processing to satisfy needs of users conducting studies and research.

2.2 IGOSS is to be a dynamic global system, composed largely of national facilities, co-ordinated through Unesco's IOC in collaboration with the WMO, and supported by other appropriate organizations such as ITU, FAO, IMCO, ICAO. Thus it is a new principle, indeed a new dimension of activity for both the international oceanographic and meteorological communities. Participation in IGOSS is voluntary.

2.3 Principles for the development of IGOSS have been established as follows:

- (a) IGOSS should be a global oceanic system and should consist of national facilities and services provided largely by the participating countries themselves with co-ordination and support from IOC and other components of Unesco, from WMO and other international and regional organizations.
- (b) IGOSS, to be effective, should be a co-ordinated system responsive to the operational and research requirements agreed upon among the participating nations and should utilize the most modern observing, communication and processing technology available.
- (c) IGOSS should be a dynamic system, flexible enough to be adapted to scientific and technical advances.
- (d) IGOSS should be planned and operated closely with the WWW, including GARP. Information collected by IGOSS should be available to all countries and be presented in a form convenient for use.
- (e) All types of IGOSS observations, their accuracy, frequency, technical characteristics, means of communication, reporting codes, and methods of data exchange and storage should be fully standardized and uniform.
- (f) IGOSS should be used only for peaceful purposes, due account being taken of the national sovereignty and security of States, in accordance with the provisions of the Charter of the United Nations.

#### 2.4 Elements of IGOSS

The elements of IGOSS comprise global systems for:

- (i) observation
- (ii) telecommunication



- (iii) data processing
- (iv) data storage and retrieval

In addition, IGOSS will need research and training activities so that the maximum benefits may be derived from an efficiently planned system.

#### 2.4.1 Global Observation System

The system will comprise various types of properly instrumented Ocean Data Acquisition Systems (ODAS) sited on specific stations as follows:

- (i) Coastal and island stations;
- (ii) Nearshore manned stations - occupied by light vessels, oil rigs etc.;
- (iii) Offshore manned stations - occupied by ocean weather ships etc.;
- (iv) Unmanned stations - occupied by automatic buoys etc.;
- (v) Stations on shipping routes;
- (vi) Offshore reference stations visited regularly;
- (vii) Cables used for oceanographic observations;
- (viii) Repetitive drifting stations (by areas) - occupied by ice islands, drifting buoys etc.;
- (ix) Satellite orbits;

and observations made en route by ships of opportunity and aircraft. Some oceanographic observations are at present being carried out on board ocean weather ships and specially equipped research vessels. These programmes should, however, be widened to cover the standard oceanographic observations required. Automatic buoys will provide an important basis for IGOSS. They are still being developed and should be capable of measuring standardized oceanographic and meteorological observations. Some are already in operation. Voluntary observing ships which are recruited within the framework of the WWW may provide, in the initial stages of IGOSS, a useful source of some oceanographic data, as a number of such ships may be able to extend their normal meteorological observing programme to include oceanographic observations as well. Finally, observation by specially equipped aircraft and by means of satellites is notably progressing and is expected to furnish important information on sea surface temperature, currents and other phenomena. The global nature of observation by satellites is an asset of particular importance to IGOSS.

#### 2.4.2 Global Telecommunication System

Telecommunication support for IGOSS involves the rapid collection, exchange and dissemination of information from and to an extensive and remote array of observing and user locations. It comprises the following:

use of six HF bands, designated by ITU's World Administrative Radio Conference (WARC) 1967, for the collection of data

use of maritime mobile channels

shared use of the WWW Global Telecommunication System for transmission of data between centres on land and for relay of some products

use of various national circuits, according to agreements which must be established, for collection and relay of certain data and products where it is necessary or expedient to do so

use of facilities and techniques newly developed or as may be developed, such as satellite relay or interrogation links, etc.

IGOSS telecommunications should ensure the regular technical control of automatic observation facilities, and the collection and retransmission of oceanographic and related meteorological data from stations to collection and data-processing centres. Collection and exchange should operate through IGOS and WWW liaison arrangements. Further study is needed to determine the technical parameters which would render data collection under IGOS fully standard and uniform. Also, frequencies reserved for the transmission of ocean data should be distributed in accordance with the structure of the global observation network, the technical facilities employed and the radio-wave paths.

#### 2.4.3 Global Data Processing System

Ocean data are processed for operational and monitoring purposes, such as forecasting oceanic conditions and monitoring marine pollution, at national centres or appropriate international centres. These can be meteorological centres where the oceanographic parameters will generally be processed in conjunction with meteorological parameters or other centres specialized in oceanography. The products may comprise basic processed data, in chart or in digital form, or they may be provided in a form which is adapted to special user requirements. These include forecasts of oceanic conditions and parameters such as upwelling, water temperature at specified depths, salinity variations and currents. The types of products will vary as user requirements change and as user applications are more clearly identified. Obviously, creditable products cannot be generated until the data acquisition and telecommunication support requirements are adequately satisfied. After use for operational purposes, the oceanographic and meteorological data should be forwarded to the appropriate storage centre.

#### 2.4.4 Global data storage and retrieval

Data storage and retrieval, the processing of archived data, may be done at various types of storage centres. These may be national, multinational or world centres. Arrangements should be made for the exchange of files, such exchanges being determined by the requirements of the users. Thus, data files are not all maintained by world data centres but a complete inventory list of all stored data, with types and locations identified, will be kept up-to-date by such centres. Consequently, archiving procedures should be compatible throughout so that stored data is maintained in a form suitable for rapid retrieval. The global organization should form a single co-ordinated system having properly trained staffs and technical facilities. There is an IOC Working Group on International Oceanographic Data Exchange that has been assigned responsibilities within its terms of reference to develop procedures for standardizing the formats for archiving and retrieval of oceanographic data and to recommend on data exchange procedures.

#### 2.5 Research

IGOSS has available a strong input from the research sector, and it is fully recognized that the successful implementation of IGOS requires continuing input from this sector. As IGOS continues to develop, research is needed for the determination of the optimum density of stations and the optimum accuracy and frequency of observation, so as to improve existing and to develop new methods for using the information in oceanographic calculations and forecasts. These needs can only be met through an intensified research effort in areas such as modelling of the general circulation of the ocean, studies of the variability of the oceans, and air/sea interaction.

Developments in electronics should result in new instruments and computers, which participating States should, as soon as is feasible, incorporate in IGOSS. On the other hand, IGOSS should take into account in an appropriate way, the needs of the research community for both standard and special data. Since the data requirements for research and operations are not expected to be identical, the problem of co-ordinating data requirements for IGOSS is of an extreme importance and is being given the most thoughtful attention by the IOC and WMO Secretariats. The Joint WMO/IOC Panel of Experts on Co-ordination of Requirements was established and already has had two meetings. The Panel has identified data requirements and accuracy specifications for both oceanographic and meteorological measurements; it continues to work on other aspects of the assignment given by its terms of reference.

## 2.6 Education and training

Education and training in marine sciences is a subject of active consideration with the IOC. An IOC Working Group is established specifically to review the present state of activities in oceanographic training projects and to propose necessary training programmes directed to needs as recognized. The IOC Bureau and Consultative Council has emphasized the necessity for additional attention to be given to the training of specialists for the diverse aspects of work associated with IGOSS, both on the national and international level. Categories of training and education within the realm of IGOSS include the following:

- (a) training in observation techniques for data acquisition
- (b) training in equipment and instrument installation and maintenance
- (c) training in telecommunication equipment operation and maintenance
- (d) education in data processing methodology and computer programming
- (e) education in analysis and prediction of oceanic processes
- (f) education in analysis of user requirements for determination and application of products and services.

The training of oceanographers is an urgent requirement in participating States and some will need special programmes, possibly with aid from Unesco-IOC or under bilateral or multilateral agreements (courses in secondary and higher colleges, seconding of suitably qualified teachers, fellowships for study in advanced countries and so on). Proposals are expected from Members concerning their national needs for education and training which can be considered by the IOC Working Group on Training and Education in Marine Sciences. In the initial stage of development of IGOSS on a global basis, primary attention should be directed toward the first three training aspects listed above.

## 2.7 A multiphase approach to the development of IGOSS

In view of the magnitude of the ultimate goals of IGOSS and due to the urgency of need for an initial plan, it has been agreed that the implementation of IGOSS should proceed in several consecutive phases, the first two of which can be visualized already now. The first phase of the implementation programme for IGOSS,

using existing technology, should be developed for consideration and approval by the appropriate IOC and WMO bodies in 1969. This Phase I Implementation Programme should be carefully correlated with the WWW implementation programme now under way. The second phase should incorporate new technology, and the Phase II Implementation Programme should be developed for consideration by IOC and WMO in 1971.

## 2.8 General direction of Phase II

All sections of IGOSS will be further developed in its second phase.

Automatic buoy systems which are expected to form the major part of the observation system will be expanded and augmented with aircraft, satellites and other facilities. Such steps are expected to achieve the development and improvement of IGOSS.

Global data collection, processing and storage will have to be adapted for handling the growing amounts of operational oceanographic and related meteorological information derived from the more widespread and intensive use of automatic observation facilities in the second phase. Coastal and ship data collection or relay centres may have to be increased or developed for the interpretation and transmission of data.

A specific programme for the second phase is to be drawn up by IOC and WMO in 1970-1971 to broaden the scope of IGOSS. It should incorporate new techniques and results of experience gained during the first phase. Furthermore, the second phase must recognize the requirements and recommendations set out jointly by the appropriate bodies of IOC and WMO. The plan for Phase II will be submitted for approval by the IOC and WMO in 1971.

## SECTION III

### IMPLEMENTATION

#### PROGRAMME

#### PHASE I

### 3. Implementation Programme for IGOSS - Phase I

#### 3.1 General Scope

In view of the economic and scientific importance of IGOSS for all countries as well as for the development of the WWW, and of the need for speedy, properly coordinated implementation, IOC and WMO, once they have endorsed the programme, will appeal to all interested IOC and WMO Member States, intergovernmental and international non-governmental organizations to participate and to support IGOSS in the following ways:

- (1) States should be encouraged to provide observation, communication and data processing facilities and services to the maximum extent possible from their national resources;
- (11) States should be encouraged, when necessary, to submit requests for assistance from UNDP funds and international organizations concerned should support such requests, subject to due examination;
- (111) States and international organizations should be encouraged to assist developing States in the implementation of IGOSS by financial aid, the provision of equipment or personnel on a bilateral or multilateral basis or as part of international organization aid programmes.

3.1.1 Beginning in 1970, IOC and WMO will prepare and publish for the information of all Members of IOC and WMO and interested international organizations, periodic progress reports on implementation of all aspects of IGOSS on the basis of the declared contributions of States and progress in the implementation.

3.1.2 Initially, upon commencement of IGOSS activities, the programme will function necessarily on a limited scale. Limitations relate to the number of ocean data stations and the character of their observations which are, or can be, readily made, coded, collected, relayed or exchanged, and which can be processed rapidly within the realm of national resources committed to participate in IGOSS. In time and as additional national resources are established and made available for oceanic data acquisition, rapid collection and exchange, and rapid processing, the programme for IGOSS will be extended to augment the existing international and national efforts to produce daily synoptic oceanographic charts, services and studies to satisfy user requirements.

3.1.3 Required observations consist of measurements of the near-surface parameters now operationally obtained for meteorological purposes with the addition of surface salinity and currents, sea water temperature and salinity at various depths, speed

and direction of ocean currents at various depths, and net radiation. Determination of the ultimate disposition pattern of observational data acquisition devices requires further study and will be based on knowledge of the variability and significance of parameter values in space and time. As a rule, the pattern must be denser in those areas where there is greater variability of factors and oceanic processes; observation points will not be evenly distributed over the oceans, nor will the parameters to be observed be identical at all points. The method for establishing the pattern must be kept sufficiently flexible to permit changes in the light changing requirements and technical advances. Several working groups continue their studies directed towards determining feasible and optimum solutions to the various problems remaining to be solved.

3.1.4 During Phase I of IGOSS, observational requirements for data are as follows:

(a) Elements to be observed<sup>(1)(2)</sup>

1. Temperature and salinity at sea surface
2. Temperature and salinity versus depth
3. Wind waves and swell (direction, height and period)
4. Current (speed and direction)
5. Wind speed and direction at standard height
6. Atmospheric pressure
7. Air temperature
8. Dew point
9. Net solar radiation

(b) Accuracy and characteristics for oceanic elements

(See Tables 1 and 2) - items 1-9 in the tables equate to the items listed above.

(c) The ODAS<sup>(3)</sup> to be considered during Phase I are:

- A. Manned and unmanned fixed platforms, weather ships and research ships
- B. Ships of opportunity (merchant ships, fishing vessels, etc.)
- C. Satellites and aircraft
- D. Coastal and island stations
- E. Buoys

(1) A preliminary set of elements developed by the WMO/IOC Panel of Experts on Co-ordination of Requirements, July 1969.

(2) There is no intention of implying priority by the order of listing.

(3) ODAS - Ocean Data Acquisition Systems (see Appendix I)

TABLE 1

## DESIRABLE REQUIREMENTS FOR OCEANOGRAPHIC AND RELATED DATA DURING IGOSS - PHASE I -

(manned and unmanned platforms, research ships and ocean weather ships)

		RANGE	DEPTH	BEST OBTAINABLE ACCURACY	FREQUENCY	AVERAGING TIME	REMARKS
1	Temperature and Salinity at surface	T: $-2^{\circ}$ to $+36^{\circ}\text{C}$ Sal: 20 to 40 ‰	Surface	T: $\pm 0.1^{\circ}\text{C}$ Sal: $\pm 0.03\text{‰}$	4 per day (at synoptic times)	2-3 min.	
2	Temperature and Salinity versus Depth	same	either continuous profile or standard depths to 500 meters (see Remarks)	T: $\pm 0.03^{\circ}\text{C}$ Sal: $\pm 0.03\text{‰}$ Depth: within $1\frac{1}{2}\%$	same		Standard depths are defined as: 0,10,20, 30,50,75,100,150, 200,300,400,500 meters
3	Wind Waves and Swell	$H_c$ : 0.5-20m (see Note 1) $P_b$ : 1-30 sec.	Surface	$H_c$ : $\pm 0.5\text{m}$ or 10% whichever larger $P_b$ : $\pm 0.5$ sec.	same (special obs. required during storms)	10 min.	Accuracies apply to visual observations. Instrumental observations are more accurate.
4	Current	0.05-4.0 mps when possible	10,50,100,300, 500 meters	Spd: $\pm 0.02$ mps or $0.03\text{V}$ whichever larger Dir: $\pm 15^{\circ}$	same	5-10 min. averaging but continuous records	NOTE - requires a moored station at present
5	Wind Speed and Direction	1-50 mps	10-20 meters altitude	Spd: $\pm 0.5^{\circ}$ or $\pm 0.05\text{V}$ whichever larger Dir: $\pm 15^{\circ}$	same	10 min.	special observations when $> 15$ mps
6	Atmospheric Pressure	950-1050 mb	Surface	$\pm 0.1$ mb	same	2-3 min.	
7	Air Temperature	$-25^{\circ}$ to $+40^{\circ}\text{C}$	Surface	$\pm 0.1^{\circ}\text{C}$	same	2-3 min.	
8	Dew Point	$-30^{\circ}$ to $+35^{\circ}\text{C}$	Surface	$\pm 0.1^{\circ}\text{C}$	same	2-3 min.	
9	Net Solar Radiation	Langley's/sec	Surface		same		

NOTES: 1.  $H_c$  = characteristic wave height - for visual observations to represent  $\bar{H}^{1/3}$ ; this provision has been made to differentiate between visual and instrument observational data.

2. Subject to revision by the WMO/IOC Group of Experts on Co-ordination of Requirements

TABLE 2

SHIPS OF OPPORTUNITY (MERCHANT SHIPS, FISHING VESSELS, ETC.)

	Range of parameter value	Depth	Accuracy	Frequency	Averaging Time	Notes
1			SAME AS WEATHER SHIPS			Temperature only - required accuracy not now being obtained
2		Continuous profile to 275 meters	SAME AS WEATHER SHIPS		as in available existing instrumentation	Temperature only - when equipped with mechanical or expendable bathythermographs
3			SAME AS WEATHER SHIPS			Visual observations only
4			NOT AVAILABLE			
5			SAME AS WEATHER SHIPS			
6			SAME AS WEATHER SHIPS			
7			SAME AS WEATHER SHIPS			
8			SAME AS WEATHER SHIPS			
9			NOT AVAILABLE			



3.1.5 The development of IGOSS has been enhanced by the recent designation by ITU of radio frequency bands intended for use in the collection of data relating to oceanography in a worldwide system. It is certainly recognized that there are existing radio communication links such as those used by fixed ocean stations (e.g. weather ships), some research and fishing vessels, and some ships of opportunity. In addition, nascent facilities, such as buoys, will use the designated frequency bands, and others such as satellites which will use yet a different set of frequency bands.

3.1.6 In order to help countries create or extend national systems which can eventually be integrated into IGOSS and in order to attract scientists and engineers to solve problems related to IGOSS, considerations are being given to promote by all available means a regular exchange of information on technical aspects of IGOSS and related activities. In this connexion, international symposia or conferences on technical aspects of IGOSS may be arranged. Moreover, Members are urged to exchange between Members, through the Secretariat, results of studies conducted and reports of national projects or programme expansion as they relate to IGOSS.

### 3.2 Observing System

The observing system for the first phase of IGOSS will begin basically with the existing oceanic observing system, comprising ocean weather ships, ships of opportunity, research ships, satellites, and other miscellaneous devices. This existing system will be gradually expanded through the addition of new or augmented observing capabilities on ocean weather ships, on roughly 100 merchant vessels equipped to make upper air observations under the WWW programme, and on additional ships of opportunity. The system will also be expanded through the addition of new observing devices planned by Members. The growth of the observing system will receive considerable impetus from the various national programmes being established and expanded in the framework of IGOSS and WWW and in response to the United Nations General Assembly resolutions concerning the development of a long-term co-ordinated programme.

3.2.1 The rôle of the ocean weather ships (OWS including NAOS) should be gradually expanded by the addition of time-series observations of temperature and salinity to varying depths on a regular basis in a manner similar to their meteorological observational programme. The collection of current data and certain chemical and biological data might be envisaged during Phase I but should be added during Phase II of IGOSS. OWS's offer a unique opportunity to collect both operational and research data on a routine basis. As quasi-fixed ODAS, they can support time variability ocean studies ranging from seasonal to diurnal, and by continued coupling of ocean-atmosphere data they can support studies of air-sea interaction.

3.2.2 The rôle of the 100 elected merchant vessels and some ships of opportunity should be expanded to include bathythermograph observations, preferably to depths of 400 to 500 meters, made on a regular basis according to national and multilateral programmes. Equipment for measuring salinity should also be added to these ships. If the 100 selected ships now planned to be especially equipped for atmospheric observations under the expanding WWW are also equipped with devices for acquiring oceanographic data, manpower and radio transmission facilities already available for WWW participation may be used to handle the additional oceanic data in a similar manner.

3.2.3 Technical developments have advanced to the state where the employment of unmanned ocean data buoys has been confirmed as an effective means for acquiring

a substantial segment of marine data. Several countries are developing and testing buoy sub-systems. A limited amount of data, acceptable for operational use, is already being collected. With further buoy development and their production and deployment, IGOSS will be enhanced considerably. Planned instrumentation includes elements for sensing physical, chemical, biological, and radiological variables. Buoys are being designed for emplacement in the deep ocean areas, in waters over the continental shelves, and in major gulfs, bays, and estuarial areas.

3.2.4 All Member countries, and others interested in services for marine activities, are encouraged to arrange for expanding the oceanic data acquisition programme by:

installing instruments appropriately for the measurement of temperatures, salinity, wave motion, currents, thermal radiation, and chemical and biological parameters as are feasible;

establishing programmes directed towards objectives as are stated above;

conducting training programmes designed to instruct personnel in the use and maintenance of observational equipment.

3.2.5 All Member countries are requested to keep the Secretariat regularly advised regarding their projects to expand or enhance the existing data acquisition or observing systems in order that all Members can be kept informed by the Secretariat concerning the changes being made in the programme for IGOSS.

### 3.3 Data Reporting Codes

There are several national codes in existence for reporting oceanographic data via rapid telecommunication methods; others are being developed. The IOC is collaborating closely with the WMO which has offered the expertise of the Working Group on Data Needs and Codes (of its Commission for Synoptic Meteorology) to assist in further development of data reporting codes. Most of the participants in Phase I of IGOSS have indicated a favourable disposition towards acceptance of standardized coding methods. The exclusive use of metric units and degrees Celsius has been advocated. Participants in IGOSS are requested to experiment in the employment of data codes as are provided by the Secretariat and comment upon their utility; as other data reporting formats are developed, they will be circulated for use and comment also.

### 3.4 Telecommunication System

It has been agreed that the telecommunication system to support IGOSS should ensure timely collection, exchange and distribution of data and products amongst user nations. As a basic principle for organizing the collection and distribution of data, all nations should have access to all data relevant to their stated requirements. For the sake of economy and efficiency it will be necessary to use the existing and planned WWW Global Telecommunication System (GTS) to the maximum extent possible. The overall telecommunication plan to support IGOSS may conveniently be divided into three sub-systems for collection, exchange and distribution of data and products. Each of these sub-systems are dealt with briefly below.

#### 3.4.1 Collection

The collection sub-system which encompasses the various radio installations of ocean data stations, shore-based receiving stations and collection stations may

use two methods, automatic and interrogation types. However, the existing arrangements using other frequency bands for the transmission of ocean data from fixed and mobile ships and other ocean data stations should be maintained until such time as they are properly equipped to use the bands allocated by WARC, 1967.

During Phase I the radio frequency bands designated for the collection of data relating to oceanography in a worldwide system will only be used by those ocean data stations, shore-based receiving stations and collection stations which are equipped in accordance with the specifications given in Appendix 2, para. 2.

The use of space techniques for collection should be introduced, after appropriate tests and trials have been successfully completed. The allocated frequency bands, if utilized knowledgeably, will provide for automatic radio transmission from most existing and proposed oceanographic sensor systems to shore-based receiving stations. In the interest of economy, the oceanographic data traffic should be added to the meteorological data traffic wherever possible and vice versa, rather than attempting to develop separate and generally parallel facilities.

#### 3.4.2 Exchange

For the exchange and dissemination sub-system the WWW Global Telecommunication System (GTS) should be used as much as possible. A brief description of the GTS is given in Appendix 3. Attention must also be drawn to the need for strict compliance with the GTS procedures as regards message formats and alphabets.

In order to ensure complete dissemination, the data received at designated collection stations should be disseminated to all countries in need of these data. These stations should, therefore, have adequate telecommunication facilities for connexion to the GTS. In some cases, shore-based receiving stations and collection stations may be planned in such a way that they are co-located with telecommunication centres of the GTS. Meanwhile, stations used for the collection of ocean data should be connected wherever possible to the GTS in the same manner as land-based synoptic observation stations.

#### 3.4.3 Distribution

The distribution of both observational and processed data will be made through the Global Telecommunication System to the maximum extent possible and may be in either digital or pictorial form. The procedures being developed will also ensure that the stated requirements of all users, whether on land or at sea, are met.

#### 3.5 Data Processing and Product Generation Services

It is premature to set forth specific details of an international scheme for processing data from the entire world ocean. Data processing is used here in the context of rapid or real-time processing rather than the type of processing of stored or archived data as has been common in oceanography.

3.5.1 Several Members have already established centres which are designed and equipped for rapid data processing operations. Collections of data from an ocean basin, for example, are edited and analysed in order to develop forecasts of specified ocean conditions. Such analyses and forecasts, generally called

products, are made available rapidly in various forms; the most common form is a graphic illustration of the distribution of specific parameter values over a given area for a specific time or time period. Products may also take the form of literal descriptions or tabular presentations of parameters of interest according to the needs of the user concerned. The compendium of products thus generated are referred to as product generation services.

3.5.2 Member States participating in or intending to participate in IGOSS are encouraged to undertake pilot projects (i.e. data processing ventures) either bilaterally or multilaterally, aimed at the development of services as will be necessary to satisfy user support requirements. As indicated earlier, reports of such projects or programme expansion should be exchanged with other Members through the Secretariat. Since it is a principle of IGOSS to become a global oceanic system developed in close collaboration with the WWW, an international approach is being designed to achieve this objective. The main thrust of effort during Phase I of IGOSS is to be directed toward designing the international scheme for developing product generation services. Albeit, while pursuing that objective, effort and emphasis must continue to be directed toward expanding the data acquisition and data collection systems to facilitate the implementation of data processing and product generation services on a global scale during Phase II of IGOSS.

3.5.3 Processing of archived data, as stated in Section II, will continue as a rôle of the World Data Centres and other data storage centres according to procedures as developed by the IOC Working Group on International Oceanographic Data Exchange.

## APPENDIX 1

### LIST OF ABBREVIATIONS AND DEFINITIONS

ACMRR (of FAO)	Advisory Committee on Marine Resources Research
CMM (of WMO)	Commission for Maritime Meteorology
CSM (of WMO)	Commission for Synoptic Meteorology
FAO	Food and Agriculture Organization of the United Nations
GARP	Global Atmospheric Research Programme (WMO/ICSU)
GOS (of WWW)	Global Observation Station
GTS (of WWW)	Global Telecommunication System
IABO	International Association of Biological Oceanography
IAPSO	International Association for the Physical Sciences of the Ocean
ICAO	International Civil Aviation Organization
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IFRB	International Frequency Registration Board
IGOSS	Integrated Global Ocean Station System
IMCO	Intergovernmental Maritime Consultative Organization
IOC	Intergovernmental Oceanographic Commission
ITU	International Telecommunication Union
ODAS	Ocean Data Acquisition Systems (see note 2)
ODS	Ocean Data Station
OSV	Ocean Station Vessel
OWS	Ocean Weather Ship
SCOR (of ICSU)	Scientific Committee on Oceanic Research
UNESCO	United Nations Educational, Scientific and Cultural Organization

WARC (of ITU)	World Administrative Radio Conference
WMO	World Meteorological Organization
WWW (of WMO)	World Weather Watch

Station describes a geographic location where data are observed by appropriate sensing devices.

Ocean Data Acquisition System (ODAS) describes the vehicle, device or platform on which or in which the station is taken ("occupied"). ODAS may be fixed (towers, lightships, weather ships, buoys) or mobile (aircraft, ships, satellites, drifting buoys, etc.).

## APPENDIX 2

### INTERIM PROCEDURES FOR CO-ORDINATION OF THE USE OF FREQUENCIES ALLOCATED BY WARC, 1967, FOR OCEAN DATA TRANSMISSIONS\*

#### 1. Introduction

1.1 The need for the allocation of radio frequencies for meteorological and oceanographic stations collecting ocean data has long been realized. This requirement was given close attention by the Intergovernmental Oceanographic Commission from its first session in 1961 as well as by its Working Group on Communications established at that time. Both WMO and IOC have been active in efforts to secure frequency allocations for this purpose over the years between.

1.2 However, as explained below, it is only recently that frequency bands for this purpose have been allocated. At this time when they are about to come into use, it was thought that it would be useful to explain briefly and simply to the future user how he should set about obtaining an assignment within these bands.

1.3 The World Administrative Radio Conference (WARC, 1967) to deal with matters relating to the Maritime Mobile Service was held in Geneva in 1967. It decided to allocate six HF frequency bands each 3.5 kHz wide for the transmission of ocean data. They are:

4162.5 - 4166.0 kHz  
6244.5 - 6248.0 kHz  
8328.0 - 8331.5 kHz  
12479.5 - 12483.0 kHz  
16636.5 - 16640.0 kHz  
22160.5 - 22164.0 kHz

1.4 These frequency bands will be available from July 1969 for the transmission of ocean data.

1.5 The increased interest of both the meteorologist and the oceanographer in the collection of data from the oceans may be expected to result in early use of the frequency bands allocated by WARC (1967). Expanded efforts are now being made to obtain data from the oceans under both the World Weather Watch (WWW) and the Integrated Global Ocean Station System (IGOSS). A number of countries already have well-developed plans for the deployment of stations or platforms over the oceans for the measurement of meteorological and oceanographic parameters.

1.6 For this reason resolution No. MAR 20 WARC invited IOC and WMO "to develop jointly in consultation with the IFRB and in consultation with administrations of the Members and Associate Members of the Union, as appropriate, a co-ordinated plan designed to meet existing and future requirements of all interested Members and Associate Members, for use by stations in the collection of data relating to

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\* In this context "ocean data transmissions" means transmission of environmental data (e.g. oceanographic, meteorological, etc.) from ocean areas.

oceanography in a world-wide system, within the framework of provisions made by the present Conference for such a system; this plan to include the geographical distribution of oceanographic stations, their system of operation, the deployment of frequencies in the system and the manner in which the oceanographic information is to be transmitted".

1.7 The IOC Working Committee on IGOSS (Paris, April 1968) and the WMO Executive Committee (Geneva, June 1968) agreed that the task of preparing the draft co-ordinated plan by 1 April 1969 should be given to the Joint WMO/IOC Group of Experts on Telecommunication.

1.8 The Joint Group took up this task during its first session in September 1968, but considered that it could not complete a co-ordinated plan as called for by resolution No. MAR 20 because such a plan must be based on requirements which are not yet fully known and that the development of detailed technical characteristics must also be awaited. It therefore decided to set forth a broad outline which would serve for the establishment of the co-ordinated plan.

1.9 The broad outline gives the primary objectives of the plan and basic planning principles, which need not be restated here in detail.

1.10 However, the Joint Group felt that the difficulties which prevented the establishment of the final plan in no way precluded the interim use of the frequencies allocated for ocean data transmissions. Indeed it felt that the creation of an interim arrangement was urgent since co-ordination of the use of the frequencies in the allocated bands is essential.

The Joint Group considered that the maintenance of records of frequencies requested by users and the operational characteristics of their use for ocean data transmissions was a task which should be carried out centrally. In view of the urgency that requests from countries be co-ordinated, the Secretary-General of WMO was requested, in collaboration with the IOC Secretariat, to assume this work until such time as a formal arrangement has been approved. The co-ordination of requests should be made on the basis of the agreed interim frequency utilization plan. Requests for the co-ordination of the use of radio frequencies for ocean data transmissions may also be routed through the IOC Secretariat for onward transmission to the WMO Secretariat.

1.11 In taking this action, the Joint Group recorded its view that this interim arrangement should be replaced as soon as practicable by a formally established co-ordination body under the aegis of WMO and IOC.

1.12 In setting up this interim procedure, it is recommended that all countries use frequencies in the allocated bands only after co-ordination as proposed above has been effected. The need for adherence to the above principle is very important in order to ensure orderly use of the frequency bands and to avoid interference. In principle, prior to the use of frequencies, the co-ordination must be ensured. It was also recommended that administrations should indicate, in their notices to the IFRB of frequency assignments concerning these bands, that the use of the frequency object of the notification has been co-ordinated in accordance with interim procedures and the agreed interim frequency utilization plan set up jointly by IOC and WMO.



## 2. Interim procedures

2.1 Countries wishing to use frequencies within the bands allocated for ocean data transmissions should follow the simple procedure set forth below:

### (a) Co-ordination with WMO and IOC

A country desiring to use a frequency in the bands allocated by WARC 1967, should first determine the frequency or frequencies necessary, the time period for which they would be required, as well as other technical and operational characteristics of the emission. This information should then be communicated by the notification form - attached to this Appendix - to the WMO Secretariat, with a copy to the IOC Secretariat. The Secretariats will maintain records of the status of the frequencies in use or planned to be used, and will examine each new request received in the light of these records. If the request is in conformity with the relevant IOC/WMO recommendations and with the agreed interim frequency utilization plan the country will be informed by the WMO Secretariat that its request has been co-ordinated as specified by resolution No. MAR 20.

If, on the other hand, a request is found to conflict with the agreed interim frequency utilization plan or other requests which have already been co-ordinated, the country will be informed accordingly and suggestions will be made for the use of alternative frequencies and/or time periods. In this instance, the country should notify the WMO Secretariat of its choice as soon as possible.

As mentioned above in paragraph 1.10, request for co-ordination may also be routed through the IOC Secretariat for onward transmission to the WMO Secretariat if so desired.

### (b) Assignment of frequencies

Once a country has co-ordinated a request with the WMO Secretariat (through the IOC Secretariat if desired) and has been informed that the request is not in conflict, then action may be initiated by the country to make the assignment according to national and international procedures. When a frequency assignment is notified to the IFRB, an indication must be made that the use of the frequency object of the notification has been co-ordinated in accordance with the interim procedures and the agreed interim frequency utilization plan set up jointly by IOC and WMO.

### (c) Publication of schedules and other information

In order to keep countries informed on ocean data transmissions and the use of radio frequency bands, the Secretary-General of WMO, in collaboration with IOC, is requested to publish and update in an appropriate form the agreed interim frequency utilization plan as well as information on the status of the actual use of the frequency bands, including frequencies used, transmission schedules, content of transmissions, codes used, and other technical and operational characteristics of ocean data transmissions.

### (d) Use of frequencies

Countries should use frequencies only after co-ordination has been completed. In order to avoid mutual interference with other ocean data transmissions, all

emissions in these frequency bands - under the interim procedures - shall conform with the following conditions:

- (i) channelling arrangements as decided by WARC, 1967 <sup>(1)</sup>  
(see Table 1)
- (ii) occupied band widths should be kept as small as possible, but should in no case exceed 300 Hz;

frequency stability should be maintained

initially at 1 part of  $10^6$

ultimately at 1 part of  $10^7$

(which means)

it should not exceed  $\pm 2.2$  Hz at the highest frequency assigned;

the effected radiated power (ERP) of stations working in these bands should be kept as low as possible and yet ensure reliable communication;

both interrogated type and clock-controlled stations are permitted to work on these frequencies;

provisions must be made to ensure that clock-controlled transmissions will remain totally within the allotted time blocks. The time blocks will be indicated in full minutes with reference to GMT;

particular attention should be given to the co-ordination of the use of frequencies for interrogation signals. These signals shall in no case interfere with data transmissions;

the modulation rate of the digital data transmitted should be 100 baud;

frequency modulation will be the preferred method of transmission;

WMO/IOC will assign to each data station a 5-digit identifier in addition to any call sign which may be assigned by the administration in conformity with radio regulations. The 5-digit identifier should be transmitted at the beginning and end of the message or transmission.

### 3. Cancellation procedures

3.1 In the event a frequency or time period is no longer needed, the country shall inform the WMO/IOC Secretariats accordingly.

### 4. Further information

Any further information required in connexion with the use of the frequency bands allocated by WARC, 1967, for ocean data transmission, or the procedures for their use by countries, may be obtained from the Secretariats of WMO or IOC.

- (1) The Joint WMO/IOC Group of Experts recommends that the channel spacing decided by WARC, 1967, should be reviewed at the next appropriate administrative radio conference of ITU.

CHANNEL ARRANGEMENTS FOR HF RADIO FREQUENCY BANDS  
ALLOCATED BY WARC, 1967, FOR OCEAN DATA TRANSMISSIONS

Channel	Frequencies (kHz)					
Guard	4162.50 -	4162.75	6244.50 -	6244.75	8328.00	- 8328.25
1	" 2.75 -	" 3.05	" 4.75 -	" 5.05	" 8.25	- " 8.55
2	" 3.05 -	" 3.35	" 5.05 -	" 5.35	" 8.55	- " 8.85
3	" 3.35 -	" 3.65	" 5.35 -	" 5.65	" 8.85	- " 9.15
4	" 3.65 -	" 3.95	" 5.65 -	" 5.95	" 9.15	- " 9.45
5	" 3.95 -	" 4.25	" 5.95 -	" 6.25	" 9.45	- " 9.75
6	" 4.25 -	" 4.55	" 6.25 -	" 6.55	" 9.75	- 8330.05
7	" 4.55 -	" 4.85	" 6.55 -	" 6.85	8330.05	- " 0.35
8	" 4.85 -	" 5.15	" 6.85 -	" 7.15	" 0.35	- " 0.65
9	" 5.15 -	" 5.45	" 7.15 -	" 7.45	" 0.65	- " 0.95
10	" 5.45 -	" 5.75	" 7.45 -	" 7.75	" 0.95	- " 1.25
Guard	4165.75 -	4166.00	6247.75 -	6248.00	8331.25	- 8331.50
Guard	12479.50 -	12479.75	16636.50	16636.75	22160.50	- 22160.75
1	" 9.75 -	12480.05	" 6.75	" 7.05	" 0.75	- " 1.05
2	12480.05 -	" 0.35	" 7.05	" 7.35	" 1.05	- " 1.35
3	" 0.35 -	" 0.65	" 7.35	" 7.65	" 1.35	- " 1.65
4	" 0.65 -	" 0.95	" 7.65	" 7.95	" 1.65	- " 1.95
5	" 0.95 -	" 1.25	" 7.95	" 8.25	" 1.95	- " 2.25
6	" 1.25 -	" 1.55	" 8.25	" 8.55	" 2.25	- " 2.55
7	" 1.55 -	" 1.85	" 8.55	" 8.85	" 2.55	- " 2.85
8	" 1.85 -	" 2.15	" 8.85	9.15	" 2.85	- " 3.15
9	" 2.15 -	" 2.45	" 9.15	9.45	" 3.15	- " 3.45
10	" 2.45 -	" 2.75	" 9.45	9.75	" 3.45	- " 3.75
Guard	12482.75 -	12483.00	16639.75	16640.00	22163.75	- 22164.00

# NOTIFICATION

For use when forwarding to the WHO Secretariat a request for a frequency in the bands allocated by WARC(1967) for transmission of ocean data.

(a) \_\_\_\_\_  
Notifying Member

\_\_\_\_\_ MHz

1(a) Frequency request

(b) New request

(c) Change of characteristics or time

(d) Deletion of an assignment

2 \_\_\_\_\_  
Date of putting into use

3 \_\_\_\_\_  
Call sign / identifier

4(a) \_\_\_\_\_  
Establishing Member(s)  
(Jurisdiction)

(b) \_\_\_\_\_  
Longitude and latitude of the transmitter site

Locality(ies) or area(s) with which communication is established or geographical location of collecting station	Length of circuit (km)	Class of station	Class of emission, necessary band- width and descrip- tion of transmission	Power ( in kW ) Pc Pm Pp e	Transmitting antenna characteristics			Effective radiated power	Time period	Proposed frequency channel and assigned frequency	Transmission code	Content of trans- mission	Ocean/Met. Code	Supplementary information
					Azimuth of maximum radia- tion	Angu- lar width of radia- tion main lobe	Antenna gain (db)							
5(a)	5(b)	6	7	8	9(a)	9(b)	9(c)	10	11	12	13	14	15	16

17 (a) \_\_\_\_\_  
operating service

(b) \_\_\_\_\_  
Name and postal address

(c) \_\_\_\_\_  
Telegraphic address

**NOTE :** Detailed instructions for completion of the form, based on the Radio Regulation, will be given later.

### APPENDIX 3

#### TELECOMMUNICATION PLAN FOR INTERNATIONAL EXCHANGE OF DATA AND PRODUCTS TO SUPPORT IGOSS

##### Introduction

1. At its first meeting, the Joint WMO/IOC Group of Experts on Telecommunication expressed the opinion that the WWW Global Telecommunication System (GTS) should be used to the maximum extent possible in the exchange and dissemination of ocean data and products to Members. It recognized that detailed arrangements could not be worked out because the requirements of Members for receipt of ocean data for oceanographic purposes were not adequately known. Noting the inquiry being carried out by IOC, the Group requested the Secretary-General of WMO to prepare a proposed scheme for the exchange of these data on the GTS or other circuits during Phase I of IGOSS based on an analysis of the results of the inquiry. This document presents the proposed scheme of the Secretary-General of WMO for use of the GTS.

##### Global Telecommunication System (GTS)

2. The Global Telecommunication System (GTS) is organized on a three-level basis, namely:

(a) The main trunk circuit to interconnect the WMCs and appropriate RTHs, RMCs and NMCs. All the RTHs and RMCs should have equal access to the main trunk circuit;

(b) The regional telecommunication networks;

and

(c) The national telecommunication networks.

3. The system also requires that all NMCs, RMCs and RTHs shall be connected with the main trunk circuit either directly or through corresponding NMCs, RMCs and RTHs. The successful functioning of the GTS depends mainly on the reliable and timely reception of reports from observing stations by NMCs. Members should accordingly ensure that their national arrangements for collecting observations are adequate to meet the international as well as the national needs.

##### Exchange of ocean data on the GTS

4. The results of the IOC inquiry show that there is unlikely to be any great volume of data for exchange during the IGOSS Phase I period. It is suggested that the material available could most easily be fed into the GTS through the appropriate NMCs/RTHs of the countries providing data on a synoptic basis.

5. At present it is not clear in most cases at what points the shore reception of data of purely oceanographic interest will take place in these countries. It may, however, reasonably be assumed that use will be made of existing facilities for meteorological data or that collection stations will be set up in conjunction with the operation of buoys and other ocean data stations.

6. The information provided in response to the IOC inquiry also shows that ocean data may be expected from mobile ships, from ocean weather stations, as well as from buoys. The reception of data from each of these sources is considered briefly below:

(a) Mobile ships

Procedures for the transmission of weather reports from mobile ship stations to designated coastal radio stations are laid down in WMO Publication No. 9, Volume D, Part B. If the reports from a mobile ship station were to contain both meteorological and oceanographic data, there would appear to be no difficulty in handling them in the same way in which weather reports are handled at present. If a separate message is to be made for ocean data, it would seem necessary for the same procedures to be applied if use is to be made of the existing system.

It is a national obligation to provide adequate facilities for the prompt collection at the appropriate NMC of all ships' weather reports received at coastal radio stations (Resolution 21 (CMM-V)).

(b) Ocean weather stations

Weather information from ocean weather stations is transmitted both by broadcast and point-to-point procedures in accordance with schedules given in WMO Publication No. 9, Volume C. The addition of oceanographic data to these messages is not expected to call for any change in the present procedures.

(c) Buoys

Arrangements for the interrogation of, reception of, or reports from buoys will need to be made as part of the operation of the buoy system. Sometimes use will be made of existing collecting stations whilst in others new stations will be set up. In either case the arrangements will need to cater for the reception of both meteorological and oceanographic data, and for its onward transmission to the NMC when necessary. It will thus again be a national responsibility for the country receiving the report to ensure that it is conveyed to the NMC at which it enters the GTS.

7. From the above, it may be seen that the arrangements for the exchange of ocean data on the GTS during Phase I of IGOSS are not expected to give rise to any very great problems. Decisions will be required on the way in which each type of data will be handled and on the most expeditious method of entering it into the GTS at the NMC level.

The preparation of a scheme to handle a large amount of data is not required at this stage and must in any case await fuller information on the type and quantity of material to be exchanged.

8. In the later detailed design of the telecommunication system to support IGOSS it will be necessary to make decisions on many aspects of the system. Amongst these, the following may be mentioned:

(a) Standardization of data formats;

(b) The volume of traffic to be exchanged between defined centres;

(c) Data collection arrangements from ocean platforms to shore stations.

9. There are other aspects of IGOSS, such as the data requirements or the processing arrangements, which will need to be worked out in greater detail. This is not, however, the task of the Joint WMO/IOC Group of Experts on Telecommunication.