WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

JOINT WMO / IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY (JCOMM)

SHIP OBSERVATIONS TEAM

FIFTH SESSION

GENEVA, SWITZERLAND, 18-22 MAY 2009

SOT-V/Doc. III-4.5
08.04.2009)

ITEM III-4.5

Original: ENGLISH

REVIEW OF VOS CLASSES

(Submitted by Julie Fletcher, VOSP Chairperson)

Summary and purpose of the document

This document provides information on existing VOS Classifications, and seeks to get each VOS ship assigned with the correct classification. It also introduces a new Classification for VOSClim ships and ships with AWS.

ACTION PROPOSED

The Team will review the information contained in this report, and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

Appendices: A. The Guide to Marine Meteorological Services, WMO-No.471 Chapter 6

References: A. Voluntary Observing Ships' Scheme web site: http://www.bom.gov.au/jcomm/vos/index.html

- A - DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

III.4.5.1 Julie Fletcher, Chair of the VOS Panel, presented the report on existing VOS Classifications and discussed the introduction of a new Classification for VOSClim ships and new sub-classes for ships equipped with AWS.

III.4.5.2 The existing VOS classifications of Selected, Supplementary and Auxiliary, are described in The Guide to Marine Meteorological Services, WMO-No.471 Chapter 6.

III.4.5.3 Essentially, the classifications denote the quality of the meteorological instrumentation on-board and the regularity or otherwise of the observation programme. The description 'certified meteorological instruments' refer to instruments belonging to an NMS. These NMS supplied instruments have been certified for use by an NMS laboratory, prior to installation, as meeting WMO specifications and are regularly inspected/re-calibrated. Non-NMS instruments, such as those belonging to a ship, are considered to be not certified, as they have not been subject to NMS laboratory calibration, and therefore are not traceable to international meteorological instrument standards.

III.4.5.4 Certain assumptions can be made about observations based on their VOS classification, so it is important that ships be assigned the correct classification. For example, if a ship is listed as 'Selected' but is in fact, using non-certified ship's instruments, the quality of the data will be uncertain. To give data users' confidence in the data, ships classified, as 'Selected' must be carrying certified NMS meteorological instruments.

III.4.5.5 The NMSs were urged to assign the correct VOS Classification (Selected, Supplementary or Auxiliary) to each VOS ship. The classification must match the classification code listed in the WMO Pub 47 metadata.

III.4.5.6 **VOSClim class:** The Panel recalled that it had already considered [*and agreed*], a recommendation from the Task Team on VOSClim, to establish a new class of meteorological reporting ship called VOSClim (VOS Climate Reference Ship). The criteria for declaring a ship as VOSClim was discussed under agenda item III-4.1.

III.4.5.7 **New Classifications to cover AWS**: The Panel agreed that the existing VOS classifications did not adequately cover the case of AWS on ships. In addition, with the increasing number of AWS shipboard installations, the Panel considered the introduction of VOS sub-classifications for AWS. New AWS sub-classifications were considered necessary to (1) be able to differentiate between the level of sophistication of different AWS, and (2) differentiate between AWS owned, installed and maintained by an NMS as opposed to an AWS owned by a ship with a less rigorous maintenance schedule and no instrument traceability. New AWS sub-classifications will make it easier to count and report on the growing numbers of AWS systems globally.

The Panel agreed on the following:

III.4.5.8 The Panel accepted the proposal to add an AWS sub-class to each of the existing VOS classes, including the new VOSClim class. The number indicated is the 'new' Pub47 Table 2202 entry.

- 15 – Selected (AWS)
- 35 – VOSClim (AWS)
- 45 – Supplementary (AWS)
- 75 – Auxiliary (AWS)

III.4.5.9 The Panel established and agreed on criteria for the new AWS sub classes. The Panel noted that several WMO publications would have to be updated because of the new VOSClim Class

and the AWS Sub-Classes. It requested the Task Team on VOSClim and the Task Team on Instrument Standards to liaise with appropriate JCOMM and CBS Expert Teams in view to realize the VOSClim and AWS integration in the VOS fleet and implement the resulting required changes to the following **publications** (***action; TT VOSClim & TT IS; asap***):

- WMO No 471, WMO Guide on Marine Meteorological Services (Chapter 6 - The WMO Voluntary Observing Ships' Scheme)
- WMO No. 544, WMO Manual on the Global Observing System (GOS) (section 2.3.3 Sea Stations which makes references to selected, supplementary, and auxiliary)
- WMO No. 488, WMO Guide to the Global Observing System (GOS) (section 3.2.1.3.3 Mobile sea stations which defines selected, supplementary, and auxiliary, and criteria for recruiting VOS; there is also section 3.7 dealing with climatological stations although these are basically land stations but a note could be added, to refer to VOSClim)
- JCOMM TD No.4, The Voluntary Observing Ships Scheme – A Framework Document

- B - BACKGROUND INFORMATION

1. VOS Classes

1.1 Background

1.1.1 The Guide to Marine Meteorological Services, WMO-No.471 Chapter 6 (**Appendix A**) describes The WMO Voluntary Observing Ship (VOS) Scheme, and defines the three classifications of mobile stations engaged in the observing programme; namely:

(i.) **Selected**: A mobile ship station equipped with sufficient certified meteorological instruments for making observations, transmits regular weather reports and enters the observations in a meteorological logbook. A Selected ship should have at least a barometer, a thermometer to measure SST, a psychrometer (for AT and humidity), a barograph and possibly an anemometer.

(ii.) **Supplementary**: A mobile ship station equipped with a limited number of certified meteorological instruments for making observations. It transmits regular weather reports and enters the observations in a meteorological logbook.

(iii.) **Auxiliary**: A mobile ship station, normally without certified meteorological instruments, which transmits in a reduced code form or in plain language, either on a routine basis or on request, and in certain areas, and under certain conditions.

1.1.2 Essentially the classifications denote the quality of the meteorological instrumentation on-board and the regularity or otherwise, of the observation programme. The description, 'certified meteorological instruments', refers to instruments belonging to a NMS. These NMS instruments have been certified for use by an NMS laboratory, prior to installation, as meeting WMO specifications and are regularly inspected/re-calibrated. Non-NMS instruments, such as those belonging to a ship, are considered to be not certified, as they have not been subject to NMS laboratory calibration, and therefore are not traceable to international meteorological instrument standards.

1.2 Implications

1.2.1 Certain assumptions can be made about observations based on their VOS classification, so it is important that ships be assigned the correct classification.

1.2.2 The designation of the correct classification is necessary for the following reasons:

(i) To assess data quality or give different weightings to data, based on whether a ship is using

certified or non-certified meteorological instruments

(ii) The classification listed in WMO Pub 47, allows a PMO to infer what instruments are on-board a ship, in particular a foreign VOS ship. This enables the PMO to provide the appropriate met supplies or instrument calibrations

(iii) In the case of 'suspect' real-time data, the classification listed in WMO Pub 47, will indicate whether a ship is using certified or non-certified meteorological instruments. Knowing that the classification assists in assessing whether to investigate or disregard potentially bad data.

1.2.3 For example if a ship is listed as 'Selected' but is in fact using non-certified ship's instruments, the quality of the data will be uncertain. To give data users' confidence in the data, ships classified, as 'Selected' must be carrying certified NMS meteorological instruments.

1.3 Classification Assignment

1.3.1 The correct VOS Classification (Selected, Supplementary or Auxiliary) **must** be assigned to each VOS ship. This classification must match the classification code listed in the WMO Pub47 metadata.

1.4 New Class of VOS ship - VOSClim

1.4.1 The Panel has already considered a recommendation from the Task Team on VOSClim to establish a new class of meteorological reporting ship called VOSClim (VOS Climate Reference Ship). The Task Team on Metadata for WMO No, 47 supports this recommendation.

1.4.2 Background

1.4.2.1 The Task Team on VOSClim will recommend terminating the project status of VOSClim and transferring the benefits learned to the wider VOS, as happened following VOSP-NA, the predecessor to VOSClim.

1.4.2.2 The Task Team is also encouraging the upgrading of regular VOS to VOSClim standard wherever possible, and, in consultation with the Chairs of SOT and VOSP, is supporting the introduction of a new class of meteorological reporting vessel to accommodate VOSClim standard ships. The criteria proposed for declaring a ship as VOSClim will be discussed under agenda item III-4.1 VOSClim project status implications. A concise summary of the points made under Appendix A of document III-4.1 regarding the class definition for VOSClim is given below.

1.4.3 VOSClim

*Definitio*n**:** A mobile ship station equipped with sufficient certified meteorological instruments for making observations, transmits regularand timely weather reports, enters the observations in an IMMT compliant electronic logbook and has a proven record of providing high quality observations. A VOSClim ship should have at least a barometer, a thermometer to measure SST, a psychrometer (for AT and humidity), a barograph and possibly an anemometer. In addition, a VOSClim ship must be inspected at less than six monthly intervals, the full range of metadata must be maintained in WMO No. 47, the full suite of digital images, sketches and drawings must be available, and the delayed-mode IMMT data must be submitted quarterly to the GCCs.

1.5 New Classifications to cover AWS

1.5.1 Background

1.5.1.1 NMS are increasingly using shipboard AWS to provide ship's weather reports for reasons that are well known within the VOS community. The level of sophistication of these AWS varies greatly. Many AWS contain the full suite of sensors and provide a manual input facility, whilst others are

simple stand-alone systems with a reduced sensor suite. Some ships may even be fitted with an AWS during construction.

1.5.1.2 The existing VOS classifications do not adequately cover the case of AWS on ships, and, with the increasing number of AWS shipboard installations; it is time for the Panel to consider some additional VOS sub-classifications for AWS. New AWS sub-classifications are considered necessary to (1) be able to differentiate between the level of sophistication of different AWS, and (2) differentiate between AWS owned, installed and maintained by an NMS as opposed to an AWS owned by a ship with a less rigorous maintenance schedule and no instrument traceability. New AWS sub-classifications will make it easier to count and report on the growing numbers of AWS systems globally.

1.5.1.3 Some ships now have effectively two separate systems, or 'ship stations' on board, (1) a set of manual instruments used to make a manual report, and (2) an AWS installation. Using the new sub-classifications for AWS, both ship stations could be reported in Pub47 using the appropriate class.

1.5.2 Proposal

It is proposed to add an AWS sub-class to each of the existing VOS classes, including the new VOSClim class. The number indicated is the 'new' Pub47 Table 2202 entry.

- **15 – Selected (AWS)**
- **35 – VOSClim (AWS)**
- **45 – Supplementary (AWS)**
- **75 – Auxiliary (AWS)**

1.5.3 Criteria for AWS Sub-Classes

(i.) **Selected (AWS)** – an AWS system equipped with certified meteorological instruments to measure at least at least air pressure, pressure change, temperature and humidity. Optional sensors would include wind speed, direction, and sea temperature measurement. The AWS may or may not have the facility for manual input of the visual elements, and transmit reports at least three hourly or more frequently. The AWS should have the facility to log the data.

(ii.) **VOSClim (AWS)** - An AWS system equipped with certified meteorological instruments to measure at least air pressure, pressure change, temperature and humidity. Optional sensors would include wind speed, direction, and sea temperature measurement. The AWS may have a facility for manual input of the visual elements, and transmit reports at least three hourly or more frequently. The AWS must have the facility to log the data including the extra VOSClim delayed-mode groups. In addition, a VOSClim (AWS) ship must be inspected at less than six monthly intervals, the full range of metadata must be maintained in WMO No. 47, the full suite of digital images, sketches and drawings must be available, and the delayed-mode IMMT data must be submitted quarterly to the GCCs.

(iii.) **Supplementary (AWS)** –an AWS system equipped with a limited number of certified meteorological instruments, reporting regularly.

(iv.) **Auxiliary (AWS)** – an AWS system using non-certified meteorological instruments, reporting regularly.

1.5.4 Examples of application

1. A shipboard AWS, supplied by a NMS, with a full suite of calibrated sensors to measure all the non-visual VOS parameters, with or without the manual input facility would be a Selected AWS.

2. A basic shipboard AWS, supplied by a NMS, with a limited number of calibrated sensors e.g. a drifting buoy on a ship, or a BAROS AWS, would be a Supplementary AWS.

3. An AWS, whether sophisticated or basic, owned by a ship and not certified by an NMS would be an Auxiliary AWS.

1.6 Impact of the New VOSClim Class and AWS Sub-Classes

The following publications will require updating with the new classes and descriptions:

- The Guide to Marine Meteorological Services, WMO-No.471 Chapter 6
- The Manual on the Global Observing System, WMO-No.544 Vol 1 Part III
- The Guide to the Global Observing System, WMO-No.488 Part III
- JCOMM TD No.4, The Voluntary Observing Ships Scheme – A Framework Document
- WMO Pub.47 Code Table 2202 metadata – discussed under TT on Metadata for WMO No. 47

1.7 Recommendations

The Panel makes the following recommendations:

1. That members review the VOS class of all ships in their national VOF and correct to the proper VOS class as necessary.

2. That members ensure the metadata contained in WMO Pub.47 matches the assigned VOS classification.

3. The Team approves the criteria discussed under item III-4.1 for declaring a ship as VOSClim.

4. The Team approves the new sub-classes and criteria for shipboard AWS.

5. That all relevant publications are updated to include the new VOS class of VOSClim and the new sub-classes for VOS AWS including the classification criteria.

_____

Appendices: (if any)

APPENDIX A

EXCERPT FROM THE GUIDE TO MARINE METEOROLOGICAL SERVICES, WMO-NO.471 CHAPTER 6

THE WMO VOLUNTARY OBSERVING SHIPS' SCHEME

6.1 Introduction

The international scheme under which ships plying the various oceans and seas of the world are recruited for taking and transmitting meteorological observations is known as the WMO Voluntary Observing Ships' Scheme. The forerunner of the scheme dates back to 1853, the year in which delegates of 10 maritime countries came together at a conference in Brussels, on the initiative of Lieutenant Matthew F. Maury, then director of the U.S. Navy Hydrographic Office, to discuss the establishment of a uniform system for the collection of meteorological and oceanographic data from the oceans and their use for the benefit of shipping. In the twentieth century, the system was recognized in the *International Convention for the Safety of Life at Sea*, which specifies in Regulation 4 of Chapter V — Safety of navigation — that 'the Contracting Governments undertake to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation'.

Voluntary observing ships make a highly important contribution to the Global Observing System of the World Weather Watch. Relevant standard and recommended practices and procedures are contained in Part III, Section 2.2.3 of the *Manual on the Global Observing System* (WMO-No. 544). Although new technological means, such as satellites and automated buoys, are used to gather data from the oceans, voluntary observing ships continue to be the main source of oceanic meteorological information.

From the beginning of such activity, shipping has assisted in the scientific exploration of the oceans, as well as in the development of suitable measuring techniques for use by shipborne observers. Nowadays, the cooperation of voluntary observing ships is sought in each of the large-scale scientific experiments conducted by special research vessels in order to furnish the additional data needed for complete analyses of environmental conditions. In addition, the participation of these ships is regularly requested in technical studies and investigations concerning observing methods, such as the measurement of sea-surface temperature, precipitation and wind.

6.2 Classification of voluntary observing ships

*6.2.1 **Types of surface synoptic sea stations***

Meteorological observing stations include surface synoptic sea stations of different types. The terminology used in the Manual on the Global Observing System, Part III, Section 1 is as follows:
Sea stations:

- Fixed sea stations
- Ocean weather stations
- Lightship stations
- Fixed platform stations
- Anchored platform stations
- Island and coastal stations
- Mobile sea stations
- selected ship stations
- supplementary ship stations

- auxiliary ship stations
- ice-floe stations
- Automatic sea stations (Data may be asynoptic when collected by satellite)
- fixed sea stations
- mobile sea stations
- drifting buoy stations

Since this *Guide* emphasizes the mutual collaboration between marine users and meteorologists, only the activities of Meteorological Services with regard to mobile ship stations are described in the following paragraphs. There are three types of mobile ship stations engaged in the WMO Voluntary Observing Ships' Scheme, namely:

(*a*) Selected ships;
(*b*) Supplementary ships; and,
(*c*) Auxiliary ships.

The types of observation normally made by each of these types of ship stations is shown in Table 6.2.

6.2.2 Selected ships

A selected ship station is a mobile ship station which is equipped with sufficient certified meteorological instruments for making observations, transmits regular weather reports and enters the observations in meteorological logbooks. A selected ship should have at least a barometer (mercury or aneroid), a thermometer to measure sea-surface temperature (either by the bucket method or other means), a psychrometer (for air temperature and humidity), a barograph and possibly an anemometer.

Selected ships constitute the large majority of voluntary observing ships.

6.2.3 Supplementary ships

A supplementary ship station is a mobile ship station equipped with a limited number of certified meteorological instruments for making observations. It transmits regular weather reports and enters the observations in meteorological logbooks.

6.2.4 Auxiliary ships

Beyond the shipping lanes normally used by selected or supplementary ships very few observations are available. Ships plying data-sparse areas may be asked to make and transmit weather reports even if they are not equipped with certified instruments. Such ships are classified as 'auxiliary ships'. Auxiliary ship stations are mobile ship stations, normally without certified meteorological instruments, which transmit reports in a reduced code form or in plain language, either on a routine basis or on request, in certain areas and under certain conditions.

6.2.5 International list of selected, supplementary and auxiliary ships

Selected, supplementary and auxiliary ships constitute an important source of marine data. In analysing these data, Meteorological Services should be aware of the type of instrumentation onboard a given ship, or the particular method of observation when several methods are generally in use. To this end WMO compiled the International List of Selected, Supplementary and Auxiliary Ships (WMO-No. 47) which is kept up to date through information supplied by Members, and for each ship. The information contained covers such particulars as:

(*a*) Name of ship
(*b*) Call sign
(*c*) Vessel type

(*d*) Vessel dimensions
(*e*) Area or routes the ship normally plies
(*f*) Type of barometer
(*g*) Type of thermometer
(*h*) Exposure of thermometer
(*i*) Type of hygrometer or psychrometer
(*j*) Exposure of hygrometer or psychrometer
(*k*) Method of obtaining sea surface temperature
(*l*) Type of barograph
(*m*) Various other meteorological instruments used aboard the ship
(*n*) Types of radio equipment, including INMARSAT
(*o*) Height of barometer, in metres, measured from maximum load line
(*p*) Height of anemometer, in metres, measured from maximum load line; and
(*q*) Depth of sea temperature measurement

The *International List of Selected, Supplementary and Auxiliary Ships* needs to be regularly updated (see the *Manual on the Global Observing System*, Part III, paragraphs 2.2.3.3 and 2.2.3.4) because of frequent changes in the international merchant fleet and changes in the recruitment of auxiliary ships. Members are asked to provide to the WMO Secretariat every quarter, updates of their list of selected, supplementary and auxiliary ships, preferably on computer readable media. This is the most efficient means of keeping the master list updated, as no retyping is required. The Secretariat makes available the master list through its web page (http://www.wmo.ch/web/ddbs/publicat.html). In addition, the Secretariat distributes a hard copy of the master list annually.

Table 6.1 shows the number of selected, supplementary and auxiliary ships during the years 1981–1996.

Table 6.1
Number of Ships belonging to the Voluntary Observing Ships' Scheme

Year	*Selected*	*Supplementary*	*Auxiliary*	*Total*
1981	4827	1637	1034	7498
1982	4877	1513	1084	7474
1983	4830	1637	1050	7517
1984	4968	1567	1155	7690
1985	4875	1480	1363	7718
1986	4760	1514	1313	7587
1987	4642	1470	1274	7386
1988	4438	1420	1344	7202
1989	4664	1436	1439	7539
1990	4645	1412	1434	7491
1991	4647	1434	1369	7450
1992	4608	1332	1422	7362
1993	4512	1374	1430	7316
1994	4092	1386	1197	6675
1995	4124	1332	1270	6726
1996	4171	1311	1270	6752
1997	4187	1285	1287	6759
1998	4230	1375	1457	7062

6.3 Recruitment of voluntary observing ships

6.3.1 ***Requirement to recruit ships***

According to the Manual on the Global Observing System, Volume I, Part III, paragraph 2.2.3.5, each Member shall arrange for the recruitment of ships that are recorded on the national register as mobile sea stations. In fulfilling this obligation, each Member contributes to the common objective of obtaining sufficient coverage of meteorological observations over the sea. While a uniform coverage of the oceans is desirable, this is difficult to achieve in view of the large differences in the density of shipping traffic. This traffic is comparatively dense in the northern hemisphere, but this is not the case in the tropics or in the southern hemisphere. Consequently, greater attention should be given to the recruitment of voluntary observing ships in these areas. A map showing the density of observations received from ships in a typical month in 1996 is shown in Annex 6.A.

Meteorological Services in many countries are required to provide more detailed information of the weather and sea conditions in coastal areas. Some services have successfully recruited ships of local companies to make and transmit observations during their voyage from harbour to harbour along the coast. Such ships may be recruited as supplementary or as auxiliary ships. Their observations have been widely recognized as being of great value.

6.3.2 Criteria for recruitment

Several criteria can be used in deciding whether a particular ship should be recruited as a selected, supplementary or auxiliary ship, to satisfy national and international needs. Questions which should be examined are whether all the necessary intruments can be installed, whether the ship's officers will have the time available for recording and transmitting the observations and whether the necessary regular contact can be established for the receipt of meteorological logbooks. Shipowners and masters are generally very cooperative in these matters; however, it is advisable that these questions be thoroughly discussed at the recruiting stage.

Countries may recruit ships of foreign registry which visit the ports of the recruiting country sufficiently often to permit regular contact. This recruitment is sometimes arranged by the Meteorological Services of the two countries concerned. In order to avoid the entry of duplicate data into the international archiving system, meteorological logbooks from ships of foreign registry should be procured and stored through appropriate arrangements with the Meteorological Service of the country of registry. When a ship of foreign registry is recruited, the Member in whose country the ship is registered should be notified, except in the case when the port in the country of the Member which recruits the ship is considered to be its home port.

For the recruitment of an auxiliary ship, no prior arrangements are required with the Meteorological Service of the country of registry.

Members should establish a suitable organizational unit for the recruitment of voluntary observing ships. This unit should contact shipping agencies to enlist their cooperation, arrange for the provision of instruments, educational information material and other necessary documents ships, arrange for the collection and examination of the ships' meteorological logbooks, arrange for visits to ships, and to examine the various financial questions involved. Port Meteorological Officers can play a large role in the recruitment of ships.

Complaints about meteorological observations from a particular observing ship should be directed to the Member with which the ship is registered. If the ship was recruited by another Member, the Member receiving the complaint should forward it to the Member concerned.

6.4 Meteorological observations from ships

6.4.1 Danger messages

The International Convention for the Safety of Life at Sea, 1974, in its Regulation 2, Chapter V, concerning the safety of navigation, specifies that ship masters are obliged to issue a danger message

when a ship meets with objects or conditions which are of direct danger to navigation. As far as meteorological phenonema are concerned, danger messages should contain information on:

(*a*) Tropical cyclones (tropical storms) and their development;
(*b*) Winds of force 10 or above on the Beaufort scale for which no storm warning has been received;
(*c*) Sub-freezing air temperatures associated with gale force winds causing severe ice accretion on super-structures;
(*d*) Sea-ice or ice of land origin (e.g. icebergs).

Details concerning the contents of danger messages and their transmission are described in Regulation 3 of Chapter V of the *International Convention for the Safety of Life at Sea*. The information given in these messages directly serves the safety of navigation. Those containing meteorological information are of vital importance to Meteorological Services for the preparation of weather and sea bulletins.

6.4.2 Surface observations

6.4.2.1 **CONTENT OF SURFACE OBSERVATIONS FROM SHIPS**

The elements observed by the various types of voluntary observing ship are shown in Table 6.2.

Table 6.2
Observations made by mobile ships stations

	Selected	*Supplementary*	*Auxiliary*
Present and past weather	x	x	x
Wind direction and speed	x	x	x
Cloud amount	x	x	x
Cloud type and height of base	x	x	
Visibility	x	x	x
Temperature	x	x	x
Humidity (dew point)	x	1	
Atmospheric pressure	x	x	x
Pressure tendency	x		
Ship's course and speed	x		
Sea temperature	x		
Direction, period and height of waves	x		
Sea-ice and/or icing	x	x	x
Special phenomena	x		

Supplementary and auxiliary ships are sometimes asked to add observations of waves to their reports.

6.4.2.2 PROGRAMME FOR SURFACE OBSERVATIONS ON BOARD SHIPS

The basic programme for making surface observations on board ships consists of the following procedures:

(*a*) Synoptic observations should be made at the main standard times: 0000, 0600, 1200 and 1800 UTC. When additional observations are required, they should be made at one or more of the intermediate standard times: 0300, 0900, 1500 and 2100 UTC;
(*b*) While taking observations, atmospheric pressure should be read at the exact standard time, the observation of other elements being made within the ten minutes preceding the standard time;
(*c*) When operational difficulties on board ship make it impracticable to make the synoptic observation at a main standard time, the actual time of observation should be as near as possible to the main

standard times. In special cases, the observations may even be taken one full hour earlier than the main standard time, i.e. at 2300, 0500, 1100 and 1700 UTC. In these cases the actual time of observation should be indicated; however, these departures should be regarded only as exceptions;

(*d*) When sudden or dangerous weather developments are encountered, observations should be made for immediate transmission without regard to the standard times of observation (see paragraph 6.4.1 above for obligations under the *International Convention for the Safety of Life at Sea*);

(*e*) Observations should be made more frequently than at the main standard times whenever storm conditions threaten or prevail. Meteorological Services may request more frequent observations for storm warnings, particularly for tropical cyclones. Special observations may also be requested for search and rescue operations or other safety reasons;

(*f*) When required for scientific studies supplementary observations should be made at intermediate standard times, subject to non-interference with navigation duties;

(*g*) To ensure the transmission of an observation made at 0300, 0900, 1500 or 2100 UTC to a coastal radio station, it is desirable that the observation at the next main standard time should be made for climatological purposes, and if possible transmitted in accordance with normal procedures;

(*h*) Ships' officers should be encouraged to continue taking and reporting observations while the ships are in coastal waters, provided it does not interfere with their duties for the safety of navigation;

(*i*) Transmission of ships' observations by INMARSAT is not constrained by the watchkeeping hours of shipboard radio officers; transmission can be made at any time.

6.4.2.3 OBSERVATION OF SEA AND SWELL

The distinction between two separate wave trains and particularly the distinction between sea and swell can be difficult for an inexperienced observer. Sea waves are systems of waves observed at a different place than within the wind field producing the waves. Swell waves are systems of waves observed at a point remote from the wind field which produced the waves, or observed when the wind field which generated the waves no longer exists.

The distinction between sea and swell can be made on the basis of one of the following criteria:

Wave direction — if the mean direction of all waves of more or less similar characteristics differs 30° or more from the mean direction of waves of different appearance, then the two sets of waves should be considered to belong to separate wave systems.

Appearance and period — when typical swell waves characterized by their regular appearance and long-crestedness arrive approximately, i.e. within 20°, from the direction of the wind, they should be considered as a separate wave system if their period is at least four seconds greater than the period of the larger waves of the existing sea.

More guidance on the observation of waves and swell, as well as the observation of sea ice, can be found in the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) Part II, Chapter 4, Marine observations.

6.4.3 Upper air observations

In the past very few mobile ship stations were equipped for making upper-air synoptic observations. An automated means of making upper air soundings from a merchant ship has now been developed under the Automated Shipboard Aerological Programme (ASAP). The balloon can be automatically filled and released, and observations received and encoded under the supervision of a ship's officer. However, the number of ships making upper-air observations is still small.

An upper-air synoptic observation consists of one or more of the following elements:

(*a*) Atmospheric pressure;
(*b*) Air temperature;
(*c*) Humidity; and,
(*d*) Wind speed and direction.

The standard times of upper-air synoptic observations are 0000, 0600, 1200 and 1800 UTC. The actual time of regular upper-air synoptic observations should be as close as possible to 30 minutes before these standard times, and should not fall outside the 45 minutes prior to the standard time. The actual time of a pilot-balloon observation may deviate from this time range if wind observations at considerably greater heights can be achieved.

In the basic programme of upper-air soundings from mobile ships the general objective is to obtain reports from positions which are not more than 1000 km apart and the observations are normally required at 0000 and 1200 UTC. These observations are to be coordinated within the framework of an international programme to ensure that data are obtained from those parts of the oceans where upper-air data are needed. On the other hand, as these observations are scheduled according to circumstances, Members establishing a programme of upper-air observation on board voluntary observing ships should communicate to the Secretariat the following information:

(*a*) Name and call sign of the ship;
(*b*) The routes the ship normally plies and the zones in which the upper-air observations will be taken;
(*c*) The means of communication of the reports, and if coastal radio stations are to be used, the names of these stations;
(*d*) The scheduled dates of departure and arrival at various ports;
(*e*) Details of the observing programme scheduled for the voyage;

On receipt, these particulars will be notified by the Secretariat to other Members.

6.4.4 Sub-surface observations

Selected ships may also be equipped to make bathythremograph observations during ocean crossings. The use of an expendable bathythermograph (XBT) does not oblige the ship to reduce speed or make course alterations. All arrangements for this type of observation are made within the framework of the Integrated Global Ocean Services System (IGOSS) jointly operated by WMO and IOC.

Procedures for the collection and exchange of BATHY and TESAC (temperature, salinity and current) observations are specified in the *Guide to Operational Procedures for the Collection and Exchange of IGOSS Data* (IOC/WMO *Manuals* and *Guides* No. 3) and the WMO *Manual on the Global Telecommunications System*, Volume 1, Part 1, Attachment I-1 (WMO-No. 386). The preferred times for BATHY and TESAC observations are 0000, 0600, 1200 and 1800 UTC. However observations taken at any time are useful and should be transmitted.

6.4.5 Special observations

In relation to international programmes of scientific or economic significance, observations of a special nature are needed from ships at sea and WMO is requested to assist through its Voluntary Observing Ships' Scheme. One such example is the request for observations on locust swarms in the seas around Africa, Arabia, Pakistan and India. This programme, which is of great importance to the agricultural economy in the countries concerned, is described in Annex 6.B of this Chapter.

Another example is the logbook report of freak waves. A freak wave is defined as a wave of very considerable height preceded by a deep trough. It is the unusual steepness of the wave which makes it dangerous to shipping. Favourable conditions for the development of freak waves seem to be strong

current flows in the opposite direction to a heavy sea and especially when this occurs near the edge of the continental shelf. The reports may contribute to a mapping of these particularly dangerous areas and to a better understanding of the phenomenon. Guidelines covering the content and form of the report and the forwarding arrangements are described in Annex 6.C of this Chapter (see also Chapter 3, paragraph 3.3.1).

Sea-surface currents are also subject to special observation. These data are derived from measurement of ships' set and drift and form the basis for consideration of the ocean surface current circulation. They are of value to research and climatic studies and are collated by the International Surface Current Data Centre (ISCDC) in the United Kingdom which sends a copy of the stored data to the World Data Centres for Oceanography. In order to improve this database, all vessels are encouraged to obtain and supply such data on a voluntary basis. Details of the form of the report and the forwarding arrangements are given in Annex 6.D of this Chapter (see also Chapter 3, paragraph 3.3.2).

6.4.6 Coding of observations

Ships' observations are coded in the international meteorological codes published in the Manual on Codes, Volume I (WMO-No. 306). The various code forms are given code names which are sometimes included in the heading of the ship's report. In all cases, however, a 4-letter identification group is used (see code 2582 in the Manual on Codes). The identification groups used by ships are shown in Table 6.3.

Table 6.3
Identification groups of codes reported by SHIPS

Code name	*Identification group(s)*	*Content of code*
SHIP	BBXX	Surface report from a sea station
PILOT SHIP	QQAA, QQBB, QQCC, QQDD	Upper-wind report from a sea station; Parts A, B, C, D respectively
TEMP SHIP	UUAA, UUBB, UUCC, UUDD	Upper-level pressure, temperature, humidity and wind report from a sea station; Parts A, B, C, D respectively
BATHY	JJXX	Bathythermal observation
TESAC	KKXX	Observation of temperature, salinity and current from a sea station
TRACKOB	NNXX	Report of a marine surface observation along a ship's track

6.4.7 Automation of on-board observations

Automation of shipboard observations have been greatly stimulated by the advent of personal computers and satellite communications. Observations are taken manually in the traditional way and then entered into a personal computer, which may be in the form of a laptop or notebook. The computer programme then:

(*a*) Provides screen prompts to assist with data entry;
(*b*) Calculates the true wind, MSL pressure and dew point;
(*c*) Checks the validity of some data, e.g. month in range 1–12, observations near climatological extremes;
(*d*) Stores the observation in SHIP code on disc and prints it out for transmission;
(*e*) Formats the observation in IMMT format (referred to in Chapter 3, paragraph 3.2.7), and stores it on disc or transmits the data to a shore station via a satellite system.

If the ship is equipped with INMARSAT-C, the computer diskette can be placed in the INMARSAT terminal and transmitted without rekeying. In addition manually entering data in a meteorological logbook the diskette of observations in IMMT format is sent periodically to the Meteorological Office.

Another form of automation is the Marine Data Collection Platform (MDCP) which consists of a hand-held computer, air temperature and air pressure sensor, transmitter and antenna. The coded SHIP observations are entered into the computer and collected by Service Argos satellite. In this case the meteorological logbook still has to be entered manually and returned to the Meteorological Office in the traditional way.

Completely automated shipboard weather stations present difficulties. Proper locations for sensors are not easy to find, particularly for wind and dew point, while equipment for automated measurement of visibility, weather, clouds and wave height cannot be accommodated in the confined space of a ship.

6.5 On-board meteorological instrumentation

6.5.1 ***General***

Full guidance on the basic meteorological instruments suitable for use onboard ships making observations under the Voluntary Observing Ships Scheme, together with advice on methods of observations, is provided in the Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8), Part II, Chapter 4, Marine observations.

Experience shows that certain features of these meteorological instruments onboard ships require constant attention. The following comments emphasize where special care should be paid and are fully complementary to the general guidance in the above-mentioned *Guide*.

6.5.2 Instruments measuring atmospheric pressure

As the proper installation and operation of mercury barometers at sea has proved very difficult, they are now rarely installed on board ships. The use of precision aneroid barometers on the other hand does not give rise to similar problems. However, because of the zero drift to which these instruments are liable, frequent checking against standing barometers is necessary in order to ensure proper continuous operation. The zero drift of aneroids currently in use is seldom continuous, as the instrument correction remains stable for a rather long period of time, then suddenly drops to another level. Checking procedures should therefore continue routinely even if the correction has remained stable for some time. This checking should be carried out by a PMO whenever possible, preferably at intervals not exceeding three months. A permanent record of all such checks should be attached to the instrument and should include information on the date of the check and the temperature and pressure at which the check was made.

On board small vessels the reduction of the pressure reading to Mean Sea-Level (MSL) may be carried out by the addition of a given reduction constant, or simply by correcting the reading of the scale to give pressure at MSL directly. When the elevation of the barometer varies significantly with the loading of the ship, the use of different reduction constants has to be considered. The draught of very large tankers can vary by as much as 10 metres between a sea-going ballast condition and a fully-loaded condition. If the barometer elevation is great, air temperature may also have to be taken into consideration when preparing reduction tables. At all times the limit of accuracy of the applied reduction should be kept within 0.2 hPa.

Barographs used on board ships should be supplied with an efficient built-in damping device and the instrument should be mounted on shock-absorbing material in a position where it is least likely to be affected by concussion, vibration or movement of the ship. The best results are generally obtained from a position as close as possible to the centre of flotation. The barograph should be installed with

the pen arm oriented athwart-ship to minimize the risk of its swinging off the chart.

6.5.3 Instruments measuring wind speed and direction

In order that wind reports from ships equipped with instruments are comparable with estimated winds and wind reports from land stations, anemometer readings should be averaged over 10 minutes. It is difficult to estimate 10-minute means by watching the dial of an anemometer. An overestimation of more than 10 per cent is not uncommon. It is therefore preferable that the instrument read-out used for reporting wind velocities be automatically averaged over 10 minutes. If such read-outs are not available, careful instructions should be given in order to avoid overestimation.

Due to the flow distortion caused by superstructure, masts and spars, the site of the anemometer sensor has to be carefully selected, preferably as far forward and as high as possible. Wind speed also needs to be corrected for effective height (For further information see *Wind Measurements Reduction to a Standard Level*; R. J. Shearman and A. A. Zelenko (MMROA Report No. 22, WMO/TD-No. 311).

Any anemometer mounted on a ship measures the movement of air relative to the ship and it is essential that the true wind be computed from the relative wind and the ship's velocity. A simple vector diagram may be used, although in practice this can be a frequent source of error. Special slide rules and hand computers are available and programs can be installed on small digital computers.

6.5.4 Instruments measuring temperature and humidity

Temperature and humidity observations should be made by means of a psychrometer with good ventilation and exposed in the fresh airstream on the windward side of the bridge. The use of a louvred screen is not as satisfactory, but if it is used, two should be provided, one secured on each side of the vessel, so that the observation can be made on the windward side. The muslin and wick fitted to a wet-bulb thermometer in a louvred screen should be changed at least once a week, and more often in stormy weather.

Automated or distant-reading thermometers and hygrometers should be sited in a well-ventilated screen with good radiation protection and placed as far as possible from any artificial source of heat. It is advisable to compare the readings with standard psychrometer observations at the windward side of the bridge at regular intervals, particularly when new types of equipment are introduced.

6.5.5 Instruments measuring sea temperature

It is important that the temperature of the uppermost thin film of water (measured by infra-red radiometers) should be distinguished from the temperature of the underlying mixed layer. It is the representative temperature of the mixed layer which should be reported by voluntary observing ships.

The 'bucket' instrument method is the simplest and probably the most effective method of sampling this mixed layer, but unfortunately the method can only be used on board small vessels slowly moving. Other methods are:

(*a*) Intake and tank thermometers, preferably with distant reading display and used only when the ship is moving;
(*b*) Hull-attached thermometers located forward of all discharges;
(*c*) Trailing thermometers; and,
(*d*) Infra-red radiometers.

These instruments are described in Part II, Chapter 4 of the *Guide to Meteorological Instrument and Methods of Observation* (WMO-No. 8).

6.6 Transmission of ship's observations to the shore

*6.6.1 **INMARSAT***

Ship reports can be readily transmitted to a Coast Earth Station (CES) which has been authorized to accept these reports at no cost to the ship. The NMS of the country operating the CES pays the cost, which is usually less than the cost of a report received via coastal radio. There are a number of such CESs in each satellite footprint and they are listed, together with the area from which they will accept reports in WMO-No. 9, Volume D, Part B, Coastal Radio Stations Accepting Ships' Weather Reports. Code 41 is the INMARSAT address which automatically routes the report to the Meteorological Service concerned. To place a limit on the costs incurred by an NMS, a CES may be authorized to accept reports only from ships within a designated area of ocean. These limits should be drawn to the attention of the relevant ship's officers when recruiting a ship under the Voluntary Observing Ships Scheme. A radio operator is not needed to transmit the report, transmission is therefore not restricted to the operator's hours of duty.

6.6.2 Coast radio stations

Ship reports can be transmitted by radio-telegraphy to a coastal radio station which has been authorized to accept these reports at no cost to the ship (the costs are met by the country operating the coastal radio station, in many cases by the NMS).

The global plan for the collection of ship reports, and the procedures for the transmission of weather reports to coastal radio stations are described in *Manual on the Global Telecommunications System*, Volume 1, Part 1, Section 2.6 and Attachment I-1 (WMO-No 386).

Weather reports from mobile ship stations should (without special request) be transmitted from the ship to the nearest coastal radio station situated in the zone in which the ship is navigating. If it is difficult, due to radio propagation conditions or other circumstances, to contact promptly the nearest radio station in the zone in which the ship is navigating, the weather messages should be cleared by applying the following procedures in the order given below:

(*a*) Transmission to any other coastal radio station in the zone in which the ship is navigating;
(*b*) Transmission to any coastal radio station in an adjacent zone within the same Region;
(*c*) Transmission to any coastal radio station in any other zone within the same Region;
(*d*) Transmission to a coastal radio station in an adjacent zone in a neighbouring Region or failing that, to any other station in neighbouring Region;
(*e*) Transmission to another ship or an ocean weather station with the function or willing to act as a relay station.

In zones situated along the borderline between two Regions, the order of the procedures for the transmission of ships' weather reports to coastal radio stations, as laid down in subparagraphs (*a*), (*b*), (*c*), (*d*) and (*e*) above, may be interchanged subject to agreement between the two Regional Associations involved. Any agreement reached on this matter should specify the limits of the area concerned.

Members may issue instructions to their mobile ship stations to the effect that their weather reports may be transmitted via one of their home coastal radio stations designated for the collection of reports from the zone, if the application of such procedures may facilitate the efficient contact with coastal radio stations and the clearing of weather messages.

On most voluntary observing ships there is only one radio officer whose watch-keeping hours total eight per day, he/she is therefore not always available at the time when a weather report is ready for transmission. Watch-keeping hours are based on local standard time where the ship happens to be, and these times do not always synchronize with coordinated Universal Time (UTC) used for meteorological observations. It is desirable that watch-keeping hours are chosen so that as many

ships' observations at the main standard times (0000, 0600, 1200, 1800 UTC) as possible can be transmitted immediately after the observations are taken.

Observations taken while the radio officer is off-duty should be sent at the first opportunity even with a delay of up to 12 hours. In the southern hemisphere and other areas where few ships' weather reports are available they should be sent up to 24 hours after the time of observation.

In transmitting meteorological reports to coastal radio stations, ships' radio officers follow the regulations which are valid for maritime mobile services, as defined in the ITU Radio Regulations; these are reproduced in Annex 6.E of this Chapter.

Coastal radio stations designated to receive ships' weather reports should, for the purpose of receiving the reports:

(*a*) Keep a continuous 24-hour watch; or,
(*b*) Keep a watch for at least 30 minutes beginning at 0000, 0600, 1200 and 1800 UTC daily; a watch should also be kept for a similar minimum time at the beginning of the nearest 'single-operator period' following those standard synoptic hours;
(*c*) Keep watch for shorter periods (stations with limited hours of operation) than those mentioned under (*b*) above when these stations are considered of particular value.

The list of coastal radio stations accepting ships' weather reports, free of charge to the ship, together with their radio addresses and other relevant particulars, is contained in *Coastal Radio Stations Accepting Ships' Weather Reports* (WMO-No. 9), Volume D, Part B. Members responsible for the reception of meteorological reports from ships need to advise the Secretariat of changes to their coastal radio stations so that this publication can be kept up to date.

The ship weather report must be addressed to the telegraphic address of the relevant NMC. The addresses are included in the information published in WMO-No. 9, Volume D, Part B. The address should be preceded by the abbreviation 'OBS' to ensure appropriate handling of the message at the coastal radio station. The coastal radio station must forward the report to the NMC with minimum delay (by telex, landline or other means of electronic communication).

Members whose ships repeatedly encounter difficulties in clearing ships' weather reports with coastal radio stations should communicate promptly with the Member(s) concerned giving full particulars as to dates and times; the presidents of the Commission for Basic Systems and the Commission for Marine Meteorology and the Secretary-General of WMO should also be informed.

6.6.3 Service Argos

Service Argos is a system for receipt of data from automatic weather stations by orbiting satellites. It has been used for many years to collect data from drifting buoys, but is also used to collect data from Marine Data Collection Platforms (MDCPs) on board ships. The data are read out from the satellite at one of three ground stations and are then distributed on the GTS.

6.7 Distribution of ships' weather reports over the GTS

Ship weather reports received at an NMC from INMARSAT Coast Earth Stations (CES) and coastal radio stations should be assembled into meteorological bulletins and transmitted over the GTS with minimum delay. Some Centres transmit a bulletin of available ship weather reports every 15 minutes. The speed of transmission over the GTS has become more important with the advent of INMARSAT, as ship reports which were quickly received at a local coastal radio station may now be received by a CES in a distant country and have to arrive over the GTS. Ship weather reports are also a vital input to global models run at a number of centres, which should receive their data from different parts of the world with minimum delay.

6.8 Meteorological logbooks for ships

6.8.1 ***Layout***

The recording of observations in permanent form is obligatory for selected and supplementary ships and recommended for auxiliary ships. On ships where the observations are entered on a personal computer a diskette (or other computer readable media) will be likely be used to record data. Otherwise the observations are recorded in a meteorological logbook. The layout of logbooks is a national responsibility. Generally, the order of parameters recorded in the logbook follows the order of elements in the SHIP code form. Thus the logbook can be used both for recording the synoptic weather report which is to be transmitted and to include additional information required for climatological purposes. For the latter use, the entries are subsequently transferred on to IMMT format (see Chapter 3, paragraph 3.2.7 and Annex 3.C).

Logbooks should contain clear instructions for entering observations. Code books should also be provided, along with logbooks, for ready reference and to correct wrong entries as necessary. It is useful to mark in the logbook those columns which are earmarked for entries to be transmitted as part of the weather report. In some national logbooks, these columns are lightly shaded or coloured and in others they are inserted in a special frame. Space is often also provided in logbooks to enter the various readings used to compute a meteorological element such as air pressure reduced to sea-level, or actual wind derived from a measured apparent wind and the ship's movement. This will enable a check of the computations carried out on board ship for subsequent quality control of the data during processing for climatological purposes.

The size of a meteorological logbook is such that it is possible to enter four days of observations on one sheet, that is 16 observations made at the four main standard times. Ships should be requested to return a completed logbook to the Meteorological Service or PMO which has recruited the ship. The period covered by a logbook should not be more than three months, so that the delay in entering the observations in the climatological system is not too great.

Logbooks should be returned with information regarding the ship, the instruments used and other details of a general nature, and space should accordingly be provided for these entries. The name of the master, the observers and the radio officer should also be included, particularly if an incentive programme exists in the country where the ship has been recruited. An example of a page from a meteorological logbook for ships is given in Annex 6.F of this Chapter.

6.8.2 Supply and return

To facilitate the supply of meteorological logbooks to ships which do not regularly visit their home ports, Port Meteorological Officers in various ports keep a stock of logbooks of different National Services. In addition, Port Meteorological Officers may also keep stocks of observing and coding instructions in other languages for supply to ships which may require them. As the method of recording observations on diskette becomes widespread, it may also be necessary for Port Meteorological Officers to keep a stock of these for supply to ships.

Completed logbooks are generally considered the property of the NMS which has recruited the ship. As they contain the results of work done on a voluntary basis, they should be kept for a sufficent number of years to permit examination of the original entries. Such an examination is often required to satisfy requests from the ships's officers concerned or from the shipping company. Sometimes, special arrangements are made between countries whereby one country takes care of all recruitment procedures, but the completed logbooks are sent to the country of registration. In such cases, the country which has recruited the ship receives a copy of the completed logbook when so desired.

6.8.3 Scrutiny of entries

However clear the instructions relating to entering observations in a logbook, there is always the possibility of errors occurring in entries to a logbook. Completed logbooks must therefore be scrutinized upon receipt and obvious errors corrected. It is of great importance that recurrent types of errors be brought to the attention of the observers concerned so that any misinterpretation of the instructions or erroneous practices in reading instruments or making entries can be corrected. When the logbooks are received by the Port Meteorological Officer, or section of the NMS dealing with voluntary observing ships, a first check should be made as soon as possible to permit a personal conversation with the appropriate ship's officers. Such conversations or written responses commenting on logbooks which have been received constitute an important element of the continuous training of shipborne observers. Without this feedback ship officers would soon become uncertain as to the quality of their work or the implementation of certain observing or coding procedures and, with the inevitable waning of interest, the quality of their observations may deteriorate.

Similar scrutiny and personal liaison is especially important in respect of special observations of, among others, freak waves, sea-surface currents (see Chapter 3, paragraph 3.3 and paragraph 6.4.5 of this Chapter). Without the willing cooperation of marine observers, these non-routine data would not be available.

Ships' officers often include questions on coding matters or on any special phenomena observed by them in the 'remarks' column of the logbook. Response to these questions is important, as this falls within the same spirit of maintaining interest in meteorological work. Some countries have instituted special periodicals for meteorological observers on board their ships in which these questions are discussed and explained (see paragraph 6.11 below).

6.9 Port Meteorological Officers (PMOs)

In recruiting voluntary observing ships and assisting them in their meteorological work, direct contact with ships' officers is often needed to provide them with instructive material and other documents, to inspect meteorological instruments on board ships, to collect completed logbooks of observations and, after an initial check, take such corrective action as is possible by personal contact. For this purpose, Port Meteorological Officers (PMOs) with maritime experience should be appointed at main ports.

PMOs are representatives of the Meteorological Service of the country as far as the local contact with maritime authorities is concerned. The role of PMOs is a very important one and the efficiency of the voluntary system of ships' observations often depends on the initiative displayed by these officers. They are in a good position to discuss with ships' officers any problems they have encountered and offer suggestions, bring to their attention any changes in procedures that may have taken place and give them the latest information which they may wish for. Opportunity should also be taken to explain various meteorological and/or oceanographic programmes whenever observations are specially needed from ships. Meteorological instruments on board ships should be checked and other advice or assistance in meteorological matters should be given by PMOs upon request by the master of any ship, irregardless of its country of registration.

PMOs should also report to the meteorological authorities in their country if the meteorological work carried out on board the ship has not been entirely satisfactory. Members should immediately respond to these reports; when they concern the work carried out under the authority of another Member, the latter should be informed. If action has to be taken following complaints this can best be done through the PMOs who can play a very important role by a tactful approach to the masters and, if constructive criticism is expressed in positive terms, goodwill can be maintained all round.

The scope of the work of PMOs depends largely on the importance of the marine traffic in the particular area served. Before deciding to establish a PMO in a given port, a study must be made of the various services which should be provided. As marine activities develop, a review should be made from time to time to see whether new services should be provided. Guidelines for organizing PMO

activities are given in Annex 6.G of this Chapter. Useful information on the role of PMOs can be found in *Proceedings of the International Seminar for Port Meteorological Officers* (1993) (MMROA Report No. 30, WMO/TD-No. 584).

A list of PMOs with their addresses and telephone numbers is contained in WMO-No. 9, Volume D, Part C. The list should be provided nationally to ships' officers to facilitate their contact with PMOs.

6.10 Incentive programme for voluntary observing ships

In recognition of the valuable work done by ships' officers in taking and transmitting meteorological observations and as an incentive to maintaining a high standard of observation many maritime countries have established a national award or certificate system. These systems vary greatly from country to country; in some countries the ships receive the awards, while in other countries awards are made to the individual masters or navigation and radio officers. Sometimes recognition for the meteorological work done on board ships is given in the form of books, charts and other documents presented to the ship.

Members are encouraged to continue the practice of issuing national awards or certificates to selected, supplementary and auxiliary ships recruited by them, or to the ships' personnel, as a sign of their participation in the WMO Voluntary Observing Ships' Scheme.

6.11 Marine meteorological publications produced by National Services for seafarers and marine observers

A number of National Meteorological Services in maritime countries publish magazines directed to the masters and officers of ships participating in the WMO Voluntary Observing Ships' Scheme. Although content and format differ widely, all these periodicals have two goals in common: first to stress the importance of ships' participation in the marine observing programme and second to offer timely marine meteorological information of interest. A list of these periodicals is given in Annex 6.H of this Chapter.

Among the material included in these periodicals are:

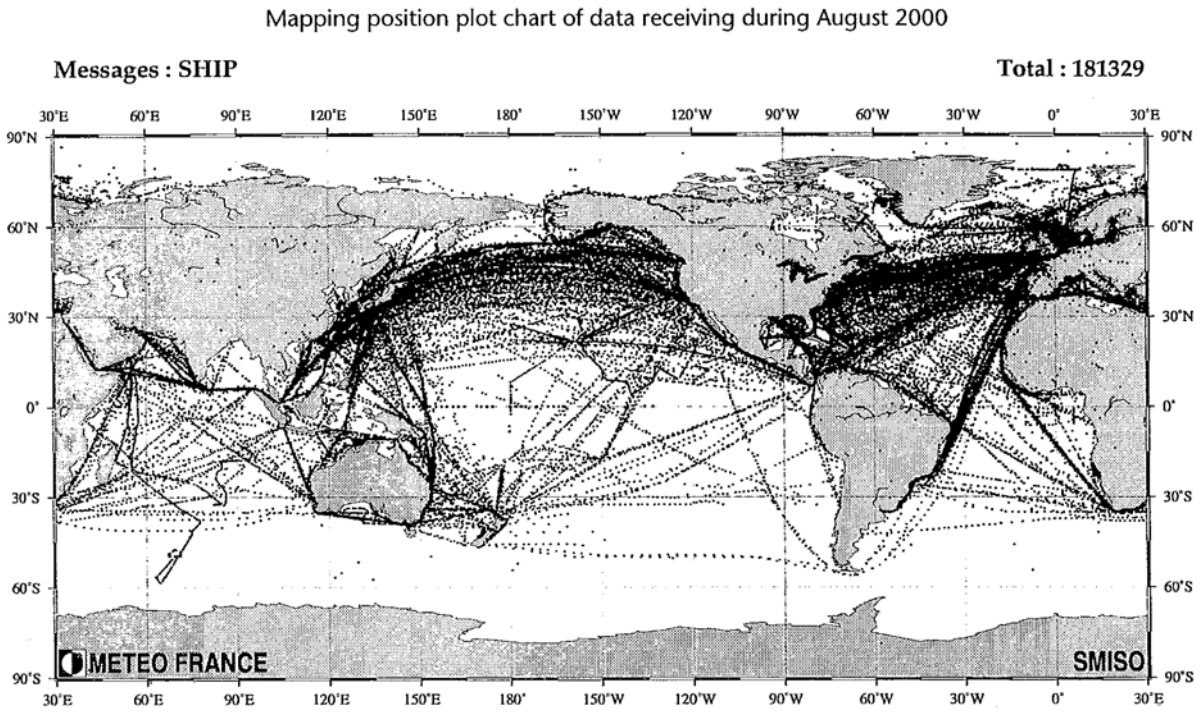
(*a*) Incidents where ships' observations proved particularly useful;
(*b*) Commendations on active participation in the WMO Voluntary Observing Ships' Scheme;
(*c*) Hints on observing practices;
(*d*) Changes in broadcast schedules of weather and sea bulletins or radiofacsimile broadcasts;
(*e*) Articles on important weather features of particular ocean areas.

Members are encouraged to produce such periodicals and supply them to voluntary marine observers.

ANNEX 6.A

GEOGRAPHICAL DISTRIBUTION OF SHIPS' WEATHER REPORTS IN A TYPICAL MONTH

(Reference: paragraph 6.3.1)



ANNEX 6.B

LOCUST REPORTS FROM SHIPS

(Reference: paragraph 6.4.5)

Members concerned should instruct reporting ships, regardless of their nationality, operating in the seas around Africa, Arabia, Pakistan and India, to send by radio, and in plain language, reports on any locusts seen to the Food and Agriculture Organization of the United Nations (FAO) in Rome Telex 610181 FOODAGRI. Costs are paid by the FAO.

Each locust report should contain the following elements:

(*a*) Date and time (specifying UTC or zone time) when locusts first seen);
(*b*) Latitude and longitude, if possible to nearest minute, where locusts first seen;
(*c*) Time and position at which locusts last seen;
(*d*) Whether *isolated locusts* (seen in flight singly), *locust group*(s) (flying locusts seen intermittently in numbers), *swarm* (flying locusts seen continuously in numbers, over a period of at least a minute), *dense swarm* (obscuring part of horizon or other background), *locusts appearing on board* or *floating dead locusts* (isolated, groups or swarms);
(*e*) Colour of locusts (yellow, pink, grey);
(*f*) Wind direction and speed.

Details of such reports should be entered in the ship’s meteorological logbook, even when it has not been possible to send a radio report.

In addition to sending locust reports, ships should be instructed to collect, wherever practicable, specimens of the locusts observed and post them as soon as possible to the Marine Superintendent, Met O(OM), Scott Building, Eastern Road, Bracknell RG12 2PW, United Kingdom.

ANNEX 6.C

GUIDELINES FOR REPORTING OF INFORMATION ON FREAK WAVES AND FOR RECORDING IN METEOROLOGICAL LOGBOOKS, AND AN EXAMPLE OF A SPECIAL LOG SHEET

(Reference paragraph 6.4.5)

(i) Guidelines

It is recommended that the following information be recorded in meteorological logbooks:

(1) *Information on freak waves*

Date: Time: Ship's position

....

Full description of freak wave (including height and horizontal distance between crest and trough, if possible)

Weather condition:

.....

State of sea:

.....

Any other factors that may have influenced the state of sea:

.....

Any damage sustained by ship:

.....

(2) *Information to be attached to freak wave reports by National Meteorological Centres when forwarding them to the Bracknell collecting centre*:

Ship's name:

.....

Gross registered tonnage:

.....

Ship's radio call-sign:

.....

(3) *All freak wave reports and related information received by national centres should be sent onward to the United Kingdom Meteorological Office, Bracknell, Berkshire, England, for further action*.

FREAK WEATHER REPORT

A freak wave may be defined as a wave of very considerable height, ahead of which there is a deep trough. Thus, it is the unusual steepness of the wave which is its outstanding feature and which makes it dangerous to shipping.

ss/mv

.....

Call sign

.....

Gross tons

.....

Date ..... . Time .....GMT

Ship's position.....

DESCRIPTION OF FREAK WAVE

Height .....m Direction if known

.....

Horizontal distance between crest and trough .....m

Depth of water .....m (either by sounding or from chart)

Remarks

.....

..

WEATHER CONDITIONS

Wind direction ..... Wind speed .....knots

Any other weather factor applicable

.....

.....
.....

STATE OF SEA

Sea waves: Height .....m Period .....sec
Swell waves: Direction ..... Period ..... sec Height .....m
Any other factor that may have influenced stat of sea (tide, currents, etc.)
.....
.....
.....

DAMAGE TO SHIP (if any)
.....

Signature of Observer
.....

Signature of Master
.....

ANNEX 6.D

GUIDELINES FOR THE OBSERVATION AND RECORDING OF SEA CURRENT DATA ON BOARD SHIP, AND AN EXAMPLE OF A SPECIAL LOG SHEET

~~(Reference paragraph 6.4.5)~~

(i) Guidelines

1. *Introduction*

The knowledge which we now possess regarding surface currents in the world seas is, for the most part, based on information from current observations taken on board ships.

The systematic collection of surface current information had already begun in the middle of the nineteenth century. The famous Lieutenant Matthew F. Maury of the U.S. Navy was one of the first who saw the importance of gathering wind and current data from ship logbooks. In 1845, he published the first of a series of 'Wind and current charts'.

For constructing current charts, as many observations as possible are required, covering many years. As the variability of local currents can be examined only on the basis of a large number of observations, and as the number needed has not been reached for any place at sea, there is still a great need of current observations, especially from areas less frequented by ships outside the major shipping lanes. More observations are also needed to establish, year to year, variations in currents, as some of these are of great significance for marine science, e.g., the *El Niño*. The only way of obtaining enough observations is by the cooperation of voluntary observers.

By making and reporting observations of currents experienced, the seaman not only gains practical knowledge himself, but benefits shipping generally by adding to our statistical knowledge, so that up-to-date information can be published.

2. *Methods of ocean-current observations and some definitions*

The method of making current observations is to calculate the difference between the dead reckoning (DR) position of the ship after making due allowance for leeway and the position by a reliable astronomical, land, radio, radar, electronic or satellite fix. The result is the set and drift over the ocean floor experienced by the ship during the interval since the previous reliable fix was obtained, and applies to a mean depth of about half the ship's draught.

The *sea of current* is the direction in which it acts; that is the direction toward which it flows. So, the current set is from the DR position to the fix.

The d*rift of a current* is the distance measured in nautical miles from the DR position to the fix.

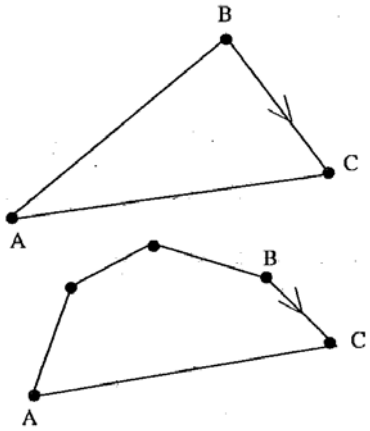
The *leeway* is the angular difference between the ship's course and the ship's direction of movement through the water (i.e., the direction shown by the wake). Leeway occurs when a ship is subjected by the wind to a pressure from a beam. The angle is rarely more than a few degrees, but there is a considerable loss of accuracy in the observation of the current if a realistic allowance is not made for leeway.

The *"FROM" position* is the true position at the beginning of the stretch over which the current is calculated.

The *"TO" position* is the true position at the end of the stretch over which the current is calculated.

The *dead reckoning (DR) position* is the position of the ship determined by applying to the last well-determined position (the "FROM" position), the run that has since been made, using only the true courses steered (corrected for leeway, if necessary) and the distance run, as determined by log or engine revolutions, *without considering current*. It is important that the true course is corrected for the influence of the wind, so that the difference between the DR position and the true fix is caused only by the current.

3. *The calculation*



A: Position "FROM"
B: "DR" position
C: Position "TO"
AB: True course steered, corrected for leeway and distance run
AC: Course and distance made good
BC: Current set and drift

When more courses are steered between A and B, the "DR" position B has to be calculated in steps

The calculation is done in two steps and is based on the following data:

First step — Calculation of the DR position
Data: (*a*) Position FROM
(*b*) Course(s) steered, corrected for possible wind influence without considering current
(*c*) The distance, calculated from speed and time, run along each of the course lines without considering current

Second step — Calculation of the current
Data: (a) DR position
(b) Position TO

It is possible to do both calculations by computer. In this case, it is necessary that all three data for the first step and also the position TO are entered in the logbook by the observer.

The advantages of doing the calculation by computer are that the extra work involved for the observers on board is avoided and that errors in the callculation are practically eliminated. A disadvantage, however, is that errors in the basic data cannot be discovered and this inevitably leads to incorrectable faulty results. On the other hand, the observer is in a position to check the basic data for possible mistakes; also, he can check if the data are reliable enough for current calculation.

Calculation by computer therefore means an increased responsibility of the observer for entering the basic data correctly and for their reliability. For this reason, it is advisable to always enter the data carefully, and then, to check them.

However, in many cases, the officer will wish to calculate the current for his own interest and use, and this is to be encouraged. When the current is calculated on board, it should be entered in the logbook, along with the data from which it was calculated.

4. *The observation*

The following notes are intended to give practical guidance on the ways in which the most useful

observations of currents can be made. The usefulness of an observed current depends largely on its representativeness and its accuracy. Nevertheless, an observation which might normally be rejected as being unlikely to have the desired accuracy might still be of value if it came from an area of sparse shipping, i.e., one about whose currents little was known. The observation of currents is particularly desirable in such areas.

The representativeness and accuracy of current observations are discussed below in more detail:

(*a*) Representativeness of observed currents
Ideally, each observation would represent a single current. In practice, though an observation is made over a distance over which there is likely to be some variation in current. An observation is not required if it is likely to incorporate currents from two different systems. In particular, it is desirable to interrupt an observation when passing a cape, a strait or a current rip, as they are likely to form boundaries between different current systems. Also, observations should not be made with the distance between FROM and TO positions, in excess of about 500 nautical or with the time interval between these positions in excess of about 24 hours. Observations should not be made where there are tidal influences, e.g., on coastal passages.

(*b*) Accuracy of fixes
The accuracy of current observations depends largely on the accuracy of the two fixes. In general, fixes accurate to within two nautical miles are required. Observations based on noon (sun) positions, derived by running fix, usually have less than the desired accuracy; the accuracy of such fixes depends on a due appreciation of the currents experienced — the very element we are trying to determine. On ther other hand, the fixes derived from observing two or more planets or stars at twilight, are likely to be very suitable for calculating currents. When suitable equipment is available, fixes by such accurate methods as satellite navigation or OMEGA give especially useful current observations.

(*c*) Course
The true course, corrected for compass error, must be used. An error in the DR position, due to an incorrect course, has a direct influence on the current calculation. Therefore, the course must be corrected for leeway, whenever necessary. Estimating the correction for wind is not simple and can only be made by experience. However, at a meteorological service receiving current observations, it is hardly possible to make such corrections, because they are so very dependent on the type of ship and on its draught. If estimation of the leeway is impossible, for example, because of stormy weather, no current observation should be made. When, for some reason, the ship is stopped, it is also better to make no current observation if the wind is more than Beaufort force 3.

(*d*) Speed
It is of great importance that the speed of the ship *through the water* is known as accurately as possible. An electronic type of log is especially useful. With other, more common, types of log, the speed cannot be determined so precisely, and a compromise between log distance and distance by engine revolutions, making due allowance for slip, possibly gives the best results. The slip depends on several factors (such as draught, loading conditions, sea and swell and the time elapsed since the ship was in dry dock), but some of their effects are often hard to determine.

(*e*) Changes in course and speed between the FROM and TO positions
Between the FROM and TO positions, it is possible for the course to have been changed one or more times; also, it can happen that different corrections for leeway must be applied over a distance sailed with a constant course. In such circumstances, the distance is divided into parts, each with a constant course and speed through the water. If the current is not calculated on board, but later by computer for each part, each distance must be determined from speed and time noted in the logbook. More than three parts are not acceptable.

(*f*) Period between FROM and TO positions
The main considerations are that the period should be long enough for the current to have a measurable effect, yet short enough to make it unlikely that any large variation in current would have occured over the distance covered. Thus, the desirable period depends on the accuracy of available navigational data. Exceptionally, with very accurate data, e.g., satellite fixes and speed

through the water measured by electronic log, the current might justifiably be measured over a period as short as one or two hours. Also, when coasting, a period of a few hours between two shore fixes may be taken. Usually, however, a longer period is desirable and a period of about 12 hours between stellar fixes, determined at dusk and at dawn, for instance, would be very suitable. A period of about 24 hours is necessary when the only positions determined have been by running fix, e.g., noon (sun) positions, but such observations are barely acceptable. Observations from still longer periods are not acceptable. Since observations of current should be independent, period of observation should not overlap.

(ii) **Example of a Special Log Sheet** **SEA SURFACE CURRENT OBSERVATIONS**

SS/MV ..... Captain .....

NOTES AND INSTRUCTIONS FOR FILLING IN EACH COLUMN

General information and guidance on observing of sea surface currents is given on pages 62–64 of the "Marine Observer's Handbook"

COLUMN	ENTRY	NOTES	CODE TABLES
1, 40–42, 49–52	No entry — for official use only		Table A
2–3	Last two figures of year	All times and dates in GMT. The interval between fixes used for current observations should not be less than 3 hours or more than 25 hours.	Code figure 1 Land fix
4–5	Month (01–12)		2 Running land fix
6–7, 20—21	Day 01–31		3 Astro fix (2 or more simultaneous bodies)
8–10, 22–24	Time GMT in hours and tenths (000–239)		4 Running solar fix 5 Satellite navigator 6 Radio fix (D/F)
11, 25	Fix type (Table A)	A current observation should be entered only when both fixes are believed to be accurate to within 2 miles.	7 Radar fix 8 Electronic fix (accurate at short range) e.g. Decca, etc. 9 Electronic fix (accurate at long range) e.g. Omega, Loran C
12–26	Quadrant (Table B)		Table B Code figure Latitude Longitude 1 N E 3 S E 5 S W 7 N W
13–15, 27–29	Latitude of fix in whole degrees (prefixed by 0 if necessary to make up two figures) and tenths	To obtain tenths figure divide the minutes by six and neglect the remainder.	
16–19, 30–33	Longitude of fix in whole degrees and tenths		Table C Code figure Code figure 1 Revolutions 4 Pitometer log 2 Towed log 5 Electromagnetic log 3 Chernikeef log 6 Doppler log
34–36	Direction of drift in degrees (001°–360°T)	Drift is taken as the direction and distance to the second fix from the position obtained by dead reckoning from the first fix. If there is no drift, zeroes are entered in clolumns 34 and 38.	
37–38	Distance drifted in whole nautical miles		Table D Code figure Metres Feet 0 0–4 0–14 1 5–9 15–31 2 10–14 32–48 3 15–19 49–64 4 20–24 65–80 5 25–29 81–97 6 30–34 98–113 7 35–39 114–130 8 40–44 131–150 9 45 or more 151 or more
39	Log type (Table C)		
43–45	Course steered in degrees (001°–360°T)		
46–47	Mean speed in whole knots		
48	Mean draught (Table D)		

	DATES, TIMES AND POSITIONS OF SHIP																CURRENT		SHIP					
	FROM									TO														
For Office use only	Year	Month	Day (GMT)	Time (GMT) in hours and tenths	Fix (type)	Quadrant	Latitude in degrees and tenths	Hundreds figure	Longitude in degrees and tenths	Day (GMT)	Time (GMT) in hours and tenths	Fix (type)	Quadrant	Latitude in degrees and tenths	Hundreds figure	Longitude in degrees and tenths	Direction in degrees from true N	Distance (n miles)	Log (type)	For Office use only	Course in degrees from true N	Mean speed in knots	Mean draught	For Office use only
1	2 3	4 5	6 7	8 9 10	11	12	13 14 15	16	17 18 19	20 21	22 23 24	25	26	27 28 29	30	31 32 33	34 35 36	37 38	39	40 41 42	43 44 45	46 47	48	49 50 51 52
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								
6																								

ANNEX 6.E
EXTRACT FROM ITU RADIO REGULATIONS 1982–86, PART B, CHAPTER 11

(Reference paragraph 6.6.2)

Article 58

Section III. Ship stations

4052 § 5. (1) For the international public correspondence service, ship stations are divided into four categories:

4053 *a*) stations of the first category: these stations maintain a continuous service;

4054 *b*) stations of the second category: these stations maintain a service for 16 hours a day;

4055 *c*) stations of the third category: these stations maintain a service for 8 hours a day;

4056 d) stations of the fourth category: these stations maintain a service the duration of which is either shorter than that of stations of the third category, or is not fixed by these Regulations.

4057 (2) Each administration shall itself determine the rules under which ship stations subject to it are to be placed in one of the above four categories.

4058 § 6. (1) Ship stations of the second category shall maintain the following hours of service:

0000–0400 }
0800–1200 } ship's time or zone time,
1600–1800 }
2000–2200 }

and, additionally, four hours of service at times to be decided by the administration, master or responsible person, to meet the essential communication needs of the ship, having regard to propagation conditions and traffic requirements.

4059 (2) Ship stations of the third category shall maintain the following hours of service:

0800–1200 ship's time or zone time, two continuous hours of service between 1800 and 2200 h, ship's time or zone time, at times decided by the administration, master or responsible person and, additionally, two hours of service at times decided by the administration, master or responsible person, to meet the essential communication needs of the ship, having regard to propagation conditions and traffic requirements.

4060 (3) Each administration will determine whether ship's time observed by its ships is to be zone time as shown in Appendix 12 (see Nos. 4058 and 4059).

4061 (4) In case of short voyages, these stations shall provide service during the hours fixed by the administrations to which they are subject.

4062 § 7. Ship stations of the fourth category are encouraged to provide service from 0830 to 0930 h, ship's time or zone time.

4063 § 8. (1) Ship stations whose service is not continuous shall not close before:

4064 *a*) finishing all operations resulting from a distress call or from an urgency or safety signal;

4065 *b*) exchanging, so far as practicable, all traffic originating in or destined for coast stations situated with their service area and for ship stations which, being within their service area, have indicated their presence before the actual cessation of work.

4066 (2) Any ship station not having fixed working hours shall inform the coast stations with which it is in communication of the time of closing and the time of reopening its service.

4067 § 9. (1) Any ship station arriving in port, and whose service is therefore about to close, shall:

4068 *a*) notify accordingly the nearest coast station and, if appropriate, the other coast stations with which it generally communicates;

4069 *b*) not close until after the disposal of traffic on hand, unless this conflicts with the regulations in force in the country of the port of call.

4070 (2) On departure from port the ship station shall notify the coast station or stations concerned that its service is reopening as soon as such reopening is permitted by the regulations in force in the country of the port of departure. However, a ship station not having hours of service fixed by these Regulations may defer such notification until the station first reopens its service after departure from port.

APPENDIX 12

Hours of service for ship stations of the second and third categories

(See Articles 26 and 58)

Section I. Table

Hours of service Ship's time or zone time (See No. 4058 and 4059)	
16 hours (H16)	8 hours (H8)
from to 0000-0400 h 0800-1200 h 1600-1800 h 2000-2200 h plus 4 hours (see No. 4058)	from to 0800-1200 h 1800-2200h[a)] plus 2 hours (see No. 4059)

a) Two continuous hours of service between 1800 and 2200 hours, ship's time or zone time, at times decided by the administration, master or responsible person.

ARTICLE 61

Order of priority of communications in the maritime mobile service and in the maritime mobile-satellite service

4441 The order of priority for communications[1] in the maritime mobile service and the maritime mobile-satellite service shall be as follows, except where impracticable in a fully automated system in which, nevertheless, category 1 shall receive priority:

1. Distress calls, distress messages, and distress traffic.
2. Communications preceded by the urgency signal.
3. Communications preceded by the safety signal.
4. Communications relating to radio direction-finding.
5. Communications relating to the navigation and safe movement of aircraft engaged in search and rescue operations.
6. Communications relating to the navigation, movements and needs of ships and aircraft, and weather observation message destined for an official meteorological service.
7. ETATPRIORITENATIONS — Radiotelegrams relating to the application of the United Nations Charter.
8. ETRATPRIORIATE — Government radiotelegrams with priority and Government calls for which priority has been expressly requested.
9. Service communications relating to the working of the telecommunication service or to communications previously exchanged.
10. Government commuications other than those shown in 8 above, ordinary private communications, RCT[2] radiotelegrams and press radio- telegrams.

4441.1 [1] The term *communications* as used in this Article includes radiotelegrams, radiotelephone calls and radiotelex calls.

4441.2 [2] RCT (Red Cross Telegram): Telegrams concerning persons protected in time of war by the Geneva Conventions of 12 August 1949.

ARTICLE 42

Special services relating to safety

Section I. Meteorological messages

3312 § 1. (1) Meteorological messages comprise:

3313 *a*) messages addressed to meteorological services officially entrusted with weather forecasts, more specifically for the protection of maritime and air navigation;

3314 *b*) messages from these meteorological services intended specially for:

3315 — ship stations;

3316 — protection of aircraft;

3317 — the public.

3318 (2) The information contained in these messages may be:

3319 *a*) observations taken at fixed times;

3320 *b*) warnings of dangerous phenomena;

3321 *c*) forecasts and warnings;

3322 *d*) statements of the general meteorological situation.

3323 § 2. (1) The various NMSs mutually agree to prepare common transmission programmes so as to use the transmitters best situated to serve the regions concerned.

3324 (2) The meteorological observations contained in the classes mentioned in Nos. 3313 and 3316 should be drawn up in an international meteorological code, whether they are transmitted by or intended for mobile stations.

3325 § 3. For observation messages intended for an official meteorological service use shall be made of the frequencies made available for meteorological purposes, in conformity with regional agreements made by the services concerned for the use of these frequencies.

3326 § 4. (1) Meteorological messages specially intended for all ship stations shall in principle be sent in accordance with a definite timetable, and, as far as possible, at times when they can be received by ship stations with only one operator. In radiotelegraphy the transmision speed shall not exceed sixteen words a minute.

3327 (2) During the transmission “to all stations” of meteorological messages intended for stations of the maritime mobile service, all stations of this service whose transmission might interfere with the reception of these messages shall keep silent in order to permit all stations which desire to do so to receive these messages.

3328 (3) Meteorological warning messages for the maritime mobile service shall be transmitted without delay. They shall be repeated at the end of the first silence period which follows their receipt (see Nos. 3038 and 3052) as well as during the next appropriate broadcast as indicated in the List of Radiodetermination and Special Service Stations. They shall be preceded by the safety signal and sent on the appropriate frequencies (see No. 3224).

3329 (4) In addition to the regular information services contemplated in the preceding subparagraphs, administrations shall take the necessary steps to ensure that certain stations shall, upon request, communicate meteorological messages to stations in the maritime mobile service.

3330 (5) The provisions of Nos. 3326 to 3329 are applicable to the aeronautical mobile service, in so far as they are not contrary to more detailed special agreements which ensure at least equal protection to air navigation.

3331 § 5. (1) Messages originating in mobile stations and containing information concerning the presence of cyclones shall be transmitted, with the least possible delay, to other mobile stations in the vicinity and to the appropriate authorities at the first point of the coast with which contact can be established. Their transmission shall be preceded by the safety signal.

3332 (2) Any mobile station may, for its own use, listen to messages containing meteorological observations sent out by other mobile stations, even those which are addressed to an NMS.

3333 (3) Stations of the mobile services which transmit meteorological observations addressed to an NMS are not required to repeat them to other stations. However, the exchange between mobile sations, on request, of information relating to the state of the weather is authorized.

3334 § 6. The provisions of Nos. 3326 to 3330 shall apply to notices to mariners.

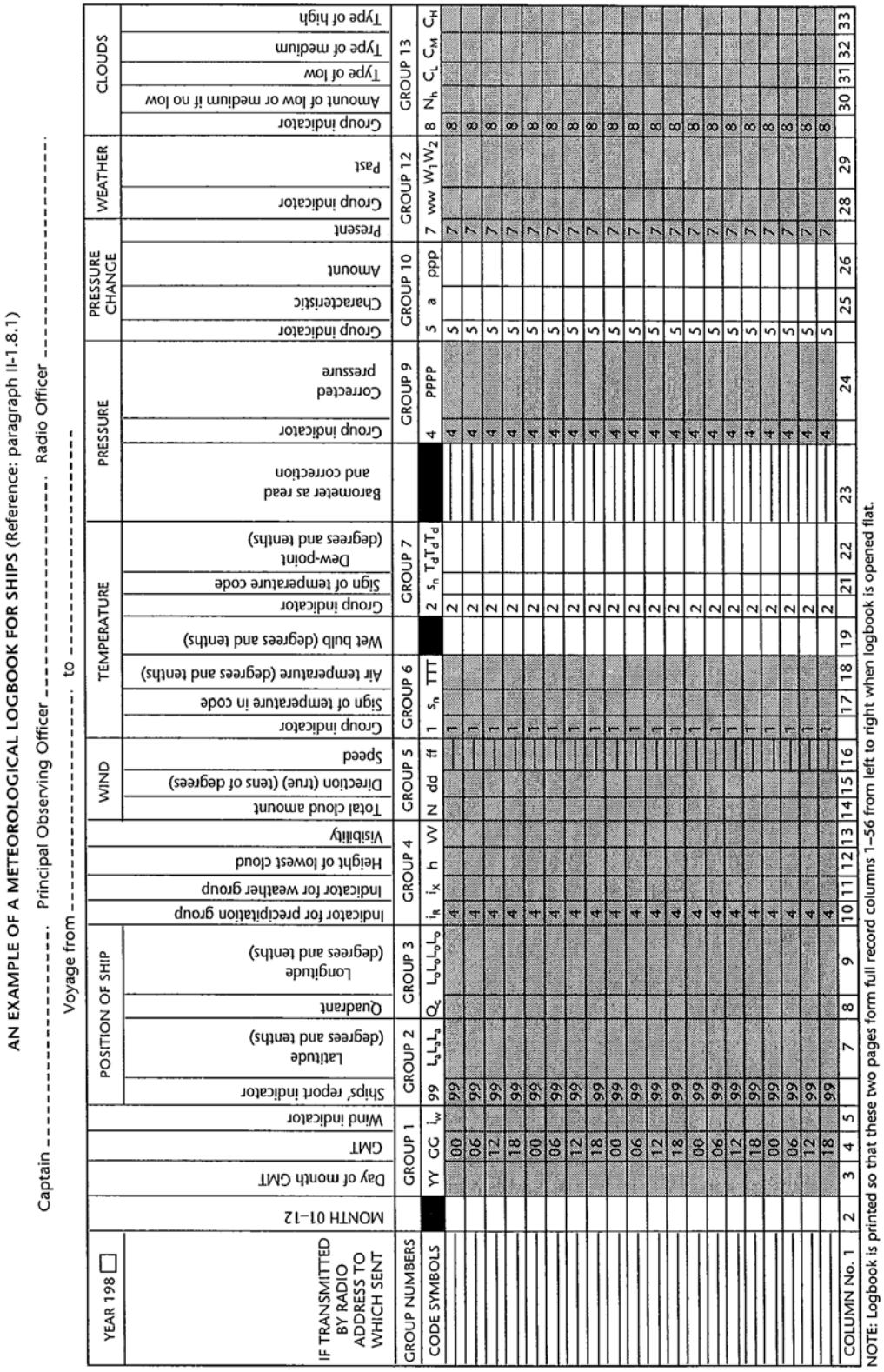
3335 § 7. Messages containing information concerning the presence of dangerous ice, dangerous wrecks, or any other imminent danger to marine navigation, shall be transmitted as soon as possible to other ship stations in the vicinity, and to the appropriate authorities at the first point of the coast with which contact can be established. These transmissions shall be preceded by the safety signal.

3336 § 8. When thought desirable, and provided the sender agrees, administrations may authorize their land stations to communicate information concerning maritime damage or casualties or information of

general interest to navigation to the marine information agencies approved by them and subject to the conditions fixed by them.

ANNEX 6.F
AN EXAMPLE OF A PAGE FROM A METEOROLOGICAL LOGBOOK FOR SHIPS

(Reference paragraph 6.8.1)



Height of barometer above sea level ------------ feet/metres

Method of taking sea temperatures: (*a*) Rubber bucket (*b*) Condenser intake (*c*) Hull sensor --------- (Note any departure from this method in Remarks Column)

				SEA TEMPERATURE			WIND WAVES			SWELL WAVES									ICE ACCRETION					ICE					REMARKS	
											1st Swell waves	2nd Swell waves	1st Swell waves			2nd Swell waves														
For Office use only	Section indicator	Course of ship	Speed of ship	Group indicator	Sign of temperature in code	Sea temperature (degress and tenths)	Group indicator	Period in seconds	Height (in half metres)	Group indicator	Direction from (tens of degrees)	Direction from (tens of degrees)	Group indicator	Period in seconds	Height (in half metres)	Group indicator	Periods in seconds	Height (in half metres)	Group indicator	Type of ice accretion	Thickness of ice (cm)	Rate of ice accretion	Group indicator	Concentration or Arrangement	Stage of development	Ice of land origin	Bearing of ice edge	Ice situation	Shifts of wind, times of start and finish of rainfall, etc. Special phenomena should be entered briefly. Space for additional remarks is provided at the end of this logbook. The Beaufort notation may be used in this column. (See "Marine Observer's Handbook").	Call sign to which sent, frequency (kHz) used and time sent GMT
	GROUP 15			GROUP 16			GROUP 18			GROUP 19			GROUP 20			GROUP 21			GROUP 22					GROUP 23						
	222	D_s	v_s	0	s_n	$T_wT_wT_w$	2	P_wP_w	H_wH_w	3	$d_{w1}d_{w1}$	$d_{w2}d_{w2}$	4	$P_{w1}P_{w1}$	$H_{w1}H_{w1}$	5	$P_{w2}P_{w2}$	$H_{w2}H_{w2}$	6	I_s	E_sE_s	R_s	ICE	c_i	S_i	b_i	D_i	z_i		
00	222			0			2			3			4			5			6				ICE							
06	222			0			2			3			4			5			6				ICE							
12	222			0			2			3			4			5			6				ICE							
18	222			0			2			3			4			5			6				ICE							
00	222			0			2			3			4			5			6				ICE							
06	222			0			2			3			4			5			6				ICE							
12	222			0			2			3			4			5			6				ICE							
18	222			0			2			3			4			5			6				ICE							
00	222			0			2			3			4			5			6				ICE							
06	222			0			2			3			4			5			6				ICE							
12	222			0			2			3			4			5			6				ICE							
18	222			0			2			3			4			5			6				ICE							
00	222			0			2			3			4			5			6				ICE							
06	222			0			2			3			4			5			6				ICE							
12	222			0			2			3			4			5			6				ICE							
18	222			0			2			3			4			5			6				ICE							
00	222			0			2			3			4			5			6				ICE							
06	222			0			2			3			4			5			6				ICE							
12	222			0			2			3			4			5			6				ICE							
18	222			0			2			3			4			5			6				ICE							
		34	35		36	37		38	39		40	41		42	43		44	45		46	47 48	49		50	51	52	53	54	55	56

ANNEX 6.G

GUIDELINES FOR ORGANIZING PORT METEOROLOGICAL OFFICER (PMO) ACTIVITIES

(Reference paragraph 6.9)

1. Introduction

The functions of a Port Meteorological Officer (PMO) cover five broad areas:

(*a*) Recruitment of ships to take part in the Voluntary Observing Ships' Scheme;
(*b*) Regular liaison with recruited ships to ensure the highest standard of observations;
(*c*) Collection of completed ships' meteorological logbooks;
(*d*) Act as an interface between the meteorological service and the marine community;
(*e*) In large ports act as a focus for the provision of meteorological services in the port.

1.1 Personnel requirements

Each maritime Member of WMO should appoint PMOs with maritime experience at its main ports. Their maritime experience enables them to communicate effectively with the ship's master and other officers. They should also have experience in, and knowledge of, meteorology, theoretical as well as practical. Knowledge of the English language would be an advantage, as most ships' officers whose mother tongue is not English are able to express themselves in this language. The necessary training of PMOs is described in the Manual on Marine Meteorological Services, Part IV, Section 3.

1.2 Location of the office of a Port Meteorological Officer

The office of the PMO should preferably be situated in the centre of the harbour area. This allows the maximum of ships to be visited and facilitates visits by observers from voluntary ships to the PMO's office and gives them access to meteorological information. The PMO will need appropriate transport for instruments and supplies to ships as required.

2. Duties of a Port Meteorological Officer

2.1 Recruitment of observing ships

2.1.1 MERCHANT SHIPPING

Recruiting of observing ships should be in the hands of the PMOs, but subject to overall guidance from the relevant section of the NMS. A worldwide distribution of observing ships is the objective to attain and every effort should be made to recruit ships which sail in data-sparse areas, e.g. the oceans of the southern hemisphere.

PMOs normally only recruit ships which are registered in their own country, but ships of other registry may be considered if they are regular callers and if the PMO considers that they would make a useful addition to the voluntary observing fleet.

Points to be considered when recruiting ships are:

(*a*) Willingness of masters and officers to carry out the voluntary weather observing and reporting in code by radio or INMARSAT throughout the voyage;
(*b*) Suitability of the ship to carry and care for the instruments.

Permission to recruit a ship should, whenever possible, be obtained from the owners, usually through the marine superintendent of the company and from the master. It is recommended that only a verbal undertaking by a ship's master to carry out the work of an observing ship should be obtained. This service is voluntary, and it is therefore not desirable to create the impression that a formal binding contract will be imposed.

When a ship agrees to participate (or volunteer) in the scheme, the PMO equips the ship with the necessary instruments and stationery. This needs to be done quickly as many ships do not spend much time in port. A list of the instruments issued should be compiled by the PMO and the equipment lent to ships must be as perfect as possible for its purpose.

If the master agrees, a ship should preferably be recruited as a selected ship. If an opportunity occurs a ship should change from being a supplementary ship to being a selected ship again, if the master so agrees.

Suggested lists of instruments and stationery for the various types of observing ships are as follows:

Selected ships

One precision aneroid fitted with a damping cap
One barograph
One pyschrometer OR two screens and two sheathed thermometers (1 air, 1 wet bulb) for each screen. plus two spares
Two sea thermometers for rubber bucket and one or two rubber buckets if that bucket method is to be used for measuring sea-surface temperature
Meteorological logbooks
Signal pads
Barograph charts
Envelopes
Plotting charts
Code and decode for use of shipping
State of sea card
Cloud types for observers
Reduction to mean sea level card
Dew-point tables, and
Marine observers guide (if available)

Supplementary ships:

One precision aneroid fitted with a damping cap
One or two screens and one sheathed thermometer for air temperature for each screen plus one spare
Meteorological logbooks
Signal pads
Envelopes
Plotting charts
Code and decode for use of shipping
State of sea card
Cloud types for observers
Reduction to mean sea level card, and
Marine observers guide (if available)

Auxiliary ships:

Signal pads
Envelopes
Aneroid barometer correction card, and
Code card

Ships' officers should be asked to keep the Meteorological Service's instruments in good and clean condition. The position for the barometer in a ship's chart room should be chosen with care in consultation with the master. It should be as safe as possible from accidental damage, in a good light and clear of artificial heating. Advice should be given as to the best exposure for the thermometer screen if issued under differing conditions. The screen should be kept white. Special attention should be drawn to the care required in ensuring accurate sea temperature observations.

PMOs should ensure that observing officers understand the importance of reading wet and dry bulb temperatures in any one observation to the same degree of precision. All temperatures are required to be read to the nearest tenth of a degree. When this is not possible and the temperatures are read to the nearest whole degree, the tenth figure is reported as a solidus and not by a zero.

Subject to financial constraints, ships under construction may be supplied with distant reading equipment. PMOs should inform their headquarters of any ships being built in their area which would be suitable, and their respective owners could then be approached by headquarters. Alternatively PMOs should inform superintendents of shipping companies that distant reading equipment is available to ships being built. If interested, they should advise them to write directly to the Meteorological Service volunteering their ships to be so equipped. When the necessary agreements and financial approvals have been obtained, the PMO should be informed. He should then arrange to visit the ship with a technician if necessary to discuss the siting of the instruments.

It is of the greatest importance that the PMO's initial guidance and instruction to newly-recruited observing and radio officers should be as thorough and complete as possible. This will immediately ensure a uniformity in observing technique.

2.1.2 FISHING VESSELS AND SMALL CRAFT

To help extend the collection of marine meteorological data small craft fitted with good communication equipment may be supplied with instruments or they may be recruited as non-instrumental observing ships and requested to report surface weather conditions, whenever possible. They become auxiliary ships under the Voluntary Observing Ships' Scheme.

Large fishing vessels and yachts can supply most valuable meteorological information from important areas from which there are normally very few ships' weather reports.

In ports from which fishing vessels and large yachts sail, the PMOs should do all that is possible to encourage and interest the owners and captains in marine meteorology. The captains should be assured of the usefulness to forecasting centres of their voluntary weather reports.

2.2 Visits to ships

Visits and inspections are primarily intended to be occasions for giving encouragement and guidance to marine observers and for thanking them for their work, but they are also the occasion of checking on the continued accuracy of the instruments. Observing ships should, if possible, be visited at intervals of no more than three months and a report made on their instruments. A point to remember when visiting ships is that all the facilities being made available to the visitor are at the discretion and invitation of the ship's staff.

At each inspection any defective National Meteorological Service instruments should be replaced and

a receipt should, if possible, be obtained from the master or his senior officer for all instruments issued.

The barometer is probably the most important instrument for weather observing. The reading should be checked by comparison with a precision instrument such as a precision aneroid kept specially for this purpose, which in turn is compared with a standard barometer.

The barometer should be withdrawn from a ship if the difference from standard exceeds 0.3 hPa and is obviously increasing,

It is recommended that a record card is kept for each precision aneroid issued to a ship. On the card is recorded the difference between the precision aneroid and the standard barometer. The difference, however small, should always be entered on a form, so that an accurate record can be kept of the behaviour of each (precision) aneroid. Plus or minus signs should be used to indicate high or low differences: the plus sign when the ship's aneroid is reading higher than standard and the minus sign when the aneroid is lower than standard.

Distant reading equipment, if fitted aboard ships, should be checked at each inspection,

Hand anemometers, if issued to ships, should be returned to the NMS once a year for recalibration and a replacement issued.

In making out reports on instruments, care should be taken to distinguish between Meteorological Service instruments and the ship's own instruments. Where the ship's own instruments are used for observing, the PMO should record this on the visit form. This is necessary to avoid confusion between the property of the NMS and that of the owners or officers.

A standard inspection form should be used for each visit. Space should be available on this form for recording:

(*a*) Any replacement of instruments
(*b*) Full details of any onboard anemometers
(*c*) Any instruments which are the property of the ship's owners or officers
(*d*) Any instruments supplied by other authorities e.g. XBTs, plankton recorders, which affect the appropriate entry to the *International List of Selected, Supplementary and auxiliary Ships* WMO-No. 47)
(*e*) Distance of the thermometer screen from the ship's side and height above sea level

The inspection report should be forwarded to the relevant section of the NMS as soon as possible after the inspection.

On visiting an observing ship, the PMO should ascertain that the necessary logbooks and stationery are on board and that the relevant publications contain up-to-date instructions and amendments. The ship's officers should likewise understand the international meteorological codes and the procedure to be carried out in transmitting weather messages to the meteorological centres ashore through the appropriate stations. Radio officers should be contacted whenever possible.

Courtesy visits should, if possible, be made to voluntary observing ships of other nations when they are in local ports and advice and assistance given as necessary, including supply of stationery if the ship has run out.

2.2.1 WITHDRAWAL OF INSTRUMENTS

It should be the duty of the PMO to recover instruments from ships which cease to observe. When ships cease observing for any reason, the fact should be recorded. PMOs should watch the shipping

papers and journals to ascertain, among others, ship sales and change of registry and if these take place abroad they should consider requesting the assistance of the PMO in the relevant country and port.

On receipt of this information, the ship's name will be removed from the national fleet list in the relevant NMS.

When withdrawing instruments care should be taken that instruments which are not the property of the NMS are not included.

2.3 Collection of ships' meteorological logbooks

When completed ships normally return their meteorological logbooks to the: NMS, but some may prefer to hand it to a PMO. The latter should see the meteorological logbook of all visiting ships and, if it is full or nearly full, they should forward it to the relevant section of their NMS as soon as possible after collection.

It is important to return completed logbooks from observing ships. When visiting observing ships, a PMO should therefore ascertain that the logbooks have been returned. If the book in current use has been started more than six months previously it should be withdrawn and the officers asked to start a new one. PMOs should take the opportunity, whenever possible, to give any advice as to the method of writing up the logbooks.

PMOs should make a special point of visiting observing ships' crews who appear to have difficulties in completing their logbooks and ascertaining the cause.

It is recommended that all meteorological logbooks received are immediately acknowledged by postcard addressed to the master at the address indicated on the front page of the book. PMOs should ensure that this entry has been completed correctly in the logbook and care taken to distinguish between the owners' and the charterers' address.

It is further recommended that after an initial examination of the book a letter of appreciation and comment is sent by the NMS to the master (not by name) through the owners. The interval between these two communications can amount to as much as three months.

2.4 General liaison with ships

A PMOs first duty is the care and supervision of the work of voluntary marine observers and they should give encouragement to the applications by the merchant marine generally of marine meteorology to safe and efficient navigation, comfort of passengers and the care of cargo.

A PMO is the channel use to communicate advice, instruction and correction to marine observers and also the gratitude of the meteorological departments responsible for coordinating the work. Thus a complimentary call by these officers upon the master and officers of a ship should be regarded as more valuable than a letter, but a complimentary card should always be left if it was not possible to see the master. All communications (the fewer letters the better) sent to ships are to be addressed to the master.

PMOs should make themselves familiar with the current international meteorological codes for ships in order to be able to explain it to the masters and officers of the voluntary observing fleet.

Advice and encouragement to voluntary observing officers should be given at every opportunity during visits and, for example, through the medium of any national marine meteorological publications aimed at the voluntary observing ships. 'Letters to the Editor' for these publications should be welcome and

should be encouraged from marine observers. PMOs should keep themselves conversant with the content of marine meteorological journals, including those of other Members.

Every encouragement should be given to marine observers and others interested in marine meteorology, to contribute papers or remarks on pertinent subjects, for publication in meteorological journals. Special attention should be directed to the pages, where provided, in the meteorological logbooks for 'additional remarks' and ocean currents. Masters and officers should be encouraged to write descriptions of their experiences not only as regards weather, but of all subjects of scientific interest. It is important that PMOs should maintain contact with their national navigation schools and colleges and give them any advice and assistance they may require.

PMOs of a Meteorological Service should remember that it is their duty to secure by the voluntary service of ships' officers the best possible information on meteorological conditions at sea, but it is also desirable to avoid imposing a workload which may interfere with, or adversely affect the main duties of a ships' officer to become, if excessive, detrimental to his or her main duties.

PMOs should make themselves thoroughly familiar with the scheme of communication for observing ships' routine weather reporting. They should give every encouragement and all necessary advice and instruction to observing ships.

Any difficulties that radio officers may have experienced in reporting by radio through the coastal radio stations should be reported by PMOs to their NMS. These reports should only be after careful enquiry and all relevant details such as the ship's position, radio frequency used, time and station to which addressed, use of correct prefix (such as OBS) should be included.

Attention should be drawn to the 41+ two digit code for ships fitted with INMARSAT. Addressed telexes to Meteorological Services without the code 41+ procedures are chargeable to the ship.

PMOs should explain the use of radio weather bulletins, gale, storm and tropical cyclone warnings issued specially for shipping, and which radio weather bulletins, including facsimile broadcasts are the most suitable for masters and officers. Information on this point should also be given to navigation schools and they should also be informed of the other meteorological services available to mariners.

PMOs should keep in touch with the management and marine superintendent of shipping companies with offices in their area and make regular visits to them.

2.5 Provision of port meteorological services

Shipping, fishing and other marine interests should be informed on how weather forecasts can readily be obtained in the port. They should also be kept informed of all meteorological services available to mariners.

Weather information useful to shipping, fishing or small craft should, if possible, be displayed at the Port Meteorological Office and at any other suitable place, such as a Customs' House, Mercantile Marine Office, Pilot Station, Yacht Club, etc. Weather information may include forecasts and charts received from a major forecasting office by facsimile. Alternatively there may be computer facilities to enable the PMO office to interrogate the database at the forecasting office to obtain the particular chart and/or forecast required. In large ports with a network of automatic weather stations the latest observations may be displayed electronically at the PMO's office (see Chapter 5 for more information on services in ports).

The PMO's office may also supply climatological data to ship's officers on request. This may be by photocopying a master set of data for the port and surrounding areas, or printing the data on microfiche if there are frequent requests for data on different areas. A dial-up or online connection to a

central computer data base may be worthwhile.

As the first point of contact by ships' officers on meteorological matters, the PMO may be asked for more specific technical information, e.g. on cargo ventilation. If the PMO is unable to answer the query himself, he should transmit it to the appropriate section of the Meteorological Service and ensure that a prompt reply is made.

ANNEX 6.H

MARINE METEOROLOGICAL PUBLICATIONS PRODUCED BY NATIONAL SERVICES AND INTERNATIONAL ORGANIZATIONS OF INTEREST TO SEAFARERS AND MARINE OBSERVERS

(Reference: paragraph 6.11)

Title of Publication	*Editions per year*	*Country of origin*	*Language*
Boletín Climático Marino	3	Cuba	Sp.
Met Mar	4	France	F
Guide de l'Observateur Météorologiste en Mer	1	France	F
Der Wetterlotse	6	Germany	German
Newsletter V.O.S. from Hong Kong, China	2	Hong Kong, China	E
Ship and Maritime Meteorology (Fune to Kaijou Kishou)	3	Japan	Japanese
Schip en Werf de Zee	11	Netherlands	Dutch
Meteorologisch Informatie Bulletin Maritiem	4	Netherlands	Dutch
Monthly Weather Summary	12	Qatar	E
Marine Observer	4	United Kingdom	E
IMO News	4	United Kingdom	E
Mariners Weather Log	4	United States	E
Storm Data	12	United States	E
WMO Bulletin	4	Switzerland	E, F, R, Sp.

_____